

IN THE

Supreme Court of the United States

DISTRICT 4 LODGE OF THE INTERNATIONAL ASSOCIATION OF MACHINISTS
AND AEROSPACE WORKERS, LOCAL LODGE 207; DAMON FAMILY LOBSTER
COMPANY, INC.; FOX ISLAND LOBSTER COMPANY, LLC; and
FRANK THOMPSON,

Petitioners,

v.

GINA M. RAIMONDO, in her official capacity as Secretary of the United
States Department of Commerce; JANET COIT, in her official capacity as
Assistant Administrator, NOAA Fisheries; and the
NATIONAL MARINE FISHERIES SERVICE,

Respondents.

To the Honorable Stephen G. Breyer, Associate Justice of the United
States Supreme Court and Circuit Justice for the First Circuit

APPENDIX

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EXHIBIT 1

UNITED STATES DISTRICT COURT
DISTRICT OF MAINE

DISTRICT 4 LODGE OF THE)
INTERNATIONAL ASSOCIATION)
OF MACHINISTS AND AEROSPACE)
WORKERS LOCAL LODGE 207,)
et al.,)

Plaintiffs,)

v.)

No. 1:21-cv-00275-LEW

GINA M RAIMONDO, in her official)
Capacity as Secretary of the United)
States Department of Commerce,)
et al.,)

Defendants)

**ORDER ON MOTION FOR TEMPORARY RESTRAINING ORDER
AND PRELIMINARY INJUNCTION**

In this action, Plaintiffs challenge a component of the Final Rule issued by the Department of Commerce, National Oceanic and Atmospheric Administration (“NOAA”) under the caption “Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations; Atlantic Coastal Fisheries Cooperative Management Act Provisions; American Lobster Fishery.” 50 C.F.R. Parts 229 and 697 (Sept. 17, 2021). Among other measures set forth under the Final Rule, the Secretary has authorized the partial closure of Lobster Management Area One Restrict

Area Offshore of Maine (“LMA 1” or “LMA 1 Restricted Area”)¹ on a recurring basis², between October and January (effective this year beginning October 18, 2021), which partial closure prohibits the use of gear that uses persistent buoy lines, also known as vertical buoy rope (“VBR”). In other words, the Secretary has effectively closed the LMA 1 restricted area to commercial lobster fishing by the vast majority of the permit holders who would fish for lobster in these waters.

According to the Final Rule, the justification for the closure is to reduce the incidence of right whale mortalities and serious injuries due to whale entanglement with VBR distributed throughout the LMA 1, although the prediction of right whales in these waters during the closure period relies on very low-percentage whale distribution models and prior area closures imposed by NOAA and its National Marine Fisheries Service (“NMFS”) through the Atlantic Large Whale Take Reduction Plan (“ALWTRP”) have relied on predictable whale aggregations in specific areas and seasons. Plaintiffs request a temporary restraining order or preliminary injunction setting aside the closure measure “unless and until NMFS issues a final rule that implements mitigation measures that are based on an evaluation of the effectiveness of existing regulations, spatial data on the location of trap/pot gear, updated right whale distribution surveys, aerial surveillance and acoustic monitoring in the LMA 1 Restricted Area, reasonable alternatives proposed as part

¹ Following the lead of the parties, this Order frequently references LMA 1 to mean the restricted area unless otherwise indicated.

² The “Framework” used by Defendants is an “adaptive” one, but the Department does not anticipate a “comprehensive evaluation” before 2025/26. Endangered Species Act Section 7 Consultation Biological Opinion (“BiOp”) at 7.

of the public comment process, and an analysis of potential triggering mechanisms to be used in connection with dynamic management of the LMA 1 Restricted Area.” Plaintiffs’ Motion at 27-28.

BACKGROUND

The North Atlantic right whale is one of the most endangered species in the world. Total population is estimated to be somewhere around 368 individuals. The species has been assigned a potential biological removal (“PBR”) level of 0.8, meaning that the removal of, on average, more than 0.8 individuals annually threatens the species’ ability to reach its optimal sustainable population level. Since 2019, ten mortality or serious injury events have been documented in U.S. and Canadian waters. Of all the large whales, only the right whale population consistently experiences takes in excess of its PBR on an annual basis.

The LMA 1 Restricted Area is a newly defined zone situated entirely within federal waters in the Gulf of Maine and marked out by the following coordinates:

43° 06’ N, -69° 36.77’ W	43° 44’ N, -68° 21.60’ W
42° 53.52’ N, -69° 32.16’ W	43° 32.68’ N, -68° 17.27’ W

This area is roughly 967 square miles and is in what is known as the “offshore” zone. The LMA 1 Restricted Area comprises but a part of the entire LMA 1. The larger LMA 1 encompasses essentially the entire coastal Maine lobster fishery. Viewing that larger fishery as a whole, some 1600 license holders have the right to set as many as 800 traps. The regulatory idea that lies at the root of NMFS’s action in relation to the LMA 1 restricted zone is that the Maine fishery, given the number of lines it generates across the entire

fishery, should contribute to the right whale conservation effort by adopting a variety of measures, including a limited seasonal closure in the LMA 1 Restricted Area.

The Defendants in this action stand behind an Atlantic States Marine Fisheries Commission formed under the auspices of the NMFS's Greater Atlantic Regional Fisheries Office ("GARFO"). Because GARFO licenses commercial fisheries that can, in the absence of regulation, jeopardize the continued existence of endangered or threatened species (for purposes of this action the North Atlantic right whale³), GARFO and/or one of its parent agencies owe(s) a duty under Section 7 of the Endangered Species Act ("ESA"), 16 U.S.C. § 1536(a)(2), to ensure that such fishing activity is conducted in a manner that is not likely to jeopardize the continued existence of any endangered species.⁴ Part of the process set in motion under this statutory regime involved a request for "formal intra-service section 7 consultation" meant to provide a biological opinion on how to address the ESA Section 7 challenge. Endangered Species Act Section 7 Consultation Biological Opinion (May 27, 2021) (NMFS) ("BiOp") at 7.⁵ The BiOp is focused on "evaluating the effects from fishing activities (i.e., entanglement/bycatch) by vessels with federal permits in federal waters only." *Id.* at 6.

³ The administrative process underlying this action addressed ESA-related concerns for a relatively long list of endangered or threatened species and a variety of different fisheries. See BiOp title page and §§ 4-5.

⁴ Habitat degradation is also a consideration under the ESA, but "[o]f all the gears used in the fisheries [addressed by the Final Rule], bottom trawl is the only gear type that has the potential to adversely affect bottom habitat in the action area." BiOp at 207. The Final Rule is also a function of NMFS's regulatory oversight of marine species under the Marine Mammal Protection Act, which Act is the primary impetus behind the ALWTRP. Final Rule at 1.

⁵ The BiOp is available on the docket at ECF 1-1.

According to NMFS, the reason for its request for consultation⁶ and issuance of a BiOp relates to “new information” received in 2017 indicating that “right whale abundance has been in decline since 2010.” *Id.* at 5. This information “may reveal effects from the fisheries analyzed in the [prior] Biological Opinions that may not have been previously considered.” *Id.* NMFS also states that certain “reinitiation triggers” in the prior Biological Opinions have been exceeded in recent years. *Id.*

With regard to the North Atlantic right whale, the BiOp ultimately concludes with a finding that “the nature and magnitude of the proposed [regulatory] action’s effects, ... including the implementation of the [North Atlantic Right Whale Conservation] Framework, is not likely to jeopardize [their] continued existence.” *Id.* 341. This finding, in turn, called for NMFS to issue an incidental take statement⁷ setting forth the anticipated level of take of the right whale and reasonable and prudent measures to avoid and minimize the take going forward.

NMFS’s consultation process involved, in part, “proposing [measures] as part of the Atlantic Large Whale Take Reduction Plan (“ALWTRP”) ... designed to modify, specifically, the American lobster and Jonah crab trap/pot fisheries.” *Id.* at 6. The BiOp incorporates NMFS’s North Atlantic Rights Whale Conservation Framework for Federal

⁶ The BiOp identifies the “action agency” as the National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, through its Sustainable Fisheries Division. The “consulting agency” is identified as the National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, through its Protected Resources Division.

⁷ NMFS predicts the take of 2.69 right whales annually (27 whales over 10 years) throughout the entire Atlantic region. BiOp App’x A, North Atlantic Right Whale Conservation Framework for Federal Fisheries in the Greater Atlantic Region, BiOp at 475 (PageID # 530). NMFS offers no predictive methodology for statistical attribution of any such take to LMA 1 during the fall and winter fishing season.

Fisheries in the Greater Atlantic Region (“Framework,” BiOp App’x. A), “to further reduce” mortalities and serious injuries to right whales. *Id.* at 7. NMFS describes its Framework as evidence of its “commitment to use its authorities to implement measures that are necessary for the recovery of right whales, while providing a phased approach and flexibility to the fishing industry.” *Id.* Like the ALWTRP, the Framework is informed not only by the ESA, but also by the Marine Mammal Protection Act, 16 U.S.C. § 1387. *See* BiOp at 7.

According to the BiOp, the Framework is an important initial consideration in NMFS’s phased and flexible approach to modifying fishing industry standards for protection of right whales.⁸ *Id.* In NMFS’s words: “If gear and operational measures cannot reach the targets of the Conservation Framework, NMFS has the authority to implement closures (partial/complete or seasonal) to reduce risk, if needed.” *Id.* (emphasis added). The Framework is meant to be “adaptive” to allow “for revisions as additional information becomes available or should any of the assumptions require revisions.” *Id.*

In its Final Rule, issued in September, 2021, NMFS amends the ALWTRP to implement what is effectively a closure of the LMA 1 restricted zone before implementing gear and operational measures that it waits to implement in May of 2022.⁹ Final Rule at 8 (ECF No. 1-2). The Final Rule suggests that NMFS’s closure of the LMA 1 restricted zone

⁸ The Framework has four phases and extends into 2030. BiOp at 8.

⁹ In its proposed rule, distributed in December, 2020, NMFS did not take a position on LMA 1 closure, but solicited public comment on the topic, suggesting three alternatives: no LMA 1 seasonal restricted area, implementation only following triggering events, and implementation of LMA 1. Proposed Rule, 85 Fed. Reg. 86878-01, 86882.

is part of its effort to spread the burdens of the ALWTRP across jurisdictions regardless of whale migratory patterns and based, in part, on the development that a Maine delegation to the planning team (comprised of representatives of the Maine Department of Marine Resources and the Maine Lobstermen's Association) withdrew its support for a 50 percent line reduction measure inside LMA 1. *Id.* at 100.¹⁰

The gear and operational measures appear promising. These measures include “trawling up” (increasing the number of traps per trawl line, thereby reducing the number of VBR in the water column), the use of sinking ground line between the traps on the trawl, and the use of VBR with a “weak line” inserted along the length of the VBR so that a whale can break free of an entanglement.¹¹ BiOp at 9, 177; Final Rule at 13-15. These all appear to be reasonable gear modifications¹² that, importantly, the average license holders could

¹⁰ The Department of Marine Resources advocated line restrictions and data collection over closure. It's perspective is available in FEIS Appendix 3.3.1.1.

¹¹ The BiOp speaks in terms of 1700 lb maximum breaking strength. BiOp at 225.

¹² Breaking line would likely ameliorate the negative consequences of an entanglement but not negate them. “Documented cases show that entangled animals may travel for extended periods of time and over long distances before freeing themselves, being disentangled by humans, or dying as a result of the entanglement (Angliss and DeMaster 1998).” BiOp at 209. *See also id.* at 213 (describing sublethal effects of entanglement).

There are generally three initial attachment points for gear to attach to large whales: (1) the gape of the mouth, (2) around the flippers, and (3) around the tail stock. Knots in the line hinder the ability of the line to pass through the baleen. Anchors on the gear or the weight of the gear itself offers resistance against which the whale may struggle and result in further entanglement of the fishing gear across the mouth and/or body of the whale. Conversely, the extra resistance could increase the effectiveness of weak links to assist in shedding gear from entangled whales. Weak links are breakable components of the gear that will part when subject to a certain tension load.

Id. at 209. Commenters on the proposed rule observed that weaker lines may not prove effective for entanglements involving juvenile whales. Final Rule at 18-19.

meet.¹³

NMFS states that lobster fishing activity in the offshore zone tends to be most active in the fall and winter months due to the biological cycle of the American lobster. BiOp at 16. NMFS thus recognizes that its closure of the LMA 1 restricted zone to VBR-systems is perfectly timed to ruin a fishing season, at least for the substantial lot of license holders who work these grounds. But is the closure timed to protect right whales? The ALWTRP has been around for several years and the regulations it has spawned address many concerns other than concerns associated with the use of VBR in lobster fisheries. It has, however, included closures in certain trap/pot fisheries. BiOp at 177. When it has done so, notably, the closures have been designed to “coincide with the presence of right whales in these areas” and closures can be extended in response to an ongoing presence of right whales in a closure area. *Id.* at 177-78.

Right whale migratory patterns are an important tool in deciding where and when a closure is called for. NMFS tells us that right whales have feeding grounds in the Northeast and calving grounds in the Southeast. *Id.* at 179. The illustrative aid provided to depict the “Northeast” feeding ground is considerably south of LMA 1. *Id.* at 180. NMFS also finds that the feeding grounds span New England waters into Canadian waters, BiOp at 186, with a case of a calf being born in the Gulf of Maine in 2009, “apparently.” *Id.* at 186-87.

¹³ Trawling up requirements place a greater demand on hauling equipment in lobster boats. The record does not provide adequate information to interpret how many traps per trawl might raise a serious impediment to the average lobster boat fishing in the LMA 1 Restricted Area. For a small subset of license holders, there may be other work arounds for the LMA 1 closure, including “ropeless” systems that brings a trawl line to the surface when needed, rather than having a static line persisting in the water, but ropeless systems are in a trial stage at this time. BiOp at 9, 225; Final Rule at 10, 110. NMFS says that “fishermen who wish to try ropeless fishing may apply for an EFP, and will be able to fish in the restricted areas to test the technology.” Final Rule at 109.

The BiOp provides the following summary of right whale migratory patterns:

Right whales predominantly occupy waters of the continental shelf, but are also known to make lengthy excursions into deep waters off the shelf (Baumgartner and Mate 2005, Davis et al. 2017, Hayes et al. 2020, Mate et al. 1997). Offshore of the Maine coast, the likelihood of a North Atlantic right whale being present increases with distance from shore (Roberts et al. 2016). Surveys have demonstrated the existence of several areas where North Atlantic right whales congregate seasonally, including areas in the action area such as the coastal waters of the southeastern U.S.; the Great South Channel; Jordan Basin; Georges Basin along the northeastern edge of Georges Bank; Cape Cod; Massachusetts Bay; and the continental shelf south of New England (Brown et al. 2002, Cole et al. 2013, Hayes et al. 2020, Leiter et al. 2017).

In the late fall months (e.g., October), pregnant female right whales move south to their calving grounds off Georgia and Florida, while the majority of the population likely remains on the feeding grounds or disperses along the eastern seaboard. Recent research indicates our understanding of their movement patterns remains incomplete (Davis et al. 2017). A review of visual and passive acoustic monitoring data in the western North Atlantic demonstrated nearly continuous year-round presence across their entire habitat range (for at least some individuals), including in locations previously thought of as migratory corridors (e.g., waters off New Jersey and Virginia). This suggests that not all of the population undergoes a consistent annual migration (Bort et al. 2015, Cole et al. 2013, Davis et al. 2017, Hayes et al. 2020, Leiter et al. 2017, Morano et al. 2012, Whitt et al. 2013).

New England waters are important feeding habitats for right whales, where they feed primarily on copepods (Hayes et al. 2020). The distribution of right whales is linked to the distribution of their principal zooplankton prey, calanoid copepods (Baumgartner and Mate 2005, NMFS 2005, Waring et al. 2012, Winn et al. 1986). Right whale calls have been detected by autonomous passive acoustic sensors deployed between 2005 and 2010 at three sites (Massachusetts Bay, Stellwagen Bank, and Jeffreys Ledge) in the southern Gulf of Maine (Morano et al. 2012, Mussoline et al. 2012). Comparisons between detections from passive acoustic recorders and observations from aerial surveys in Cape Cod Bay between 2001 and 2005 demonstrated that aerial surveys found whales on approximately two-thirds of the days during which acoustic monitoring detected whales (Clark et al. 2010).

Recent changes in right whale distribution (Kraus et al. 2016) are driven by warming deep waters in the Gulf of Maine (Record et al. 2019). Prior to 2010, right whale movements followed the seasonal occurrence of the late stage,

lipid-rich copepod *C. finmarchicus* from the western Gulf of Maine in winter and spring to the eastern Gulf of Maine and Scotian Shelf in the summer and autumn (Beardsley et al. 1996, Mayo and Marx 1990, Murison and Gaskin 1989, Pendleton et al. 2009, Pendleton et al. 2012). Warming in the Gulf of Maine has resulted in changes in the seasonal abundance of late-stage *C. finmarchicus*, with record high abundances in the western Gulf of Maine in spring and significantly lower abundances in the eastern Gulf of Maine in late summer and fall (Record et al. 2019). One of the consequences of this has been a shift of right whales out of habitats such as the Great South Channel and the Bay of Fundy, and into areas such as the Gulf of St. Lawrence in the summer and south of New England and Long Island in the fall and winter (NMFS NEFSC, unpublished data).

BiOp at 187.

Of the various locales associated with right whale migrations, the one¹⁴ that conceivably overlaps with LMA 1 during the relevant closure period is the “western Gulf of Maine,” where the NMFS predicts the presence of right whales during the LMA 1 closure period *in spring* based on seasonal abundance of late-stage *C. finmarchicus*, while also supposing that the warming¹⁵ of the Gulf of Maine has shifted right whales “south of New England and Long Island in the fall and winter.” *Id.* (citing unpublished data); *see also id.* at 198. The right whale’s migratory shift away from Maine in the fall and winter raises the flag that the timing of the LMA 1 closure (October through January) is not calibrated to the co-occurrence of whales and fishing effort, let alone the sort of whale aggregations that have informed other closures implemented by NMFS.

According to the BiOp’s discussion of the “Effects of the Proposed Action,” BiOp § 7, the “highest abundance of ... whale populations occur from March through November

¹⁴ The LMA 1 is not at the continental shelf and the Stellwagen Bank and Jeffreys Ledge areas are considerably south and west of LMA 1. Georges Bank is nowhere near LMA 1 either.

¹⁵ NMFS finds that water temperature has “a large influence on geographic ranges of cetacean species.” BiOp at 197.

in New England waters,” *id.* at 210, but this metric is linked to the combined presence of multiple species. As to right whales specifically, NMFS finds:

For many years, right whales aggregated seasonally in seven known areas: the coastal waters of the southeastern United States; the Great South Channel; Jordan Basin; Georges Basin along the northeastern edge of Georges Bank; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Roseway Basin on the Scotian Shelf. Since 2010, fewer whales have been using some of these established habitats such as the Great South Channel and the Bay of Fundy (Davis et al. 2017, Hayes 2019). Meanwhile, the use of Cape Cod and Massachusetts Bay seems to have increased and a large portion of the right whale population is now using an area south of Nantucket and Martha’s Vineyard from winter through early spring (Davis et al. 2017, Hayes 2019). This area is also used in other seasons (Oleson et al. 2020). In addition, right whales also use more of the U.S. eastern seaboard than previously believed and can be present in the Mid-Atlantic year round (Davis et al. 2017, Hodge et al. 2015, Salisbury et al. 2016, Whitt et al. 2013). The frequency with which right whales occur in offshore waters in the southeastern United States remains unclear (Hayes 2019).

BiOp at 210. These migratory paths do not overlap with the LMA 1 Restricted Area. Elsewhere, when discussing right whale jeopardy, NMFS expresses the understanding that right whales tend to forage in waters in and around the Gulf of Maine in spring and summer. *Id.* at 324. The LMA 1 Restricted Area, however, is to be implemented in fall and winter. These findings related to right whale migratory patterns do not appear to justify the closure of LMA 1 because they do not demonstrate an “overlap of the fisheries and large whales in space and time.” *Id.* at 209.

NMFS concludes that of all the fishery gear under its purview, VBR has a statistically high rate of incidence when mortalities or serious injuries occur to whales and that the greatest relative risk to whales in U.S. waters exists in offshore waters. *Id.* at 223. NMFS predicts that U.S. federal fisheries (all such fisheries using all gear types, not just lobster boats fishing in LMA 1 using VBR) will entangle roughly 15 percent of the right

whale population annually, a grim figure indeed. *Id.* Given these findings, Phase 1 of the ALWTRP focuses on right whale entanglement with “trap/pot gear used in lobster and Jonah crab fisheries.” *Id.* at 224. However, for LMA 1 to be implicated, there should be good reason to believe that VBR in the LMA 1 Restricted Area will overlap with right whale migratory patterns. NMFS provides no alternative rationale when it comes to justifying closures: “Closures protect areas of predictable seasonal aggregations of right whales.” *Id.* at 225.

The available record of known large whale entanglement and vessel strike cases between 2010 and 2019 offers little to support outright closure of LMA 1. Though it collects many entanglements and vessel strikes involving right whales, there is no known incident within LMA 1. The report identifies a known vessel strike 26 nautical miles south west of Grand Manan Island in the summer of 2010; a vessel strike 83 nautical miles east of Portland in November of 2011; an entanglement 22.2 nautical miles east of Cape Elizabeth in September 2015; and an entanglement 6.5 nautical miles south east of Seguin Island in September 2016. FEIS appendix 2.2.¹⁶ Of note, the November incident comes within the temporal parameters of the LMA 1 closure, but not its geographic boundaries. It also occurred ten years ago and Gulf of Maine warming trends make this a significant temporal factor.

¹⁶ “Final Environmental Impact Statement, Regulatory Impact Review, and Final Regulatory Flexibility Analysis for Amended the Atlantic Large Whale Take Reduction Plan” (NOAA, June 2021), portions available in the record at ECF 1-4 and 25-1.

To support the partial closure of LMA 1, the Final Rule relies on NMFS's Final Environmental Impact Statement ("FEIS"), a so-called Decision Support Tool version 3, and a habitat model described as "Duke Model Version 11" to supply the co-occurrence data (*i.e.*, co-occurrence of right whales and VBR in LMA 1 and elsewhere). Final Rule at 101-103. According to NMFS, the closure period covers a season in which the LMA 1 is a "hotspot" of right whale activity, *id.* at 101, though NMFS also allows that, "[l]ike some commentators, given the lack of systematic surveys in this area, we were concerned that whales might not be using this area after they shifted distributions in the last decade." *Id.*¹⁷

The FEIS is a product of the National Environmental Policy Act, which requires federal agency to observe certain procedures (but not outcomes) associated with federal activity, including federal permitting of private activity. The FEIS was produced to satisfy NEPA procedural requirements arising from NMFS's amendment of the Atlantic Large Whale Take Reduction Plan. The FEIS "evaluates the biological, economic, and social impacts" of NMFS's rule-making activity and describes the amendments of the Plan as encompassing measures "designed to reduce the risk of serious injury and death caused by entanglement in commercial fishing gear to a rate below each species potential biological removal level." FEIS at 1. The stated objective of the alternative regulatory measures evaluated in the FEIS is to reduce the incidence of entanglements rapidly by focusing on the reduction or removal of lobster trap/pot VBR from migratory routes at a level sufficient

¹⁷ NMFS notes that gear densities are high in LMA 1 and that it focused on LMA 1 rather than LMA 3 (which has higher whale occurrence rates) because of LMA 3's lower line densities and the fact that LMA 3 licensed vessels are adopting trawling up and weak line measures. However, such measures might have been imposed immediately in LMA 1 instead of the immediate closure to fishing with VBR in the LMA 1 Restricted Area. *Id.* at 103.

to reduce the risk of entanglement by 60 percent.¹⁸ FEIS at 4-5.

According to the FEIS, assumptions about the risk reduction impact of the Final Rule are based primarily on a Decision Support Tool (“DST”) designed by the Northeast Fisheries Science Center. NMFS has turned to the DST to substantiate a closure in LMA 1 because NMFS understands that trends over the last decade have made the Gulf of Maine less appealing to right whales. Moreover, NMFS lacks any traditional evidence that Maine fishing gear has been responsible for the take of a right whale in recent years.¹⁹ As described by NMFS in the FEIS:

The DST aids in the comparison of spatial management measures by calculating right whale entanglement risk based on three components: the density of lines in the water, the distribution of whales, and a gear threat model to determine the relative threat of gear based on gear strength.

FEIS at 10 (citing FEIS App’x 3.1). Thus, while NMFS purports to base seasonal closures on a co-occurrence of whales and line densities, the question is whether the DST

¹⁸ NMFS states at once that its FEIS focuses on achieving a 60 percent reduction, but also that an 80 percent reduction remains “the upper target.” FEIS at 5.

¹⁹ NMFS states that for many entanglement incidents resulting in the death or serious injury of a whale the responsible line either is no longer found on the whale or else bears no mark of its origin. Among the other measures being set in place by responsible regulatory agencies are line marking requirements. For example:

The Maine DMR has regulations, effective September 1, 2020, to require gear marking throughout Maine waters using purple as their unique color (DMR Chapter 75.02). Alternative 2 (Preferred) of this FEIS has a modified gear marking scheme Additional 1 foot green marks would be required in federal waters under Alternative 2 (Preferred) for better discernment between fishing in U.S. and Canada and between state and federal waters and waters of the Northeast Trap/Pot Management Area.

FEIS at 96. For some reason NMFS’s marking requirements will not take effect until May 2022. NMFS does not consider this to be an impediment to immediate imposition of a closure in the LMA 1 Restricted Area because it relies on yet another mathematical approach to assume that a set percentage (*i.e.*, 50%) of entanglement incidents of which it becomes aware are the result of an incident somewhere in U.S. waters. BiOp at 217. NMFS does not explain how it attributes these incidents further to the Gulf of Maine, which NMFS scientists do not consider to be the preferred habitat of the right whale.

substantiates the LMA 1 closure based on meaningful migratory data or simply uses math in a manner that makes a reduction in line density appear statistically meaningful even in the absence of passing whales.

Although the DST is said, by Defendants, to utilize the “best available information about whale distribution,” FEIS at 38, the information itself is controversial and not exactly transparent:

The model applies the best available information about whale distribution, buoy line numbers, and configurations of trap/pot gear. There is uncertainty in each data set. Because whales exhibit regular behavioral patterns (e.g., migration, feeding), NMFS seeks to use distribution data to reduce impacts on the fishing industry but maximize the effectiveness of the Plan by designating requirements tailored by region and season. Development of these spatial and temporal requirements involves the consideration of the inherent uncertainties and the integration of complex technical input from NMFS researchers and other experts. The models underwent Center of Independent Expert peer review in 2019 that acknowledged uncertainty and suggested modifications that were made when possible. Although much of the data is subject to uncertainty, the information employed in developing the spatial and temporal elements of the alternatives under consideration is the best information currently available.

FEIS at 38. The “consideration of inherent uncertainties and the integration of complex technical input” presumably entail some concrete inputs; according to NMFS, its models use data from the 2010-2018 period after the change in whale distribution was noted, and the data “predict[] this area as a relative hotspot.” *Id.* at 40. The issue is whether the Court can evaluate any such data before the Agency implements the LMA 1 Restricted Area.

Section 5.2.1 of the FEIS is entitled Use of NMFS Decision Support Tool. NMFS states that the Tool is “built upon the co-occurrence model” with supporting documentation “of the DST” in FEIS Appendix 3.1 with “outputs” in FEIS Appendix 3.2. Before turning to these sources, the NMFS offers some more practical observations associated with co-

occurrence and distance from shore in its discussion of the trawling up measure. NMFS agrees with the Maine Department of Marine Resources that the risk of co-occurrence increases with distance and that 12 nautical miles supplies some kind of fulcrum point that would counsel in favor of stronger measures. FEIS at 187-88, 192. However, in terms of analysis offered in the FEIS, NMFS presents only aggregate data drawn from all risk reduction measures. *See, e.g., id.* at 199. It offers details when it has them, providing a graphic of sighting data near Nantucket, for example, *id.* at 203, Figure 5.4, but offers no detail when it comes to LMA 1, only the prediction that right whales “may return [to the area in] pre-2010 frequency ... in the future,” while Maine fishermen “may ... be fishing farther offshore than in previous years” due to greater lobster abundance in these waters. *Id.* at 202. *See also id.* at 204 (“current analysis uses a newer version of the right whale density model (version 11) that captures more recent data after the regime shift that started in 2010 (Pace et al. 2017)”). I turn then to the DST to see whether a basis for fishery closure will reveal itself.

The Decision Support Tool Model Documentation (FEIS Appendix 3.1) begins with reassuring language:

Within the model, risk posed to the NARW population is calculated as the product of: (1) the density of vertical lines associated with lobster traps at a given location, (2) the threat vertical lines pose to NARW given the configuration of the lobster gear, relative to alternative gear configurations, and (3) the density of NARW expected at the given location. The DST is partially based on the Vertical Line Model (VLM) and Co-Occurrence Model developed by Integrated Economics (IEC, indecon.com) for NOAA since 2004. Many of the inputs to the DST that are comparable to the VLM have a similar format and maintain some backwards-compatibility for the purpose of datasharing.

FEIS appendices p.97. Software paraments include a “whale abundance/distribution model

... by location and month” and calculate risk values as “the product of gear threat per endline, density of endlines, and density of whales.” *Id.* p.99, §§ 2.19, 2.20. One input includes a “whaleinputmodel,” a data file with a whale density model. *Id.* § 3.1.4. The program will produce a pure cooccurrence model if queried, and allows NMFS to “examine spatiotemporal distributions.” *Id.* §§ 3.1.10, 3.1.11.

Line density models are another “primary input,” but the density input for certain areas relies on “methods for different states and the offshore fishery” rather than data, given the lack of a reporting requirement or other reliable metric. *Id.* § 4.1. The method for Maine in the disputed region appears to rely permits and landings data. *Id.* § 4.1.1.1.²⁰

Whale density models draw heavily on an external report NMFS uses to establish default right whale behavioral patterns over the last decade, citing Jason J. Roberts et al., Habitat-based cetacean density models for the United States Atlantic and Gulf of Mexico, 6 SCI. REP. 22615 (2016). *See* FEIS §§ 4.8, 6.0.

²⁰ Landings data is a controversial metric of effort/line density because landings predominantly reflect increased lobster abundance and abundance metrics are much higher closer to shore. Maine DMR Letter to NOAA re Technical Memo (Oct. 2018), FEIS Appendix 3.3.1.2 (“It is unclear why NOAA would choose to use state landings records for only one state that is dominated by inshore effort if seeking to accurately characterize offshore effort, as the majority of the truly “offshore” effort (in Area 3) is from permit holders in other states.”); Letter to NOAA re Scoping (Sept. 2021), FEIS Appendix 3.3.1.4. In the Final Rule, NMFS estimates that between 60 and 120 vessels fish for lobster in the LMA 1 restricted zone. Final Rule at 107. In practice, actual line densities are difficult to measure because they depend on fisherman effort and NMFS has not imposed reporting requirements as a condition of licensure for these offshore federal waters and because there are many latent licences out there. “Many fishermen who hold licenses do not actively fish at all, and many active fishermen do not fish all of the traps that have been allocated to them.” FEIS at 190. Because LMA 1 has lobster in high abundance, some significant effort is anticipated in this entire zone. *Id.* at 191. Yet it is understood that effort falls off with increased distance from shore. Ultimately, NMFS concedes that modeling this factor is difficult and “complicates the assessment of entanglement risk in this region.” FEIS at 193. NMFS says it would benefit from “improved trip reporting and ... vessel monitoring.” *Id.* The record includes evidence that the entire offshore zone beyond 12 nautical miles yielded roughly 9% of Maine landings in 2016. Actual vessel numbers and gear configurations in this zone are not clearly understood. Maine Department of Marine Resources Letter to NOAA re Scoping, FEIS Appendix 3.3.1.4.

The spatial and temporal distribution of whales within the model domain is adapted from the Right Whale Habitat model from Roberts et al. (2016). In short, the model uses whale sighting data from a variety of sources, matched with co-located oceanographic and habitat variables to predict whale density at any given location. The right whale habitat model has been updated over the past two years with a number of improvements. Recognizing that whale distributions and seasonal migration patterns have changed over the past decade, the whale distribution model now has three options for inputs, one model for the past decade (2010 – 2018), a second for the previous decade (2003 – 2009) and a third for the entire time series. We used the recent decade model as the default for all current analysis and used the other two models for some explorations of uncertainty in whale distributions and robustness of management plans. The updated models are estimated at a 5km pixel resolution and was translated to the domain of the DST by overlaying the points within the DST domain on the whale habitat model raster and extracting the overlapping values. Thus, whale density values for individual pixels in the DST will have the same value as some neighboring pixels if they fell into the same cell in the original whale model. (Figure 4.8.a and b).

Id.

Trap density defaults for the DST were, for the LMA 1 Restricted Area, between 10 and 100 traps per square mile between October and January. Figure 4.1.3.a. But line density defaults reflect between 1 and 10 lines per square mile. Figure 4.1.3.b. A “whale habitat score” graphic reflects another input, and November, December and January show some uptick in the default inputs, moving the needle from close to 0.00 to beneath 0.04. This graphic is confusing given that it purports to provide a habitat score but also bears the legend “Monthly whale density.” Figure 4.8.a. A logarithmic scale version of the map is, predictably, more attention grabbing. Figure 4.8.b.

From all that appears in the record, the DST provides a predictive model that ties together uncommon sightings and a habitat model that supports the idea that the Gulf of Maine can supply an adequate feeding ground for individual right whales during the fall

and winter months.²¹ In other words, it appears to be an accepted understanding that there is potential that one or more right whales may transit the LMA 1 Restricted Area during the closure period.

DISCUSSION

The standard for issuing a temporary restraining order is “the same as for a preliminary injunction.” *Bourgoin v. Sebelius*, 928 F. Supp. 2d 258, 267 (D. Me. 2013). (citations and quotation marks omitted). The record before the Court must demonstrate (A) the plaintiff is likely to succeed on the merits of a claim for which injunctive relief is available; (B) a significant risk of irreparable harm if the injunction is withheld; (C) a favorable balance of the equities; and (D) the requested relief will not harm the public interest. *NuVasive, Inc. v. Day*, 954 F.3d 439, 443 (1st Cir. 2020). As the party seeking injunctive relief – and as the only party presently before the Court – the plaintiff necessarily bears the burden of establishing that the factors favor the award of a temporary restraining order. *Nat’l Org. for Marriage v. Daluz*, 654 F.3d 115, 117, 119-20 (1st Cir. 2011).

A. Reviewability

To start, I find that Plaintiffs’ APA claim is reviewable. Defendants correctly note that the issue of whether courts may entertain “so-called ‘pure APA’ action[s] without reference to another substantive statute” remains unsettled in this circuit. *Union of Concerned Scientists v. Wheeler*, 954 F.3d 11, 21–22 (1st Cir. 2020). But this is not a “pure

²¹ The Maine Department of Marine Resources characterized the predictive model as follows: “This leaves much of the Gulf of Maine relying on the modeled distribution of right whales, which uses climatological data when there is little effort and low sightings.” Letter to NOAA re Decision Support Tool (April 2019), FEIS Appendix 3.3.1.3.

APA” claim—as I understand it, Plaintiffs argue that the Final Rule is an arbitrary and capricious application of the MMPA. Specifically, Plaintiffs claim that the challenged closure “does not further the purposes of the . . . MMPA” inasmuch as the closure is unrelated to the statutory mandate under the MMPA to protect whales and other marine mammals. Pls.’ Mot. 7, 8 (ECF 10). That Plaintiffs failed specifically to recite the MMPA’s statutory directive when stating their claim in the complaint, *see* Complaint at 34, does not warrant the dismissal of this case.

B. Likelihood of Success

Failure to demonstrate a likelihood of success on the merits ordinarily precludes the award a preliminary injunction. *New Comm. Wireless Servs., Inc. v. SprintCom, Inc.*, 287 F.3d 1, 9 (1st Cir. 2002). On the other hand, “[a]s a matter of equitable discretion, a preliminary injunction does not follow as a matter of course from a plaintiff’s showing of a likelihood of success on the merits.” *Benisek v. Lamone*, — U.S. —, 138 S. Ct. 1942, 1943–44 (2018) (per curiam). In the final analysis, “trial courts have wide discretion in making judgments regarding the appropriateness of such relief.” *Francisco Sánchez v. Esso Standard Oil Co.*, 572 F.3d 1, 14 (1st Cir. 2009)). While the “plaintiffs must show ‘more than mere possibility’ of success” for me to grant a preliminary injunction, *Sindicato Puertorriqueno de Trabajadores v. Fortuno*, 699 F.3d 1, 10 (1st Cir. 2012) (quoting *Respect Maine PAC v. McKee*, 622 F.3d 13, 15 (1st Cir. 2010)), I “need not predict the eventual outcome on the merits with absolute assurance,” *Ross-Simons of Warwick, Inc. v. Baccarat, Inc.*, 102 F.3d 12, 16 (1st Cir. 1996).

A district court is empowered to reverse agency action that is “arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.” 5 U.S.C. § 706(2)(A). *See also Motor Vehicle Mfrs. Ass’n of U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 41 (1983). “Review under the arbitrary and capricious standard is narrow and this Court may not substitute its judgment for that of the agency, even if it disagrees with the agency’s conclusions.” *River St. Donuts, LLC v. Napolitano*, 558 F.3d 111, 114 (1st Cir. 2009). Under this “deferential” standard, the “agency’s actions are presumed to be valid,” *Puerto Rico Tel. Co. v. Telecommunications Regul. Bd. of Puerto Rico*, 665 F.3d 309, 319 (1st Cir. 2011), and “the court must uphold a rule if the agency has ‘examine[d] the relevant [considerations] and articulate[d] a satisfactory explanation for its action[,] including a rational connection between the facts found and the choice made.’” *F.E.R.C. v. Elec. Power Supply Ass’n*, 577 U.S. 260, 292 (2016), *as revised* (Jan. 28, 2016) (alteration in original) (quoting *State Farm*, 463 U.S. at 43). Specifically, the court looks to whether the agency relied on factors Congress did not intend for it to consider, failed to consider an important aspect of the problem, or offered an explanation at odds with the evidence before the agency or so implausible it could not be considered to reflect a reasonable view or the application of specialized agency expertise. *Marasco & Nesselbush, LLP v. Collins*, 6 F.4th 150, 172 (1st Cir. 2021).

In this case, Defendants (hereinafter “the Agency”) imposed what is, in practical effect, a substantial closure of the Maine lobster fishery, based on what appears to be a markedly thin statistical modeling methodology. Making matters more troublesome, this approach departs dramatically from the Agency’s past practice of justifying closures based

on known and predictable whale aggregations demonstrated by concrete evidence. Instead, the Agency relied on a “right whale density model” to identify areas of “higher than average risk” where a targeted closure could achieve the greatest gain in risk reduction without overly disrupting the fishery—certainly a laudable goal. FEIS at 80. This model attempts to account for where whales are most likely to be present based on whale sightings and “environmental covariates believed to correlate with cetacean distributions,” including the shape of the seabed, oceanographic factors such as currents, and known distributions of prey species. Jason J. Roberts *et al.*, *Habitat-based cetacean density models for the United States Atlantic and Gulf of Mexico*, 6 SCI. REP. 22615 (2016). The model suggests that because the LMA 1 Restricted Area is both a viable habitat for right whales during the winter months and an abundant winter lobster fishery that will receive considerable fishing effort, it is a suitable location for a targeted closure.

While an agency may, in its discretion, choose which pieces of evidence to rely on and which to discount, *see Upper Blackstone Water Pollution Abatement Dist. v. U.S. E.P.A.*, 690 F.3d 9, 26 (1st Cir. 2012), it may not, in so doing, ignore an important aspect of the problem that it is trying to solve, *see id.* at 20. Here, the agency’s devotion to whale distribution modeling ignored what I deem to be a core aspect of the problem of right whale entanglements: whether right whales *actually* aggregate in the LMA 1 Restricted Area. While Plaintiffs’ bold contention that there are no right whales in the Gulf of Maine²² may yet be contradicted by scientific and anecdotal evidence, the record presented thus far does

²² It appears generally accepted that the Gulf of Maine is not the preferred habitat of right whales and that there is a dearth of evidence to conclude that there has been a taking of a right whale there in recent years.

not indicate that right whales actually congregate in or pass through the LMA 1 Restricted Area with nearly enough frequency to render it a “hotspot” for whale and bouy line co-occurrence, contrary to the Agency’s characterization.

I recognize that it is not my place to second guess the Agency’s informed decision to rely on this data, nor am I hubristic enough to do so. And were these distributional models the only evidence available to the Agency in its effort to preserve a quickly disappearing endangered species, the Agency’s reliance on such models may, out of necessity, be deemed reasonable and its failure to consider the actual presence of right whale aggregations excusable. But that is not the case—the agency does have the ability to generate evidence more reliable than abstract mathematical models to prove or disprove right whale occurrence rates in the Gulf of Maine in the winter season, most notably in the form of passive acoustic recorders that have *this year* been placed along the Maine coast and could have been placed earlier during the multi-year review process that resulted in the Final Rule. FEIS at 81. Presumably the Agency recognizes the practical utility of such evidence when it comes to imposing a closure based on buoy line and whale co-occurrence and will soon have such evidence to evaluate, which will either substantiate or contradict its modeling effort.²³

I do not conclude today that the Agency, in fact, acted arbitrarily or capriciously in crafting the Final Rule. I find only that the Plaintiffs have shown a strong enough likelihood of success and that their challenge to the proposed seasonal closure of the LMA 1

²³ During the oral argument on Plaintiffs’ Motion, the Agency read from a website that purports to collect acoustical data collected by a non-governmental entity, but the Agency did not place any such data in the record to substantiate the Agency’s decision-making process.

Restricted Area warrants more fulsome consideration than the preliminary injunction window allows for.

C. Irreparable Injury

The MMPA directs the Agency to consider the “economics of the [lobster] fishery” and the impact that a regulation would have on the fishery, 16 U.S.C. § 1387(f)(2), and the record shows that the Agency acknowledged the economic impact of the seasonal closure, *see* Atlantic Large Whale Take Reduction Plan Regulations, 86 Fed. Reg. 51,970, 51,971 (Sept. 17, 2021) (to be codified at 50 C.F.R. § 229.32). But the Agency characterized the impact in a broad-brush fashion, suggesting the impact represents “1.5 to 3 percent of the ... landings value to the fisheries.” *Id.* This assessment does not appear to take into consideration the local impact of a closure of the LMA 1 Restricted Area, but instead uses another mathematical maneuver to reduce local impacts to a marginal level. Standing alone, this omission is not likely to prove determinative, but it contributes weight to Plaintiffs’ side of the balance beam for purposes of my effort to decide whether the status quo should remain in place during the pendency of this action.

Plaintiffs’ concerns about the economic effects of the regulation on themselves and other Maine fishermen, *see* Pls.’ Mot. at 21–22, 23–24, are sufficiently likely and substantial to support preliminary injunctive relief. While loss of income “infrequently rise[s] to the level of irreparable harm required for a preliminary injunction,” *Nwaubani v. Grossman*, 806 F.3d 677, 681 n.8 (1st Cir. 2015) (citing *Sampson v. Murray*, 415 U.S. 61, 91–92 (1974)), it may nonetheless suffice in a case where the government is a defendant and the plaintiff can show a “significant” economic harm. *California Ass’n of Priv.*

Postsecondary Sch. v. DeVos, 344 F. Supp. 3d 158, 170 (D.D.C. 2018) (quoting *Gulf Oil Corp. v. Dep’t of Energy*, 514 F. Supp. 1019, 1026 (D.D.C. 1981)). The figures that the Plaintiffs offer for the amount of income they anticipate losing may be overstated—there is no fisherman whose state license limits fishing in the LMA 1 Restricted Area, though I acknowledge the logistical difficulties and resulting chaos when a fleet of lobstermen are dislocated from their traditional fishing grounds and find themselves seeking shelter from the storm in other claimed grounds. Plaintiffs have offered sufficient evidence to support particularized and irreparable injury. Even the Agency acknowledges that the closure will be costly for lobstermen, who are expected to bear an “annual cost of compliance” of “\$9.8–19.2 million, representing 1.5 to 3 percent of the 2019 landings value of the fisheries.” Atlantic Large Whale Take Reduction Plan Regulations, 86 Fed. Reg. 51,970, 51,971. Given that the cost of the closure also will be born by two communities—Vinalhaven and Stonington—it is hard to cast such losses as anything other than “significant.”

Regardless, I find that Plaintiffs have met their burden of showing that irreparable harm is likely to the extent that the closure would permit competitors to “infiltrate the LMA 1 Restricted Area” and thereby permanently deprive them and other established fishermen of their claims to “generational . . . fishing grounds.” Pls.’ Mot. at 23. Were this fear simply that competitors would “deplete the area of lobsters,” Defs.’ Opp’n. 11 (ECF 25), it would amount to no more than an economic harm; but as I read it, Plaintiffs in fact fear a much more permanent loss of their existing fishing grounds due to regulatory standards that effectively cede those interests to larger economic forces with which they compete.

Specifically, they fear that they will return to the LMA 1 Restricted Area in the spring to find either the area overrun with ropeless traps set by competitors or an ecosystem ruined by ground fishing.

The Agency does not deny the possibility of these outcomes, acknowledging in a response to a comment to the proposed rule that fishermen who have not previously fished the LMA 1 Restricted Area but who “obtain EFPs to fish without buoy lines” will be able to fish the area during the closure. 86 Fed. Reg. 51,970, 51,995. Indeed, the Agency appears to suggest that possible turnover of longstanding gear claims would be a benefit of the proposed rule inasmuch as it would incentivize a shift to ropeless fishing and “open[] up fishing habitat that mobile gear vessels have not been able to access due to the presence of lobster trawls.” *Id.*

Accordingly, I find that the Plaintiffs have met their burden of showing that they will be irreparably harmed in the absence of preliminary injunctive relief.

D. Balance of Equities and Public Interest

Although the “balance of [equities] and the public interest [generally] tips heavily in favor of protected species” by virtue of the fact that Congress has chosen to pass legislation protecting them, *Strahan v. Cox*, 127 F.3d 155, 160 (1st Cir. 1997) (quoting *National Wildlife Fed’n v. Burlington Northern R.R.*, 23 F.3d 1508, 1510 (9th Cir.1994)), given the foregoing discussion of the merits-related and injury-related factors, I find that the balance of the equities favors preliminary injunctive relief that stalls implementation of the LMA 1 Restricted Area.

Without trivializing the precarity or significance of the right whale as a species, I find that the certain economic harms that would result from allowing this closure to go into effect outweigh the uncertain and unknown benefits of closing some of the richest fishing ground in Maine for three months based on a prediction that it might be a hotspot for right whale entanglement. The balance of the equities favors preserving the *status quo pendente lite* until the predictive modeling methodology can be critically unpacked and corroborated or contradicted with more traditional signs and data demonstrating an appreciable co-occurrence of right whales and buoy lines in the restricted area. Likewise, while the public interest in this case cuts both ways—pitting a culturally and economically valuable fishery against the preservation of an equally iconic endangered species—it strikes me that there is an overriding public interest in insisting on orderly and epistemically sound rulemaking that members of the public have reason to believe is grounded in reality.

“The purpose of a preliminary injunction is to preserve the status quo, freezing an existing situation so as to permit the trial court, upon full adjudication of the case’s merits, more effectively to remedy discerned wrongs.” *CMM Cable Rep., Inc. v. Ocean Coast Properties, Inc.*, 48 F.3d 618, 620 (1st Cir. 1995). Just so here. Faced with the imminent closure of a large swath of fishing ground—set, after multiple years of discussion and rulemaking, to go into effect in a matter of weeks—I hold that the Agency may not enforce closure of the disputed area pending further order of the Court for the reasons herein stated.

CONCLUSION

Plaintiffs' Emergency Motion for a Temporary Restraining Order and Preliminary Injunction (ECF 10) is **GRANTED IN PART**. Implementation of the LMA 1 Restricted Area is enjoined pending a ruling on the merits of this action. Plaintiffs' request that I immediately impose specific conditions on any future implementation of the closure to vertical buoy line in LMA 1 Restricted Area is **DENIED**.

SO ORDERED.

Dated this 16th day of October, 2021.

/s/ Lance E. Walker

UNITED STATES DISTRICT JUDGE

EXHIBIT 2

UNITED STATES DISTRICT COURT

DISTRICT OF MAINE

DISTRICT 4 LODGE OF THE)
INTERNATIONAL ASSOCIATION)
OF MACHINISTS AND AEROSPACE)
WORKERS LOCAL LODGE 207,)
et al.,)

Plaintiffs,)

v.)

No. 1:21-cv-00275-LEW

GINA M RAIMONDO, in her official)
Capacity as Secretary of the United)
States Department of Commerce,)
et al.,)

Defendants,)

CENTER FOR BIOLOGICAL)
DIVERSITY, *et al.*,)

Intervenors.)

ORDER ON DEFENDANTS' AND INTERVENORS' EMERGENCY MOTIONS
FOR STAY PENDING APPEAL

Gina M. Raimondo, Janet Coit, and the National Marine Fisheries Service (“NMFS,” and, together with Raimondo and Coit, “Defendants”), and the Center for Biological Diversity, Conservation Law Foundation, and Defenders of Wildlife (“Intervenors,” and, together with Defendants, the “Movants”), have moved for an emergency stay pending their appeal of my Order dated October 16, 2021 (ECF No. 41) granting Plaintiffs’ motion for preliminary injunction to suspend, pending judicial review, Defendants’ implementation of a seasonal closure of certain lobster fishing grounds to vertical buoy lines.

STANDARD OF REVIEW

Pursuant to Rule 8 of the Federal Rules of Appellate Procedure, a party preliminarily enjoined by the District Court may seek a stay of the injunction pending appeal. Fed. R. App. P. 8(a). Ordinarily, the party must first request such relief from the District Court. Fed. R. App. P. 8(a)(1)(A).

The District Court addresses “the same” factors when considering a motion for a stay of a preliminary injunction pending appeal as governed by the issuance of a preliminary injunction in the first instance. *Bos. Parent Coal. for Acad. Excellence Corp. v. Sch. Comm. of City of Bos.*, 996 F.3d 37, 44 (1st Cir. 2021). To grant such relief, “a district court must find the following four elements satisfied: (1) a likelihood of success on the merits, (2) a likelihood of irreparable harm absent interim relief, (3) a balance of equities in the [movant’s] favor, and (4) service of the public interest.” *Arborjet, Inc. v. Rainbow Treecare Sci. Advancements, Inc.*, 794 F.3d 168, 171 (1st Cir. 2015). Of these elements, the movant’s likelihood of success on the merits is the weightiest factor. *Acevedo-Garcia v. Vera-Monroig*, 296 F.3d 13, 16 (1st Cir. 2002) (per curiam). While “common sense dictates that the moving party need not persuade the court that it is likely to be reversed on appeal,” *Canterbury Liquors & Pantry v. Sullivan*, 999 F. Supp. 144, 150 (D. Mass. 1998), “more than a mere possibility of relief is required.” *Nken v. Holder*, 556 U.S. 418, 434 (2009) (citation omitted).

ANALYSIS

I conclude that Movants are not likely to succeed in appealing the preliminary injunction. I halted the enforcement of the seasonal closure based on what I deemed to be a failure to address whether right whales aggregate in the LMA 1 Restricted Area. *See* Order Mot. Prelim. Inj. 22–23 (ECF No. 41). Identifying where right whales spend their time and targeting interventions towards those areas is an “important aspect,” *Motor Vehicle Mfrs. Ass’n of U.S., Inc. v. State Farm Mut.*

Auto. Ins. Co., 463 U.S. 29, 43 (1983), of saving the species from extinction. It is for this reason, presumably, that NMFS has generally cited known whale-migratory tendencies in support of past fishery closures. I concluded that because NMFS relied so heavily on modeling techniques to justify the closure without providing or explaining their inputs, and contrary to its own past practices did so to the exclusion of providing any evidence that right whales actually pass through the LMA 1 Restricted Area, a deeper examination is warranted to ensure that the closure is based on substantial evidence on the record. The seasonal closure should not evade judicial review based on the lack of meaningful data—especially when a preliminary read of the administrative decision suggests a blinkered adherence to predictive modeling when concrete evidence to solve those uncertainties is reasonably available, as is the case here. *Council, Inc. v. Herrington*, 768 F.2d 1355, 1391 (D.C. Cir. 1985) (an agency “may resolve even substantial factual uncertainties in the exercise of its informed expert judgment,” but it “may not tolerate needless uncertainties in its central assumptions when the evidence fairly allows investigation and solution of those uncertainties”). The Movants seek to flag some administrative findings (still not data)¹ now, but when I reviewed their opening salvos and listened to their oral argument, they relied solely on the predictive model and the favorable standard of review. Moreover, when referencing scientific findings during oral argument, the Agency conceded reading to me from a third-party webpage not included in the record. The opportunity remains to rehabilitate that opening presentation in later proceedings, but my preliminary findings for purposes of Plaintiffs’ motion for injunctive relief were based on the record presented to me at that time, which omits a substantial evidentiary bases for the model and, in any event, is not conclusive of the merits.

¹ *E.g.*, Conservation Groups’ Reply at 4 (citing Record of Decision (ECF 25-2) at 22 (referencing in response to public comment, but again in conclusory form, that the LMA 1 seasonal restricted area is “based on the best available information, including recent and historical right whale and other large whale sightings data, acoustic monitoring data, and data on prey distribution”)).

On the arguments presented to me, Plaintiffs showed a likelihood of prevailing in their challenge to the closure. Plaintiffs also showed a likelihood that seasonal closures of a large and abundant fishing ground would deal a heavy and irreparable blow not just to the lobstering industry, but to them in particular.² Finally, while I recognized that the standard for preliminary injunctions generally favors endangered species, the public's interest in evidence-based rulemaking as well as the balance between certain financial and territorial loss and potentially speculative species management favored preserving the status quo for the course of litigation. I cannot conclude, on the facts before me, that Movants have more than a mere possibility of success with their appeal of my grant of a preliminary injunction.

The remaining factors also counsel against staying the preliminary injunction. Although the government is, in some sense, harmed any time it is prevented from acting on its sovereign prerogative, *see New Motor Vehicle Bd. of California v. Orrin W. Fox Co.*, 434 U.S. 1345, 1351 (1977) (Rehnquist, J., in chambers), exalting this concern as a trump card to thwart careful judicial review would prevent plaintiffs from receiving preliminary relief when the government oversteps its bounds. I am not aware of a rule in actions challenging executive agency authority that reduces the role of the federal courts to that of a rubber stamp. Nor, using NMFS' own models, can I conclude that the death of a North Atlantic right whale is likely to occur if the closure is enjoined for the course of this litigation. I also reaffirm my determination that the balance of the equities and the public interest favor a preliminary injunction here—while a request for a stay pending appeal typically has the salutary effect of *preserving* the status quo, the opposite would be true were I to grant the present motion. Given these concerns, preliminary injunctive relief that

² The localized interests are suitably represented in this litigation by the District 4 Lodge and a few local-industry participants. The closure presents a threat to their livelihood and is at least as concrete and particularized an injury to them as is the Movants' asserted injury related to a local fishery measure said to have relatively low statistical efficacy.

preserves the status quo in the LMA 1 Restricted Area pending judicial review—the duration of which will pale in comparison to NMFS’s rulemaking process—is reasonable.

CONCLUSION

Movants’ Emergency Motions for Stay Pending Appeal (ECF Nos. 43, 46) are DENIED.

SO ORDERED.

Dated this 5th day of November, 2021.

/s/ Lance E. Walker
UNITED STATES DISTRICT JUDGE

EXHIBIT 3

United States Court of Appeals For the First Circuit

No. 21-1873

DISTRICT 4 LODGE OF THE INTERNATIONAL ASSOCIATION OF MACHINISTS
AND AEROSPACE WORKERS LOCAL LODGE 207; DAMON FAMILY LOBSTER
COMPANY, INC.; FOX ISLAND LOBSTER COMPANY, LLC; FRANK THOMPSON,

Plaintiffs, Appellees,

v.

GINA M. RAIMONDO, in her official capacity as Secretary of the
United States Department of Commerce; JANET COIT, in her
official capacity as Assistant Administrator of the NOAA
Fisheries; NATIONAL MARINE FISHERIES SERVICE,

Defendants, Appellants.

No. 21-1874

DISTRICT 4 LODGE OF THE INTERNATIONAL ASSOCIATION OF MACHINISTS
AND AEROSPACE WORKERS LOCAL LODGE 207; DAMON FAMILY LOBSTER
COMPANY, INC.; FOX ISLAND LOBSTER COMPANY, LLC; FRANK THOMPSON,

Plaintiffs, Appellees.

v.

CENTER FOR BIOLOGICAL DIVERSITY; CONSERVATION LAW FOUNDATION,
INC.; DEFENDERS OF WILDLIFE,

Intervenor-Defendants, Appellants.

APPEALS FROM THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MAINE

[Hon. Lance E. Walker, U.S. District Judge]

Before

Kayatta, Barron, and Gelpí,
Circuit Judges.

Erika B. Kranz, Todd Kim, Assistant Attorney General, Andrew C. Mergen, Alison C. Finnegan, and Taylor A. Mayhall on brief for appellants Gina M. Raimondo, Janet Coit, and National Marine Fisheries Service.

Kristen Monsell, Erika A. Fuller, and Jane P. Davenport on brief for intervenor-appellants Center for Biological Diversity, Conservation Law Foundation, Inc., and Defenders of Wildlife.

Jay P. McCloskey, Paula D. Silsby, Thimi R. Mina, Alfred C. Frawley IV, and McCloskey, Mina, Cunniff & Frawley, LLC on brief for appellees District 4 Lodge of the International Association of Machinists and Aerospace Workers Local Lodge 207, Damon Family Lobster Company, Inc., Fox Island Lobster Company, LLC, and Frank Thompson.

Ryan P. Steen, Stoel Rives LLP, Mary Anne Mason, General Counsel, Maine Lobsterman's Association, Jane C. Luxton, Kip J. Adams, and Lewis Brisbois Bisgaard & Smith LLP on brief for Maine Lobsterman's Association, amicus curiae.

November 16, 2021

KAYATTA, Circuit Judge. This case pits the Maine lobster industry against a federal environmental agency seeking to save the endangered North Atlantic right whale from extinction. Earlier this year, the National Marine Fisheries Service (the "Agency") issued a rule barring, from October to January each year, the most frequently employed methods of lobstering in a roughly 967 square mile area of the Atlantic Ocean thirty or so nautical miles off the Maine coast. The Agency implemented this new seasonal closure to reduce the risk that a right whale would become entangled in the ropes connecting lobster traps to buoys. Prior to the closure going into effect, several individuals and an organization affected by the closure joined as plaintiffs and asked the district court to postpone the enforcement of the new rule until that court could finally decide whether the new rule is lawful. The plaintiffs' preliminary request required the district court to predict how likely it is to find the new rule unlawful at the end of the case and to consider now what harms might result in the interim should an injunction either be granted or denied. Agreeing with the plaintiffs, the district court put the new rule on ice.

The government then appealed. It argues on the merits that the district court should not have issued its preliminary injunction. By separate motion, the government also asks us to issue a stay of the district court order so that the new seasonal closure would go into effect while the appeal proceeds.

For the following reasons, we grant the government's motion. As we will explain, the district court misapprehended the record and over-stepped its role in rejecting the judgments of the agency that Congress has charged with protecting endangered marine mammals. And, while there are serious stakes on both sides, Congress has placed its thumb on the scale for the whales.

I.

Congress enacted the Marine Mammal Protection Act nearly fifty years ago to ensure that marine mammals -- like the North Atlantic right whale -- are not "permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part." 16 U.S.C. § 1361(2). In 2019, the Agency estimated there were no more than 368 right whales left in the ocean, and the Agency has determined that no more than eight right whales, on average, can be "taken" every ten years if they are to reach their optimum sustainable population.¹ In other words, even one additional death a year increases the odds that the right whale will go extinct.

Entanglement in trap lines is a leading cause of serious injury and death in right whales, who otherwise live on average for four to seven decades. Nat'l Marine Fisheries Serv.,

¹ "Take" is a term of art meaning, in brief, an action that captures, kills, or has the potential to injure a marine mammal, or one that has the potential to disrupt its behavioral pattern. 16 U.S.C. § 1362(13), (18).

Biological Opinion (BiOp) 80, 136 (May 27, 2021). The Agency estimates that just under five right whales per year suffer serious injury or death due to entanglement in federally regulated fisheries.

Because of the critical nature of the right whale's population levels, there has long been federal regulation of certain fisheries aimed at reducing whale buoy and line entanglement. Most recently, an unexplained uptick in deaths in 2017² prompted the Agency to act anew. It reconvened the Atlantic Large Whale Take Reduction Team -- which includes members of the fishing and lobstering industries -- to propose amendments to the Atlantic Large Whale Take Reduction Plan. The Team, and later the Agency, considered several types of actions, including certain restrictions of fishing gear -- like requiring weaker lines -- and seasonal closure of particularly risky fishing areas.

In deciding which actions to take, the Agency used a peer-reviewed "Decision Support Tool" (the "model"). The model identifies so-called "hotspots" where right whales are most in danger based on where vertical buoy lines are likely to be, how strong those lines are likely to be, and where whales are likely to be. Nat'l Marine Fisheries Serv., Final Environmental Impact

² In 2017, seventeen right whale deaths were documented, and new information demonstrated a downward trend in the species' population since 2010.

Statement (FEIS) 73–74 (June 2021). An area may be a hotspot even if only a few whales are predicted to be there if there are a plethora of strong vertical fishing lines. The Agency employed these inputs "because entanglement risk only exists when lines are present, whales are present, and the lines pose a risk to whales." Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations ("Final Rule"), 86 Fed. Reg. 51,970, 51,991 (Sept. 17, 2021). Thus, "if any of these three factors are not present, the risk of entanglement [from the model] is zero." Id.

Based on this model, one of the actions the Agency proposed was to restrict fishing with buoy lines from October 18 to January 31 in a roughly 967 square mile area of the Atlantic Ocean thirty or so nautical miles off the Maine coast ("LMA 1 restricted area"). Representatives of the lobster industry issued comments questioning the inputs of the model, whether any whales are likely to enter that area, and whether there had been any concrete data of a right whale being injured by buoy lines in that area. On August 31, 2021, the Agency issued a final rule in which it responded to these comments but nevertheless retained the seasonal closure, as set to go into effect on October 18.

Plaintiffs -- individual lobster harvesters and a lobstering union -- sued the Agency on September 27, 2021, claiming that the closure of the restricted area was arbitrary and

capricious.³ A week later, the plaintiffs moved for a temporary restraining order and preliminary injunction, seeking to block the seasonal closure from going into effect. After briefing and a hearing, the district court agreed that the plaintiffs are likely to succeed on the merits. It found that the Agency likely acted arbitrarily and capriciously by closing the fishery "based on what appears to be a markedly thin statistical modeling methodology," which "ignored . . . whether right whales actually aggregate in the" restricted area. It concluded that while the Agency has the authority to impose the seasonal closure, it could not do so until "traditional" evidence "either substantiate[s] or contradict[s] its modeling effort."

The district court then found that the plaintiffs met their burden (for preliminary relief) to show irreparable injury because their compliance cost is "significant" and because the rule would result in the "permanent loss of their existing fishing grounds." Finally, the district court concluded that the public interest was on the plaintiffs' side -- despite the fact that it generally "tips heavily in favor of protected species," Strahan v.

³ Once plaintiffs sued the Agency, several conservation groups with an interest in protecting the right whale intervened. Those groups -- Conservation Law Foundation, Defenders of Wildlife, and Center for Biological Diversity -- are parties to this appeal and have filed their own motion for a stay. Given our disposition of the Agency's motion, we will deny the conservation groups' motion as moot.

Coxe, 127 F.3d 155, 171 (1st Cir. 1997) -- because "there is an overriding public interest in insisting on orderly and epistemically sound rulemaking that members of the public have reason to believe is grounded in reality." Based on those findings, the district court enjoined the seasonal closure from going into effect two days before it was set to do so.

The Agency appealed and moved the district court for a stay pending appeal, in essence asking the district court to permit the closure to go into effect while it sought review of the preliminary injunction order. The district court denied that motion two weeks later. The same day, the Agency moved for similar relief in this court. After a review of the record and a consideration of the stay factors, we now grant the Agency's motion.

II.

In ruling on a motion for a stay pending appeal, we consider "(1) [w]hether the stay applicant has made a strong showing that it is likely to succeed on the merits, (2) whether the applicant will be irreparably injured absent a stay, (3) whether [the] issuance of the stay will substantially injure the other parties interested in the proceeding, and (4) where the public interest lies." Common Cause R.I. v. Gorbea, 970 F.3d 11, 14 (1st Cir. 2020) (second alteration in original) (quoting Nken

v. Holder, 556 U.S. 418, 426 (2009)). "The first two factors 'are the most critical.'" Id. (quoting Nken, 556 U.S. at 426).

A.

Determining the likelihood of the Agency's success in this appeal requires us to determine the likelihood that the district court itself erred in issuing a preliminary injunction. To the extent the district court's ruling rested on findings of fact, we defer to those findings absent clear error; we review any questions of law de novo, without deference. Swarovski Aktiengesellschaft v. Bldg. No. 19, Inc., 704 F.3d 44, 48 (1st Cir. 2013).

We begin with the clear policy choices made by Congress in instructing the Agency to protect right whales, even if that protection causes harm to commercial fishing operations. We do not make policy determinations; the branches accountable to voters do that. Rather, we serve as a backstop to ensure an executive agency does not act arbitrarily and capriciously or not in accordance with law. 5 U.S.C. § 706(2)(A).

Two statutes call for the Agency to take swift action to protect the endangered right whale: Section 7 of the Endangered Species Act (ESA) requires the Agency to ensure that its fishing licenses are "not likely to jeopardize the continued existence of any endangered species." 16 U.S.C. § 1536(a)(2). The Marine Mammal Protection Act (MMPA), in turn, makes it "the immediate

goal that the incidental mortality or serious injury of marine mammals occurring in the course of commercial fishing operations be reduced to insignificant levels approaching a zero mortality and serious injury rate" and requires the Agency to "develop and implement a take reduction plan," whose "immediate goal" is "to reduce, within 6 months of its implementation, the incidental mortality or serious injury of marine mammals incidentally taken in the course of commercial fishing operations to levels less than the potential biological removal level established for that stock." 16 U.S.C. § 1387(a)(1), (f)(2), (f)(5). Indeed, the MMPA requires the Agency "to assist in the recovery or prevent the depletion of" endangered marine mammals that "interact[] with commercial fisheries." Id. § 1387(f)(1).

The potential biological removal (PBR) level for the right whale is currently 0.8, which means that the removal of more than eight individuals every ten years (i.e., an average of 0.8 per year) threatens the species' ability to reach its optimal sustainable population level.⁴ Of all the large whales, only the right whale population consistently experiences annual takes in excess of its PBR level. In fact, an "annual average of five entanglement-related mortalities and serious injuries were

⁴ The PBR levels of marine mammals are also determined by the Agency, and we note that plaintiffs do not challenge this number here.

documented from 2009 through 2018." Final Rule, 86 Fed. Reg. at 51,971. The discrepancy between annual right whale deaths and the species' PBR level required the Agency to act. 16 U.S.C. § 1387(f)(7)(F). And, because the trend is "toward species extinction," the licensing of the federal fisheries for lobster harvesting implicates the ESA, in which Congress opted as a matter of policy to require the Agency to act "whatever the cost." Tenn. Valley Auth. v. Hill, 437 U.S. 153, 184 (1978) (finding that the ESA embodies Congress's "plain intent" to "halt and reverse the trend toward species extinction, whatever the cost" (emphasis added)); see also 16 U.S.C. § 1361(6) (requiring the Agency to ensure endangered marine mammals, including the right whale, are "protected and encouraged to develop to the greatest extent feasible").

Whenever an administrative agency acts, it must follow the applicable administrative rules of procedure. See 5 U.S.C. § 553 (detailing requirements for agency rulemaking); 16 U.S.C. § 1387(f) (detailing requirements for agency action when an endangered marine mammal is being taken at a rate higher than its PBR level); see also BiOp at 1 (explaining that section 7 of the ESA requires the Agency to "conduct intra-service consultation" when it is "proposing an action that may affect listed species"). Here, though, the plaintiffs offer no reason to question the Agency's compliance with these procedural requirements. Most

importantly, the Agency proposed and explained its new rule, solicited public comment on the proposed rule, and considered those comments -- including all comments from participants or representatives of the lobster industry -- before finally issuing the rule.

The district court (in passing) and the plaintiffs on appeal complain that the seasonal-closure regulation did not go through a collaborative process with the Atlantic Large Whale Take Reduction Team (the "Team"), but no party points us to any requirement that every aspect of a take plan be discussed by the Team. Rather, the Team is an advisory body. As the Agency explained, "While the [Team] provides recommendations, and [the Agency] makes every effort to incorporate those recommendations, it is ultimately [the Agency's] responsibility to meet the mandates of the MMPA." Record of Decision for the FEIS (ROD) 24 (Aug. 30, 2021); see also 16 U.S.C. § 1387(f)(7)(B)(i) (permitting the Agency to make "changes . . . with an explanation of the reasons" to any plan drafted by the Team); id. § 1387(f)(7)(B)(ii) (requiring the Agency to publish its own "proposed take reduction plan and implementing regulations" if the Team "does not submit a draft plan . . . within 6 months").

With Congress having thus mandated action to protect the right whale from commercial fishing, and with plaintiffs pointing to no procedural failure by the Agency in deciding what action to

take, the district court had only a narrow role to play. A court can set aside an otherwise proper agency action if it is arbitrary and capricious or if it is not based on substantial evidence.⁵ 5 U.S.C. § 706(2)(A), (E). The district court found that plaintiffs had made a showing that the Agency rule in this case was likely arbitrary and capricious. In so doing, the district court claimed that the Agency's action fell short because it failed to consider what the district court decreed was an "important aspect of the problem," see Upper Blackstone Water Pollution Abatement Dist. v. EPA, 690 F.3d 9, 20 (1st Cir. 2012) (quoting Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 43 (1983)), namely "whether right whales actually aggregate in the LMA 1 Restricted Area." The court explained that that the Agency "predicts the presence of right whales during the LMA 1 closure period in spring" and that "the warming of the Gulf of Maine has shifted right whales 'south of New England and Long Island in the fall and winter.'" (quoting BiOp at 187). From those observations, the court concluded that the Agency likely did not time the closure to coincide with the presence of whales.

⁵ The Supreme Court "has described the APA court/agency 'substantial evidence' standard as requiring a court to ask whether a 'reasonable mind might accept' a particular evidentiary record as 'adequate to support a conclusion.'" Dickinson v. Zurko, 527 U.S. 150, 162 (1999) (quoting Consol. Edison Co. v. NLRB, 305 U.S. 197, 229 (1938)).

That reasoning constituted a fundamental misapprehension of the Agency's analysis. Whale death by entanglement requires the intersection of two objects: a line and a whale. As the Agency explained, and as its model assumes, the risk of entanglement therefore varies based on the number of lines and the number of whales in a given area. A large number of whales can certainly pose a significant risk in the presence of even relatively few lines, but just a few whales can also pose a significant risk in the presence of a large number of lines.

This type of scenario -- few whales/many lines -- was just what the Agency confronted in the LMA 1 restricted area during the winter months. Its peer reviewed "co-occurrence model" projected both that some right whales would be present in the winter months, FEIS at 81, and that the proliferation of trap lines would pose a substantial risk to those whales, see FEIS at 73, 78, 81. So the district court's central criticism based on the fact that the data showed (as the Agency itself pointed out) that whales only aggregated in the area at other times provides no basis for rejecting the Agency's findings.

The district court also criticized the agency's use of its "co-occurrence model" absent a better explanation of the inputs, and the court made no bones about the fact that it would prefer to have -- and indeed require -- "traditional," concrete evidence of right whales within the restricted area. But an agency

may use a model in determining what actions will likely achieve its goals. Scientists regularly use models to understand complex interactions and predict likely future occurrences (like, for example, the weather in two days). The use of a model is reasonable where it reflects "the best information available when [the agency] began its analysis," and where it has "check[ed] the assumptions of those models as new information became available." Village of Bensenville v. FAA, 457 F.3d 52, 71 (D.C. Cir. 2006). The Agency appears to have done both here. The model included "[d]ata from recent gliders operating in offshore Maine waters during December and January in 2018 and 2019 [that] detected the presence of right whales, with positive detections within an area in the season and within the boundaries selected" with the model, FEIS at 81, and the Agency considered "supplementary acoustic data" on top of the "data [it] already had on predicted whale density in this area according to the new 2010 to 2018 model" when developing the restricted area, ROD at 22. In addition, the Agency went through an iterative process to narrow the restricted area to the riskiest area. FEIS at 81 ("The final borders around these areas were drawn through an iterative process, testing the risk reduction offered in each version with the [co-occurrence model] and selecting an area that is robust to annual shifts in predicted whale distribution without being larger than is necessary.").

The Agency also included in the model the new data regarding a post-2010 shift in right whale migrating patterns, yet the model "still showed substantial risk reduction occurring in these hotspots suggesting these areas remain relatively important between 2010 and 2018." FEIS at 81. And it obtained favorable, independent peer review of the model by knowledgeable scientists. Id. at 74-75. Thus, the Agency did everything it was supposed to do when using a model: It relied on the best evidence it had available and updated the inputs as new information emerged. Village of Bensenville, 457 F.3d at 71. Accordingly, the Agency's use of the model very likely was not arbitrary and capricious, and the resulting regulation appears to be supported by substantial evidence. See United States v. Carlo Bianchi & Co., 373 U.S. 709, 715 (1963) (explaining that the "'substantial evidence' . . . standard goes to the reasonableness of what the agency did on the basis of the evidence before it, for a decision may be supported by substantial evidence even though it could be refuted by other evidence that was not presented to the decision-making body").

The district court also faulted the Agency for simply not waiting for further "concrete" evidence of whales in the area. But the Agency persuades us, at least preliminarily, that Congress did not require the Agency to wait for more data, much less to wait until the whales are swimming among an aggregation of life-threatening lines. See 16 U.S.C. § 1387(f)(7) (requiring quick

action when "the human-caused mortality and serious injury [of the right whale] is estimated to be equal to or greater than [its] potential biological removal level . . . and [the whale] interacts with a fishery."); see also Brower v. Evans, 257 F.3d 1058, 1070 (9th Cir. 2001) ("Scientific findings in marine mammal conservation area are often necessarily made from incomplete or imperfect information."). See generally FCC v. Prometheus Radio Project, 141 S. Ct. 1150, 1160 (2021) ("[It] is not unusual in day-to-day agency decisionmaking within the Executive Branch" for an agency to lack "perfect empirical or statistical data.").

The district court expressed concern that, by considering both the density of whales in an area and the density of dangerous buoy lines, the model might "simply use[] math in a manner that makes a reduction in line density appear statistically meaningful even in the absence of passing whales." But the Agency explained that was not how the model worked. Final Rule, 86 Fed. Reg. at 51,991 ("It is appropriate for the threat model to be equally weighted with line and whale density because entanglement risk only exists when lines are present, whales are present, and the lines pose a risk to whales. If any of these three factors are not present, the risk of entanglement is zero." (emphasis added)).

Finally, the district court faulted the Agency because the "available record of known large whale entanglements . . . between 2010 and 2019 offers little to support outright closure of LMA 1," as none of the known cases have come from the Gulf of Maine. But this conclusion overlooks the problem confronting the Agency. Scientists cannot trace most known entanglements to specific fisheries. BiOp at 216 ("Assignment of an observed entanglement event to a specific fishery or country of origin is rarely possible."); Final Rule, 86 Fed. Reg. at 51,976 ("Out of approximately 1.24 million buoy lines within the Northeast waters from Rhode Island to Maine, we estimate that 72 percent of buoy lines were unmarked under current [take reduction plan] gear marking guidelines although that percentage was reduced when Maine required gear marks on lobster trap buoy lines beginning in September 2020."). And, because many whale carcasses are never recovered, there are even more entanglements that are unknown. BiOp at 212 ("Some whale mortalities may never be observed; thus, the annual observed entanglement-related mortalities are likely less than the actual number of entanglement-related mortalities occurring."); see also FEIS at 55-56 ("[M]any entanglements are never seen by humans, even when seen there is often no gear present on whales showing scars, wounds and injuries clearly caused by entanglement, gear cannot always be recovered from those whales that are seen entangled, and even when gear is recovered, it can

rarely be identified to a source fishery, and even more rarely to a precise fishing location. . . . [T]herefore, most entanglement related mortality and serious injury are unassigned."). Accordingly, the lack of a specific case of entanglement attributable to a given area does not mean none have happened in that area or that there is no risk one will happen there in the future. That is precisely why the Agency developed the model and subjected its key inputs to review and comment. And the result accords with common sense: Entanglements are a function of whales swimming near lines, with the likelihood of a death increasing as the number of either increases.

None of this is to discount entirely the district court's correct observation that the modeling employed by the Agency, in several important instances, relied on estimates of uncertain events (such as entanglement risks in given areas), rather than hard, verifiable numbers. We see no scientific basis, though, for categorically rejecting an agency's use of well-considered estimates. See generally H.C. von Baeyer, The Fermi Solution: Essays on Science 3-12 (1993). Importantly, the Agency subjected its estimates to peer review and, as we have discussed, supra, did indeed explain how its estimates comported with and were derived from the hard data that was available.

Trying to leverage the case for demanding more hard data (and perhaps to undercut the Agency's case for irreparable harm),

the plaintiffs have asked that we go outside the record to consider the acoustic data from a glider mission that occurred in October 2021, which did not find evidence of right whales near the restricted area. They claim that this undermines the Agency's model. We take the plaintiffs' invitation to look at recent acoustic data, but find it cuts the other way. More recent acoustic data posted on the NOAA website shows just what the Agency modeling predicted: right whale acoustics in and around the LMA 1 restricted area. See NOAA, Right Whale Sighting Advisory System, <https://apps-nefsc.fisheries.noaa.gov/psb/surveys/MapperiframeWithText.html> (last accessed Nov. 16, 2021). These data illustrate the benefits of the Agency's decision to act on the basis of its model rather than simply assume that no whales are imperiled in the LMA-1 restricted area during the winter months.

On the whole, the Agency has made a strong showing of likelihood of success on the merits.

B.

We next turn our attention to the harms that may be suffered depending on whether the closure is enjoined during this appeal. As a practical matter, this discussion also addresses to the extent necessary the balance of equities and the public interest.

1.

"[A]ny time a [government] is enjoined by a court from effectuating statutes enacted by representatives of its people, it suffers a form of irreparable injury." Maryland v. King, 567 U.S. 1301, 1303 (2012) (Roberts, C.J., in chambers) (second alteration added) (quoting New Motor Vehicle Bd. of Cal. v. Orrin W. Fox Co., 434 U.S. 1345, 1351 (1977) (Rehnquist, J., in chambers)); see also Thompson v. DeWine, 976 F.3d 610, 619 (6th Cir. 2020); Org. for Black Struggle v. Ashcroft, 978 F.3d 603, 609 (8th Cir. 2020); N.M. Dep't of Game & Fish v. U.S. Dep't of the Interior, 854 F.3d 1236, 1254–55 (10th Cir. 2017); Planned Parenthood of Greater Tex. Surgical Health Servs. v. Abbott, 734 F.3d 406, 419 (5th Cir. 2013).

Here, moreover, the enjoined agency action is aimed at effectuating a congressional command to avoid licensing activity that may itself cause irreparable harm: the extinction of a marine mammal species. Right whales appear to have been killed in recent years by entanglement at a rate that will lead to their extinction. The Agency rule is intended to take a major, but not yet sufficient, step in reducing those deaths. The Agency's model estimates that the new rule, of which the seasonal ban in the LMA-1 restricted area is a part, will reduce deaths by entanglement by 60%, to an annual average of 2.69 whales. Compare N. Atl. Right Whale Conservation Framework, BiOp App'x A at 478 (explaining that

the 2021 rulemaking is "focused on 60% reduction in right whale [takes] incidental to the American lobster and Jonah crab trap/pot fisheries. In federal waters, this action reduces [takes] from entanglement, on average annually, to 2.69."), with FEIS at 76 tbl.3.1 (labeling the 60% as "risk reduction").⁶ The seasonal ban at issue here accounts for over 10% of that reduction, which would seem to approximate roughly one whale saved every three or four years. See ROD at 21. While the risk reduction attributable to the challenged seasonal closure seems small -- 6.6% -- it is an important part of a larger, interrelated regulatory scheme. As the Agency explained, "[i]ndividual risk reduction associated with one measure is not as accurate as the combined risk reduction of measures implemented together because it does not account for changes in line numbers or distribution associated with other measures nearby." ROD at 21. Thus, "[w]ithout this area, the [regulatory rule] would likely not meet the minimum risk reduction target needed to reduce mortality and serious injury of right whales below PBR." Id. On top of that, the 2021 Rule is just the first step in a 10-year plan aimed at trying to turn the trajectory of the right whale around. See, e.g., id. at 59-60 (explaining

⁶ The percentage rises to 69% if action already taken to restrict harvesting in the ocean off of Massachusetts is taken into consideration. Even that percentage falls short of the Agency's "upper target" of 80%, and short of what the Agency expects will be needed to lower the annual deaths below the PBR more quickly. FEIS at 5.

that it "may require up to 92 percent . . . to reduce actual estimated mortality and serious injury below PBR," given "recent mortality conditions").

2.

On the other hand, there is the harm that will befall the plaintiffs should the ban apply. One would think that harm would be much easier to quantify. As discussed, the Agency estimated that this seasonal closure would impose costs between roughly \$635,000 and \$1.25 million.⁷ Plaintiffs in their briefs challenge that estimate. But the evidence backing that challenge is, to say the least, sketchy. It consists of an affidavit submitted not by any plaintiff, but by a third party who claims that one plaintiff told her that the seasonal ban will cost his business \$5 million in revenue (it is unclear whether this is annually or over the life of the closure), while the other plaintiff told her that the ban would reduce his company's lobster haul by 1-1.3 million pounds. Olsen Decl. ¶ 17. Neither individual plaintiff backs up these numbers with any evidence at all, and neither the plaintiffs nor even their third-party, hearsay proxy offers any calculations to support these numbers. No witness claims that any plaintiff will go out of business as a result of

⁷ The district court mistakenly relied on the Agency's estimation of the annual cost of compliance for the entire rulemaking -- \$9.8-19.2 million -- which covers much more than the seasonal closure challenged here.

the plan. Nor is there any evidence in the record to support the district court's statements suggesting that the new rule will cause a permanent loss of plaintiff's formal or informal rights to fish in the closed area even after a possible reopening, if and when the closure is lifted in coming years.

That being said, even taking just the Agency's estimates, it is fair to infer that a financial loss of a relatively small percentage to the industry as a whole will be borne primarily by those who set traps annually in the restricted area. And as such we do not doubt that it presents a major financial hardship for those individuals.

3.

The difficult question, then, is how does one balance that increased risk of impeding Congress's aims and increasing right whale fatality against the certain risk of economic harm to the plaintiffs? In this instance, we answer that question by looking to Congress for guidance. See Strahan, 127 F.3d at 171; see also Tenn. Valley Auth., 437 U.S. at 184 (finding that the ESA embodies Congress's "plain intent . . . to halt and reverse the trend toward species extinction, whatever the cost").

The plaintiffs identify no case in which we have permitted an injunction to stand against the government's authority to implement duly enacted laws, notwithstanding its strong likelihood of success, let alone in a case in which the

laws the government seeks to implement are aimed at the protection of an endangered species and when the only alleged injury is of an economic kind. See Strahan, 127 F.3d at 171 ("Under the ESA, however, the balancing and public interest prongs have been answered by Congress's determination that the 'balance of hardships and the public interest tips heavily in favor of protected species.'" (quoting Nat'l Wildlife Fed'n v. Burlington N. R.R., 23 F.3d 1508, 1510 (9th Cir.1994))); Water Keeper All. v. U.S. Dep't of Defense, 271 F.3d 21, 34 (1st Cir. 2001) (differentiating Strahan on the grounds that "the harm asserted by the navy implicates national security and therefore deserves greater weight than the economic harm at issue in Strahan").

In this unusual case, our consideration of the competing harms is also informed by our assessment of the likely outcome of this litigation. As we have explained, it is likely that the Agency ruling at issue here will be sustained given the deference that a court must accord to executive agencies carrying out congressional mandates. In that event, if any whales are lost -- or presumed lost -- because the ban was stayed, the Agency may need to modify its actions going forward to make up for what it had expected to be gains made this year. See BiOp at 7. Any such actions could operate more harshly on harvesters by having to achieve the same aggregate results in fewer years. In this

respect, prevailing on the stay could cause lobster harvesters additional harm.

For all of these reasons, while recognizing the burden placed on the plaintiffs by the Agency's ruling, we find that leaving the injunction in place during the course of this appeal will likely cause irreparable harm in the form of preventing a federal agency from undertaking its congressionally assigned task of assuring the right whales are protected from a critical risk of death. And in so requiring, Congress has effectively declared the public interest and weighed the equities in accord with the balance struck by the Agency. Strahan, 127 F.3d at 171. Whether the statutory framework that requires this result should be changed is up to Congress, not the courts.

III.

For the foregoing reasons, the Agency's motion for a stay pending appeal is granted, and, consequently, the intervenors' parallel motion is denied as moot.

While retaining jurisdiction over the appeal of the preliminary injunction on the merits, we remand to the district court to resolve, if necessary, any disputes concerning the prompt removal of the banned gear from the LMA-1 restricted area. Given the already lost time and the short period remaining for the seasonal closure, we encourage the parties to act promptly.

EXHIBIT 4

United States Court of Appeals For the First Circuit

No. 21-1873

DISTRICT 4 LODGE OF THE INTERNATIONAL ASSOCIATION OF MACHINISTS AND
AEROSPACE WORKERS LOCAL LODGE 207; DAMON FAMILY LOBSTER COMPANY,
INC.; FOX ISLAND LOBSTER COMPANY, LLC; FRANK THOMPSON,

Plaintiffs, Appellees,

v.

GINA M. RAIMONDO, in her official capacity as Secretary of the United States Department of
Commerce; JANET COIT, in her official capacity as Assistant Administrator of the NOAA
Fisheries; NATIONAL MARINE FISHERIES SERVICE,

Defendants, Appellants.

No. 21-1874

DISTRICT 4 LODGE OF THE INTERNATIONAL ASSOCIATION OF MACHINISTS AND
AEROSPACE WORKERS LOCAL LODGE 207; DAMON FAMILY LOBSTER COMPANY,
INC.; FOX ISLAND LOBSTER COMPANY, LLC; FRANK THOMPSON,

Plaintiffs, Appellees.

v.

CENTER FOR BIOLOGICAL DIVERSITY; CONSERVATION LAW FOUNDATION, INC.;
DEFENDERS OF WILDLIFE,

Intervenor-Defendants, Appellants.

Before
Kayatta, Barron, and Gelpí,
Circuit Judges.

ORDER OF COURT
Entered: November 16, 2021

In accordance with the opinion of even date, Gina M. Raimondo, Janet Coit, and the National Marine Fisheries Service's motion for a stay pending appeal is granted, and the parallel motion of the Center for Biological Diversity, Conservation Law Foundation, Inc. and Defenders of Wildlife is denied as moot.

APPX-000064

While retaining jurisdiction over the appeal of the preliminary injunction on the merits, the matter is remanded to the district court to resolve, if necessary, any disputes concerning the prompt removal of the banned gear from the LMA-1 restricted area.

By the Court:

Maria R. Hamilton, Clerk

cc: Hon. Lance E. Walker, Christa Berry, Clerk, United States District Court for the District of Maine, Emily Green, Kristen Monsell, Erica Fuller, Jane Davenport, Andrew Christopher Mergen, John G. Osborn, Julia M. Lipez, Alison C. Finnegan, Erika Kranz, Taylor A. Mayhall, John Brett Grosko, Kip Joseph Adams, Jane Charlotte Luxton, Mary Anne Mason, Ryan P. Steen, Paula D. Silsby, Thimi R Mina, Jay P. McCloskey, Alfred Cecil Frawley IV, George T. Dilworth

EXHIBIT 5

EXHIBIT B

BILLING CODE 3510-22-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Parts 229 and 697

[Docket No. FR-210827-0171]

RIN 0648-BJ09

**Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large
Whale Take Reduction Plan Regulations; Atlantic Coastal Fisheries Cooperative
Management Act Provisions; American Lobster Fishery**

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric
Administration (NOAA), Commerce.

ACTION: Final Rule.

SUMMARY: NMFS is amending the regulations implementing the Atlantic Large Whale Take Reduction Plan to reduce the incidental mortality and serious injury to North Atlantic right whales (*Eubalaena glacialis*), fin whales (*Balaenoptera physalus*), and humpback whales (*Megaptera novaeangliae*) in northeast commercial lobster and Jonah crab trap/pot fisheries to meet the goals of the Marine Mammal Protection Act and the Endangered Species Act . In addition, this action also makes a small revision to Federal regulations implemented under the Atlantic State Marine Fisheries Commission's Interstate Fishery Management Plan for American Lobster to increase the maximum length of a lobster trap trawl groundline. This action is necessary to reduce the risks to North Atlantic right whales and other large whales associated with the presence of fishing gear in waters used by these animals.

DATES: Measures modifying or establishing new seasonal restricted areas found at 50 CFR Part 229.32 paragraphs (c)(3) through (c)(6) are effective [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]. Measures requiring changes in fishing gear configurations, including changes found at 50 CFR Part 229.32 (b)(2) and (b)(3) and paragraphs (c)(2)(ii), (c)(2)(iii) and paragraphs (c)(3)(8) through (c)(3)(10, and 50 CFR Part 697.21(b)(2) and (b)(3) are effective May 1, 2022.

ADDRESSES: Copies of the Final Environmental Impacts Statement (FEIS) including the Record of Decision, Regulatory Impact Review (RIR), and Regulatory Flexibility Analysis (RFA) as well as supporting documents are accessible via the internet on the Atlantic Large Whale Take Reduction Plan website at: *Fisheries.NOAA.gov/ALWTRP* or you may request copies by email from Marisa Trego: *Marisa.Trego@noaa.gov*.

Written comments regarding the burden-hour estimates or other aspects of the collection-of-information requirements contained in this final rule should be sent within 30 days of publication of this rule to *www.reginfo.gov/public/do/PRAMain* or by email to Ainsley Smith at *Ainsley.Smith@noaa.gov*.

FOR FURTHER INFORMATION CONTACT:

Dr. Marisa Trego, Marine Mammal Take Reduction Team Coordinator, phone: (978) 282-8484 or email: *Marisa.Trego@noaa.gov*

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Background

This final rule implements modifications to the Atlantic Large Whale Take Reduction Plan (ALWTRP or Plan) as informed by the Atlantic Large Whale Take Reduction Team (ALWTRT or Team) and contained in the proposed rule, as modified based upon public input, including modifications deemed necessary by NMFS to meet the goals of the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA).

The ALWTRP was originally developed pursuant to section 118 of the MMPA (16 U.S.C. 1387) to reduce mortality and serious injury of three stocks of large whales (fin, humpback, and North Atlantic right) incidental to Category I and II fisheries. Under the MMPA, a strategic stock of marine mammals is defined as a stock: (1) For which the level of direct human-caused mortality exceeds the Potential Biological Removal (PBR) level; (2) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA of 1973 within the foreseeable future; or (3) which is listed as a threatened or endangered species under the ESA or is designated as depleted under the MMPA

(16 U.S.C. 1362(19)). When incidental mortality or serious injury of marine mammals from commercial fishing exceeds a stock's PBR level, the MMPA directs NMFS to convene a take reduction team made up of stakeholders including representatives of Federal agencies, each coastal state which has fisheries which interact with the species or stock, appropriate Regional Fishery Management Councils, interstate fisheries commissions, academic and scientific organizations, environmental groups, all commercial and recreational fisheries groups and gear types which incidentally take the species or stock, and if relevant, Alaska Native organizations or Indian tribal organizations¹.

The ALWTRT was established in 1996 and has 60 members, including about 22 trap/pot and gillnet fishermen or fishery representatives. The background for the take reduction planning process and initial development of the Plan is provided in the preambles to the proposed (62 FR 16519, April 7, 1997), interim final (62 FR 39157, July 22, 1997), and final (64 FR 7529, February 16, 1999) rules implementing the initial plan. The Team met and recommended modifications to the Plan, implemented by NMFS through rulemaking, several times since 1997 in an ongoing effort to meet the MMPA take reduction goals. Despite modifications to the Plan (notably the use of sinking groundlines effective in 2009 (72 FR 57104) and efforts to reduce the number of vertical buoy lines and an expansion of the Massachusetts Restricted Area (MRA) effective in 2015 (79 FR 36586, 79 FR 73848, and 80 FR 30367)), mortalities and serious injuries of right whales in U.S. gear and first seen in U.S. waters at levels above PBR have continued.

NMFS informed the Team in late 2017 that it was necessary to reconvene to develop recommendations to reduce the impacts of U.S. commercial fisheries on large whales with a

¹ There are no Alaska Native or Indian tribal organizations participating in fisheries managed under the Atlantic Large Whale Take Reduction Team.

focus on reducing risk to the declining North Atlantic right whale population (Pace *et al.* 2017). Seventeen right whale mortalities were observed in 2017, including many determined to have been caused by vessel strikes and entanglements, leading to a declaration of a right whale Unusual Mortality Event. An annual average of five entanglement-related mortalities and serious injuries were documented from 2009 through 2018. Most could not be identified to a country of origin; only 0.2 per year could be attributed with certainty to U.S. fisheries, only 0.7 per year to Canadian fisheries, and an average of four per year could not be attributed to either country. For the purposes of creating a risk reduction target, NMFS assigned half of the unknown entanglement incidents to U.S. fisheries. Under this assumption, based on documented mortality and serious entanglement incidents, a 60-percent reduction would be needed to reduce right whale mortality and serious injury in U.S. commercial fisheries from an annual average PBR of 2.2 to below the current PBR of 0.8 per year. However, documented mortalities and serious injuries represent a minimum count and unobserved mortalities and serious injuries are not considered in the 60-percent target risk reduction. An upper bound target of 80 percent considered estimated mortalities generated by the Pace *et al.* 2017 population model that estimates unobserved mortality (Hayes *et al.* 2019). Currently, there is no way to definitively apportion unseen but estimated mortality across causes (fishery interaction vs. vessel strike) or country of origin (United States vs. Canada). For the purposes of developing a conservative target to meet the MMPA goals, in 2019 NMFS assumed that half of the estimated undocumented incidents occurred in U.S. waters and were caused primarily by incidental entanglements. However, given the assumptions and other sources of uncertainty in the 80-percent target, as well as the challenges achieving such a target, the Team focused on developing recommendations to achieve the lower 60-percent target.

Greater detail on right whale population estimates, the stock's decline, changes in distribution and reproductive rates, and entanglement-related mortalities and serious injuries documented in recent years can be found in the preamble to the proposed rule (85 FR 86878 December 31, 2020), and are briefly summarized in Chapter 2 of the FEIS.

During a Team meeting in April 2019, the Team recommended a framework of measures to modify lobster and Jonah crab trap/pot trawls within the Northeast Region Trap/Pot Management Area (Northeast Region) intended to reduce risk of mortality and serious injury to right whales incidentally entangled in buoy line in those fisheries by at least 60 percent. The Team's near-consensus recommendations included jurisdictionally specific combinations of line reduction measures to reduce right whale encounters with buoy lines and weak rope requirements to increase the chance of right whales parting the rope (self-releasing) to reduce mortalities and serious injuries when entanglements do occur. As described in more detail in the preamble to the proposed rule and in Chapter 3 of the FEIS, the Team's recommendations were not fully crafted as regulatory elements, and the proposed rule and draft environmental impact statement (DEIS) included modifications to the Team's recommendations based on public scoping and input from New England states related to implementation and operational feasibility. The proposed rule analyzed in the DEIS included less line reduction and weak rope than the Team recommended, and included additional measures to reduce right whale co-occurrence through new or expanded seasonal restricted areas. Although the Team did not make recommendations on the existing weak link requirement at the buoy line or on the proposed change to transition seasonal restricted areas to be closures to fishing with buoy lines rather than closures to fishing altogether, those measures were also proposed and analyzed. Finally, gear marking recommendations were discussed by the Team and received general support, but

specific gear marking requirements were never taken to a vote for consensus, and gear marking requirements were not included in the Team's recommendations. Comments on the proposed rule and DEIS as well as new information regarding right whales were considered in the development of this final rule.

The public's vast input into this regulatory effort demonstrates stakeholder interest in conserving and recovering the North Atlantic right whale while also ensuring the development of operationally feasible and economical risk reduction measures. Benefits of large whale protection are difficult to describe in monetary value, but include non-consumer use benefits, non-use benefits, and potential costs savings from current disentanglements efforts. Economic research has demonstrated that society places economic value on environmental assets, whether or not those assets are ever directly exploited. The large number of commenters shows that society places real (and potentially measurable) economic value on simply knowing that large whale populations are flourishing in their natural environment (often referred to as "existence value") and will be preserved for the enjoyment of future generations. Collateral benefits to other species are also incurred through buoy line reductions that benefit other endangered species of large whales and endangered sea turtles, and weaker rope that would benefit other large whales.

Protection to large whales under the take reduction process, however, cannot be done without an economic impact. The annual cost of compliance for this rulemaking is \$9.8-19.2 million, representing 1.5 to 3 percent of the 2019 landings value of the fisheries. However, given the input of fishermen and fishery managers, operationally feasible measures were developed that, relative to the other alternative analyzed, achieve the purposes of this rulemaking with nearly the same risk reduction but a much lesser economic impact on regulated entities than the analyzed non-preferred Alternative.

Changes to the Atlantic Large Whale Take Reduction Plan

This rule modifies the Plan in 50 CFR part 229, specifically the Northeast Region (Maine through Rhode Island) American lobster and Jonah crab trap/pot fishery. Described in more detail below, this rule: Increases the minimum number of traps per trawl based on area fished and distance fished from shore in the Northeast Region; modifies existing restricted areas from seasonal fishing closures to seasonal closures to fishing with persistent buoy lines; expands the geographic extent of the Massachusetts Restricted Area to include Massachusetts state waters north to the New Hampshire border; establishes two new restricted areas that are seasonally closed to fishing for lobster or Jonah crab with persistent buoy lines; requires modified buoy lines to incorporate rope engineered to break at no more than 1,700 pounds (lb) (771.1 kilograms (kg)) or weak insertion configurations that break at no more than 1,700 lb (771.1 kg); and requires additional marks on buoy lines to differentiate vertical buoy lines by principal port state, includes unique marks for Federal waters, and expands requirements into areas previously exempt from gear marking.

Changes to the Plan to Reduce the Number of Vertical Buoy Lines

The rule increases the minimum number of traps between buoy lines, known as trawling up, to reduce the number of buoy lines. The trawl configurations are established by area fished and distance fished from shore in the Northeast Region (waters offshore of Maine (ME), New Hampshire (NH), Massachusetts (MA), and Rhode Island (RI)) as detailed in Table 1. The rule describes the areas established in Maine regulations and known as Maine Lobster Management Zones (Zones) (ME DMR 13-188 Chapter 25.94). As a conservation equivalency measure for vessels fishing in Zones, this rule allows fishermen to choose to either trawl up to the minimum established traps/trawl or fish a trawl with half the minimum number of traps with a buoy line on

only one end.

Table 1. Line Reduction Measures

<i>Area</i>	<i>Traps/Trawl</i>
ME 3 nm (5.56 km)–6 nm*, Zone A West	8 traps/rawl per two buoy lines or 4 traps/rawl per one buoy line
ME 3 nm (5.56 km)–6 nm*, Zone B	5 traps/rawl per one buoy line
ME 3 nm (5.56 km)–6 nm*, Zones C, D, E, F, G	10 traps/rawl per two buoy lines or 5 traps/rawl per one buoy line
ME 3 nm (5.56 km)–12 nm (22.22 km), Zone A East	20 traps/rawl per two buoy lines or 10 traps/rawl per one buoy line
ME 6*–12 nm, Zone A West	15 traps/rawl per two buoy lines or 8 traps/rawl per one buoy line
ME 6*–12 nm, Zone B, D, E, F	10 traps/rawl per two buoy lines or 5 traps/rawl per one buoy line (status quo in D, E, & F)
ME 6*–12 nm, Zone C, G	20 traps/rawl per two buoy lines or 10 traps/rawl per one buoy line
MA Lobster Management Area (LMA) 1, 6* – 12 nm	15 traps/rawl
LMA 1 & Outer Cape Cod (OCC) 3–12 nm (5.56 – 22.22 km)	15 traps/rawl
LMA 1 over 12 nm (22.22 km)	25 traps/rawl
LMA3, North of 50 fathom line on the south end of Georges Bank	45 traps/rawl, increase maximum trawl length from 1.5 nm (2.78 km) to 1.75 nm (3.24 km)
LMA3, South of 50 fathom line on the south end of Georges Bank	35 traps/rawl, increase maximum trawl length from 1.5 nm (2.78 km) to 1.75 nm (3.24 km)
LMA3, Georges Basin Restricted Area	50 traps/rawl, increase maximum trawl length from 1.5 nm (2.78 km) to 1.75 nm (3.24 km)

* ME 6 is a line offshore of Maine that is approximately 6 nm (11.1 km) from the coast.

Changes to the Plan Related to Seasonal Restricted Areas

The rule modifies closures in two restricted areas, the Massachusetts Restricted Area and the Great South Channel Restricted Area, by implementing closures to buoy lines rather than closures to the harvest of lobster or Jonah crab by the trap-pot fishery. The change would not include the Outer Cape Cod (OCC) Lobster Management Area (LMA), which remains closed to

the lobster and Jonah crab trap/pot fishery under Massachusetts and Federal regulations (32 Mass. Reg 6.02 paragraph(7)(a) and 50 CFR 697.7(c)(1)(xxx)) implementing the Atlantic State Marine Fisheries Commission's (Commission) Interstate Fishery Management Plan for American Lobster. This modification allows fishermen with authorization to be exempt from surface marking requirements (buoys, radar reflectors, and high flyers) to fish these areas if they fish without the use of persistent buoy lines by remotely retrieving traps from the bottom using an acoustic signal, or through other means that do not require a persistent buoy line. This measure is intended to accelerate research and development of buoyless fishing methods, commonly termed "ropeless" fishing, so that in the future, commercial fishing using ropeless technology can be used in place of seasonal closures to allow trap/pot fishing while protecting right whales.

NMFS has invested a substantial amount of funding in developing ropeless fishing gear. We anticipate that these efforts to facilitate and support the industry's development of ropeless gear will continue, pending appropriations. Given the high cost of ropeless retrieval technology, for the foreseeable future, industry participants are likely to depend on loans of gear purchased by the Northeast Fisheries Science Center for ropeless research collaborations. By 2025, we anticipate this would allow up to 33 fishermen to fish with up to 10 trawls each in the Northeast Region, including the restricted areas. Because they would be fishing under Federal exempted fishing permits (EFP) or equivalent state authorization, conditions to minimize impacts on the natural and human environment will likely include some area restrictions, reporting and monitoring requirements, gear marking of any stored buoy line, and evidence of communication and collaboration with adjacent fixed and mobile gear fishermen to minimize gear conflicts.

This rule also extends the area of the Massachusetts Restricted Area north to the New Hampshire border for state waters, mirroring the Massachusetts 2021 modification of the state

water closure (322 CMR 12.04(2)). This final rule does not adopt the Massachusetts seasonal extension through May 15, but instead retains the February through April seasonal closure.

This rule also establishes two new restricted areas that would be seasonally closed to fishing for lobster and Jonah crab with persistent buoy lines. The LMA 1 Restricted Area would be closed to buoy lines from October through January. The South Island Restricted Area would be closed to buoy lines from February through April. Figure 1 shows existing (dark gray) and new (light gray) seasonal restricted areas.

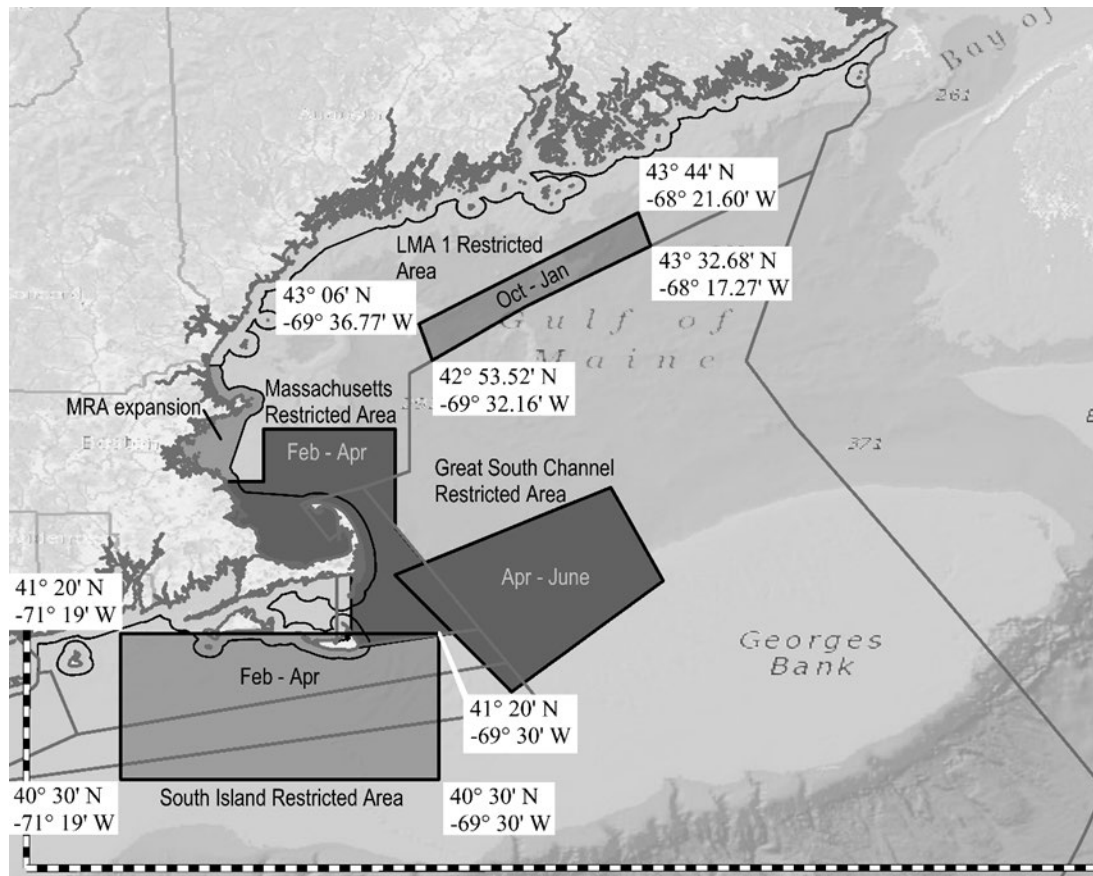


Figure 1. New (light gray) and existing (dark gray) seasonal restricted areas.

Changes to the Plan to Establish Weak Rope Requirements

This rule removes the requirement for a weak link at the buoy in the Northeast Region commercial lobster and Jonah crab trap/pot fisheries. As described in Table 2, all buoy lines in these fisheries will have weak rope or weak insertions well below the surface system. There is little information available to determine the efficacy of weak links at the buoy in reducing entanglement severity. Models suggest that when a whale encounters rope in the water column, the rope parts below the encounter (Knowlton *et al.* 2020). Retention of the buoy may have some benefits: buoys have identifying marks that could improve our understanding of set locations of retrieved gear or may provide resistance and pull gear away from a whale, improving the chances of shedding gear.

Depending on the area fished and distance from shore, this rule requires all buoy lines in the fisheries to use engineered weak rope or weak inserts as described in Table 2. Under most operational conditions, weak rope or a weak insertion within the top half of a buoy line would not be subject to forces approaching or greater than 1,700 lb (771.1 kg) during hauls. Weak insertion placement locations were developed and proposed by Maine Department of Marine Resources (DMR), with much input from Maine fishermen who identified measures that could work with their existing gear, even with the longer trawl lengths being implemented. These measures reduce economic impacts and concerns that longer trawl lengths would result in strong and more dangerous buoy ropes.

Table 2. Weak Rope Measures

<i>Area</i>	<i>Weak Rope or Weak Insertions</i>
Northeast Region	For all buoy lines incorporating weak line or weak insertions, remove weak link requirement at surface system
ME state waters outside of exemption line	1 weak insertion 50 percent down the line
MA State Waters	Fully weak line or weak inserts every 60 ft (18.3 m) in top 75

	percent of line
NH state waters	1 weak insertion 50 percent down the line
RI wtate waters	Fully weak line or weak inserts every 60 ft (18.3 m) in top 75 percent of line
ME Zone A west, B, C, D, E; Federal waters 3–12 nm (5.56–22.22 km)	2 weak insertions, at 25 percent and 50 percent down line
ME Zone A east, F, and G; Federal waters 3–12 nm (5.56–22.22 km)	1 weak insertion 33 percent down the line
MA and NH LMA 1 , OCC; Federal waters 3–12 nm (5.56 – 22.22 km)	2 weak insertions, at 25 percent and 50 percent down line
LMA 1 & OCC over 12 nm (22.22 km)	1 weak insertion 33 percent down the line
LMA 2	Fully weak line or weak inserts every 60 ft (18.3 m) in top 75 percent of line
LMA 3	One buoy line weak to 75 percent

A number of approved weak insertions are detailed in this regulation. To be approved, these weak inserts were demonstrated to break at 1,700 lb (771.1 kg) or less through 10 trials with a calibrated rope breaking machine, they are considered replicable, and are large enough and created with a contrasting color so they can be detected for enforcement purposes.

This rule also includes a provision for the Greater Atlantic Regional Administrator to approve in writing new weak insertions that are demonstrated to break at 1,700 lb (771.1 kg) or less and to include information about approved weak insertions on the ALWTRP website. The current regulations indicate that the NMFS Assistant Administrator would approve new weak insertions, as well as weak link and gear marking modifications. In actual practice, the NMFS Greater Atlantic Regional Administrator makes that determination, therefore these edits are made for accuracy. A definition for the Regional Administrator was added to the definitions list in 50 CFR Part 229.

Changes to the Plan for Gear Marking Requirements

This rule modifies gear marking requirements by establishing a state-specific color for Maine (purple), New Hampshire (yellow), Massachusetts (red), and Rhode Island (silver/gray) vessels, except those fishing in LMA 3 which retains black as the primary gear mark color. For ropeless fishing operations working under EFPs or state authorizations, gear marking is likely to be recommended as a permit condition for any stored buoy line that is retrieved remotely, and a yellow/black striped mark is anticipated. All vessels in the Northeast Region are required to include a large 3-foot (0.9-meter (m)) solid mark within the surface system using paint or tape, and additional 1-foot (0.3-m) green marks (no marking convention defined; tape, paint, twine, etc.) within 6 inches (15.24 centimeters (cm)) of each area-specific gear mark to distinguish state from Federal waters or, in the case of LMA 3 vessels, to distinguish Northeast Region vessels from vessels fishing in the southern and western LMA 3 waters. For dual permitted vessels that fish in both state and Federal waters, the green gear mark can be created with a twine or other marking system that can be applied or removed during transit between state and Federal water fishing locations, or with paint, if applicable state regulations permit Federal marks to remain on buoy lines fished in state waters by dual permitted vessels. Gear marks are all required to be 1-foot long or greater when installed to distinguish them from Canadian marks, which currently are required to be at least 6 inches (15.24 cm) in length. The term “state” refers to the state associated with the vessel’s principal port as declared on state and Federal permits. A principal port is considered the city and state where the majority of landings occur. Although more than 90 percent of lobster and Jonah crab Federal permit holders identify the same state as their principal port, mailing address, and home port (city and state where a vessel is moored), the port of landing was selected based on recommendations from some state managers, and is considered to

be the area where fishing occurs.

Table 3. Gear Marking Modifications

Area	Northeast Region Lobster and Jonah Crab Trap/Pot Gear Marking Requirement
State Waters	One 3-foot (0.9-m) state-specific colored mark (based on principal port state) in surface system within 2 fathoms (3.7 m) of the buoy. At least two 1-foot (0.3-m) marks in the state (principal port) color in the primary buoy line, one in the top half and one in the bottom half. Maine exempt waters will be regulated by Maine and not included in Federal regulations.
All Northeast Region Federal waters, except LMA 3	A 3-foot (0.9- m) state-specific colored mark within two fathoms (3.7m) of the buoy. At least three 1-foot (0.3-m) marks in the state (principal port) color on the top, middle and bottom of the primary buoy line. Additional Northeast Region Federal water mark within 6 inches of each state-specific color: 1-foot (0.3-m) long green marks. For dual permitted vessels, state regulations will determine whether green Federal markings can remain on gear being fished in state waters.
LMA 3	A 3-foot (0.9-m) black mark within 2 fathoms (3.7 m) of the buoy. At least three 1-foot (0.3-m) black marks on the top, middle and bottom of the primary buoy line. Additional Northeast Region Federal water mark within 6 inches of each black mark: 1-foot (0.3-m) long green marks within 6 inches (15.24 cm).

Regulatory Language Changes (Definitions)

This rule adds three definitions to § 229.2. A definition is added for “Lobster Management Area” to reference the management areas that were developed for the American lobster fishery, citing the Atlantic Coastal Fisheries Cooperative Management Act regulations at 50 CFR 697.18. A definition for “surface system” is added for clarity related to the gear marking requirements. A definition for “Regional Administrator” is added to clarify approvals for any new weak insertions and provide information about approved weak insertions on the ALWTRP website.

A housekeeping edit is made to the Table in paragraph (c)(2)(iv) completing a blank cell in the table by clarifying that there is no minimum number of traps per trawl in the Southern

Nearshore Trap/Pot Waters Area.

Changes to Federal Regulations Implementing the American Lobster Management Plan

In addition to changes to 50 CFR part 229, this rule makes two minor revisions to the Federal regulations implemented under the Commission's Interstate Fishery Management Plan for American Lobster at 50 CFR 697.21. To accommodate conservation equivalencies in Maine Lobster Management Zones, this rule modifies the requirement that limits lobster trap trawls with a single buoy to trawls of no more than three traps to allow up to ten traps on a trawl attached and marked with a single buoy by Maine permitted vessels fishing in some Maine Zones within LMA1. To accommodate changes in the number of traps per trawl in LMA 3, this rule also increases the maximum length of a lobster trap trawl from 1.5 nm (2.78 km) to 1.75 nm (3.24 km), as measured from radar reflector to radar reflector.

Comments and Responses

We published the Proposed Rule to Amend the Atlantic Large Whale Take Reduction Plan to Reduce Risk of Serious Injury and Mortality to North Atlantic Right Whales Caused by Entanglement in Northeast Crab and Lobster Trap/Pot Fisheries and DEIS on December 31, 2020. A 60-day public comment period began on December 31, 2020, and ended on March 1, 2021 (85 FR 86878, December 31, 2020). We reviewed and considered all written and oral public submissions received during the public comment period. Comments on the proposed rule and DEIS were accepted as electronic submissions via *regulations.gov* on docket number NOAA-NMFS-2020-0031, as electronic submissions via email to a NMFS representative, and comments submitted orally at public information sessions and hearings.

In January 2021, we held four public information sessions and in February 2021, we held four public hearings, all virtual due to the global pandemic. The sessions were organized by

region, though everyone was welcome to attend any session. Although the purpose of the January meetings was to provide information and answer questions, we accepted oral comments on the proposed rule and the DEIS at all eight meetings. A total of 122 speakers submitted comments orally at public information sessions or public hearings. Many of the speakers submitted more than one comment, and several submitted comments at more than one session. If an individual commented at more than one session, the individual was counted as a unique speaker on each day. We received 2 comments from academic/scientific individuals or organizations, 3 fishing industry associations, 27 non-governmental organizations, 27 members of the public, 59 fishermen, 2 state fishery resource managers, and 2 state/Federal legislators.

We received 171,213 written comments on the Proposed Rule and the DEIS through the comment portal. Of these, six comments from Non-Governmental Organizations were entered as counting for more than one comment: Pew Charitable Trusts: 47,699; Conservation Law Foundation: 1,192; Humane Society of the U.S: 15,922; Oceana: 18,440; Natural Resources Defense Council: 33,045; and Riverkeepers: 4. Five additional comments from Non-Governmental Organization were entered as one comment, but had thousands of signatures attached: International Fund for Animal Welfare: 31,912; Whale and Dolphin Conservation: 3,629; Environment America: 11,727; Center for Biological Diversity: 26,594; and Environmental Action: 11,135.

All of the above-referenced comments, which represent up to 201,269 people, were in favor of stronger regulations to protect North Atlantic right whales. They strongly favored the following measures: longer and larger restricted areas, increased gear marking, transition to ropeless gear, and a risk reduction target of more than 60 percent. While many were in favor of weak rope or weak link requirements, many also voiced concerns that 1700 lb breaking strength

has not been proven to reduce entanglements and could still severely entangle juveniles and calves. In addition, the vast majority urged NMFS to use the most updated population data in setting risk reduction targets and recommended the use of emergency measures to take action immediately.

After accounting for the bulk submissions, we received 53,585 comments uploaded through the *regulations.gov* portal, as well as 9 comments emailed directly to our office, 3 of which were added to *regulations.gov*, and are included in the 53,585 total above. After running a deduplication analysis, identifying additional campaign emails not detected by the deduplication analysis, and reviewing the entries for double submissions or submissions of supporting documentation separate from the original comment letter, we received approximately 1,076 unique comments that were not clearly part of a coordinated campaign. We received 28 comments from academic/scientific individuals or organizations, 2 Federal agencies, 1 Federal resource manager, 2 fishery management associations, 10 fishing industry associations, 2 manufacturers, 71 non-governmental organizations, 617 members of the public, 300 fishermen, 2 representatives from other industries, 32 state/Federal legislators, 7 state fishery resource managers, and 2 towns.

As many of the speakers who submitted comments orally also submitted comments through the *regulations.gov* portal, we considered each individual's comments, both oral and written, as one submission. This gives us a total of 1,129 unique submissions. Combining both written and oral submissions, and excluding duplicates, we received submissions from 28 academic/scientific individuals or organizations, 2 Federal agencies, 1 Federal resource manager, 2 fishery management associations, 10 fishing industry associations, 2 manufacturers, 76 non-governmental organizations, 628 members of the public, 336 fishermen, 2 representatives from

other industries, 33 state/Federal legislators, 7 state fishery resource managers, and 2 towns.

Of the 336 unique commenters who identified themselves as fishermen, either directly or through context, 312 voiced opposition to all or part of the rule, 19 commented on particular provisions, but did not expressly support or oppose, and 5 supported the general idea of the rule, though had specific comments on some measures. Of the ten fishing industry groups, eight opposed all or part of the rule, one gave specific recommendations, but did expressly support or oppose, and one supported the general idea of the rule. The primary concerns raised by fishermen are that right whales are not in the areas that they fish and this rule will not protect right whales, but instead will place a large economic burden on fishermen with no benefit for the whales (>147); the economic impact of this rule will put them out of business and devastate coastal communities (>126); and that ropeless fishing is not yet and may never be feasible on a large scale (>105).

Of the 628 unique commenters who identified themselves as members of the public, either directly or through context, the vast majority (534) supported this rule, but expressed the opinion that the rule did not go far enough to protect right whales, with 84 suggesting NMFS use emergency authority to implement immediate protections for whales. Only 54 expressed opposition to the rule. A small number suggested that this rule should be withdrawn because it does not provide adequate levels of protection for right whales, and NMFS should start over.

To summarize, overall, nearly 59 percent of unique commenters supported the Proposed Rule in whole or in part, with the majority expressing the opinion that the proposed regulations should be strengthened to provide more protection to right whales. A little over 34 percent of commenters opposed the rule in whole or in part, and about 4 percent suggested that the rule should be withdrawn because it does not provide adequate levels of protection for right whales,

and NMFS should start over. About 4 percent of commenters did not express support or opposition, but suggested specific measures or strategies that NMFS should employ. In addition, about 14 percent of commenters (who had either supported the rule or suggested starting over) wanted NMFS to take emergency action.

We identified a total of 187 distinct substantive comments that were within the scope of the current rulemaking. The majority of these comments were submitted by multiple people, some of them by thousands of people. We also received several comments that were outside the scope of the current rulemaking, which are summarized below. The final rule and analyses in the FEIS are related to amendments to the Plan. The Plan and the take reduction process are restricted to the monitoring and management of incidental mortality and serious injury of marine mammals in U.S. commercial fisheries. Because these comments were out of the scope of the final rule and the FEIS, we did not provide responses in this document.

Below, we summarize the comments received in the topic category, and then provide specific comments and responses to each. Responses may refer to portions of the FEIS or final rule that have been modified as a result of comments (to obtain copies of the FEIS see ADDRESSES). We also made changes to the DEIS and the rule in response to the comments, where appropriate, including updates to data where the comments affect the impact analysis. Technical or editorial comments on the DEIS merely pointing out a mistake or missing information were addressed directly in the body of the FEIS and final rule.

Due to the large number of comments, they are organized according to the following specific topics: 1. Canada, 2. Economics, 3. Enforcement, 4. Gear Marking, 5. Legal Issues, 6. Line/Effort Reduction, 7. Management, 8. Research, 9. Restricted Areas, 10. Ropeless Gear, 11. Stressors, 12. Trawls, 13. Weak Links/Inserts/Rope, 14. Out of Scope.

1. Canada

Of the 1,129 unique comments, around 43 suggested that Canadian fishing gear is largely to blame for the recent right whale mortalities and entanglements, and that Canada needs to do more to reduce right whale mortalities and serious injuries. In addition to these commenters, dozens of others felt it was unfair that U.S. fishermen are being asked to make expensive and time-consuming changes to fishing gear and practices, and many questioned NMFS's apportionment of unknown entanglements in determining how much risk reduction was needed to reduce U.S. commercial fishery interactions to the PBR level established under the MMPA.

Comment 1.1: Canadian fishing gear is primarily responsible for recent right whale entanglements and mortalities, not U.S. fishing gear, and NMFS should not attribute 50 percent of the unknown gear to the United States.

Response: In recent years, gear has only been retrieved from about 54 percent of the detected right whale entanglement events. The majority of the entangling line retrieved is of unknown origin. During 2010-2019, out of 114 documented right whale entanglement incidents, gear was present on 62 whales. Of these, gear could be identified to a country in only 25 incidents (22 percent of all observed incidents): 18 were documented Canadian cases (14 Canadian snow crab, 4 unknown Canadian) and 7 were documented U.S. cases (1 gillnet, 1 lobster, 2 unknown trap, 3 unknown United States). The remaining 37 incidents involved gear of unknown origin (6 unknown gillnet/mesh, 1 unknown trap, 30 unknown line). Out of approximately 1.24 million buoy lines within the Northeast waters from Rhode Island to Maine, we estimate that 72 percent of buoy lines were unmarked under current ALWTRP gear marking guidelines although that percentage was reduced when Maine required gear marks on lobster trap buoy lines beginning in September 2020.

It is important to consider that most right whale mortalities are never seen. Entanglement incidents detected in the Gulf of St. Lawrence in recent years from May to early November may reflect some observer bias as the result of the extensive survey effort since late summer 2017 in an enclosed water body. During most of that season, the whereabouts of the two-thirds of the population that were not detected in the Gulf of St. Lawrence remains largely unknown. While acoustic detections indicate that right whales are present in U.S. waters year round, counts of individuals when spread over large areas remain outside of current capabilities but, given Gulf of St. Lawrence counts, the entire population could be present in U.S. waters from December through April and up to two thirds of them could be present year round. U.S. fisheries fish many more buoy lines than Canadian fisheries. That exposure to U.S. fisheries is balanced, however, by the many broad scale gear modifications in place, as well as seasonal restricted areas implemented under the Plan. However lacking an actual estimate of the proportion of the right whale population's exposure to U.S. or Canadian fisheries each year, in 2019 NMFS apportioned unknown mortality using a 50/50 split that recognized that more whales may be exposed over more months to fishing gear in U.S. waters (suggesting higher opportunity for entanglement) but broad based U.S. conservation measures would reduce mortality and serious injury. This apportionment also recognizes that mortality is occurring on both sides of the border, and that U.S. and Canadian measures are needed to reduce human-caused mortality to this transboundary species to recover the population. For more, see FEIS Section 2.1.5.

Comment 1.2: Canada's current regulations are insufficient, as they rely on dynamic management, which could fail due to lack of visual or acoustic detections, and the delay of weak rope implementation until the end of 2022.

Response: Under the MMPA, NMFS is responsible for U.S. fisheries and protected

species within our borders and on the high seas. We work closely with our Canadian partners through bilateral meetings, coordinated disentanglement efforts, distribution and abundance data, health assessment, and gear analysis. Since July 2017, Canada has shown a commitment to reduce the impacts of their fisheries on the North Atlantic right whale population and they affirm that commitment in these bilateral efforts. The Canadian Department of Fisheries and Oceans (DFO) is responsible for fisheries management and protected species within their borders, and any concerns about their management measures should be directed to Canada's DFO.

Comment 1.3: Canada and the United States should collaborate in monitoring, data collection, and technology development to understand whale movements and sources of mortality, and the United States should pressure Canada into doing more.

Response: NMFS coordinates with Canada on right whale conservation and recovery efforts through bilateral discussions and frequent information sharing with the DFO and Transport Canada at both the senior leadership and staff levels. NMFS senior leadership have had discussions with leadership from DFO and Transport Canada on conservation and management efforts for right whales since 2019, and plan to continue these discussions. We also coordinate and cooperate with DFO and Transport Canada through the Canada and United States Bilateral Working Group on North Atlantic Right Whales. This includes discussing lessons learned on fishing and vessel regulations, planning joint scientific activities (*e.g.*, aerial surveys), and coordinating collaboration across all right whale conservation efforts.

Comment 1.4: Maine's Department of Marine Resources should be allowed to participate in all future bilateral meetings with Canada.

Response: The U.S. Government routinely conducts bilateral consultations with foreign counterparts on issues of fisheries management. Several of these ongoing consultations are

founded in formal collaborative agreements, while others occur through less formal arrangements. Discussions often include sensitive topics, such as respective positions being considered for multilateral organizations. Consequently, such consultations are restricted to Federal government personnel.

2. Economics

Approximately 143 commenters voiced concerns that this rule would cause them extreme economic hardship, with some stating that this rule would put them out of business. Many commenters expressed concern about the effects of this rule on the economic health of their communities, the supply chain, and on the state of Maine. Several questioned NMFS' economic analysis and suggested additional factors to consider in the economic analysis. Others were concerned that economics inappropriately and illegally dictated the alternatives considered in this rule; see the Legal Issues section for responses to those comments.

Comment 2.1: The new regulations will drive up costs, making fishermen unable to compete with Canada, resulting in the loss of an iconic U.S. fishery.

Response: Under the Fish and Fish Product Import Provisions of the MMPA published on August 15, 2016 (81 FR 54389), fish and fish products from fisheries identified by the NOAA Assistant Administrator in the List of Foreign Fisheries can only be imported into the United States if the harvesting nation has applied for and received a comparability finding from NMFS. Nations have until November 30, 2021, to apply for Comparability Findings for their fisheries. Beginning January 1, 2023, all nations seeking to continue exporting fish and fish products to the United States must have received Comparability Findings. Beginning in 2023, Canadian lobster and snow crab fisheries will face similar conservation costs for large whale protection if they wish to enter the U.S. seafood market. The new MMPA import regulations are intended to even

the playing field.

Comment 2.2: NMFS underestimated the economic costs of the LMA1 seasonal restricted area because it did not take into account; (1) total affected vessels, (2) displacement of effort from those vessels, (3) changes in value to landings.

Response: Based on the comments received, we identified new and updated data sources and have revised our estimation methods. In the DEIS, we relied on the Industrial Economics (IEC) model vessel data and calculated catch per trap using NMFS Vessel Trip Report data. Because only about 10 percent of Maine vessels provide trip reports annually, these data may not have reflected the catch rates and landings achieved by vessels fishing in the seasonal restricted areas. Due to public comments, we updated the analysis using Maine Department of Marine Resources (Maine DMR) harvester and dealer report data to re-estimate the total landings outside 12 nm. Please see FEIS Section 6.3.4.1 for details.

Further, not all landings would be lost when the restricted area is in place. Fishermen are expected to relocate their gear to fishing grounds within the same or directly adjacent Maine lobster management zones. As fishermen commented, vessels already fishing in those adjacent fishing grounds would then be crowded, reducing their catch rates. We have included the crowding effects to other vessels in the surrounding areas in our economic calculations in the FEIS. We also assume a 5-10 percent reduction rate based on the natural lobster mortality rate. Nearly all the lobsters not caught during the restricted area closure are assumed to be caught at other locations or later in the year. Looking at the industry as a whole, the lost value to the entire fleet would be those lobsters dying from natural causes.

In Table 6.12, as one commenter noted, we had incorrect information on the lobster price unit leading to an error in the landings values. The prices displayed in the table are in dollars per

pound but should have been calculated as dollars per kilogram. However, the costs in the last two columns are still correct, as they were calculated separately using pounds.

Comment 2.3: NMFS should include the potential benefit of reducing the need for disentanglement efforts in the economic effects analysis. We ask NMFS to evaluate the annual average costs of retaining each disentanglement team, including its equipment, insurance requirements, and staff.

Response: We agree that we should consider this in our economic analysis, and have revised our analysis to include an estimate of disentanglement costs as well as the potential benefit of reducing the need for disentanglement efforts. See the qualitative and quantitative discussion in FEIS Section 9.6.4.

Comment 2.4: The DEIS does not analyze the economic benefits of ropeless fishing.

Response: This rule does not require fishermen to fish with “ropeless” fishing gear. However, in response to commenters, we added some analysis of the economic costs and benefits of ropeless fishing to FEIS Section 6.3.3, and some details of anticipated impacts can be found in response to comments below in response to Comment 9.4.

Comment 2.5: The Proposed Rule fails to account for the full benefits of weakening vertical lines to reduce mortality and serious injury from entanglements. The full benefits should be taken into account in the development of a final rule.

Response: All cases where full weak rope was not implemented were analyzed according to the proportional risk reduction of the number of inserts compared to the equivalent of full weak rope (an insert every 40 feet). Please see FEIS Section 3.3.4 and 5.3.1.3 for a description of how the use of weak rope was analyzed and the anticipated impacts on large whales. FEIS Sections 5.3.2.3 and 5.3.4.3 discuss the expected impacts on other protected species and

protected habitat.

Comment 2.6: NMFS should consider the costs already incurred under previous take reduction measures, and the effectiveness of those measures, and should standardize a review of its economic analysis based on the actual impact of previous rules.

Response: In the FEIS, we revised our analysis to provide as much information as possible about the costs already incurred under previous take reduction measures. However, these economic impacts are not directly related to current rulemaking, so would not be included in the final costs. Under Section 610 of the Regulatory Flexibility Act, NMFS is required to review any significant rule to evaluate the continued need for regulation. Our review procedures include a summary of the expected economic impacts contained in the final rule, as well as a summary of any changes in technology or economic conditions that may have occurred since. To allow for sufficient time for economic adjustments to occur and for data to become available, we review rules every seven years. The most recent ALWTRP rule was published in 2015, and will be coming up for review shortly.

Comment 2.7: Did economic analysis take into account fishermen from outside Maine, New Hampshire, Massachusetts, and Rhode Island, as there are some fishermen from New York and Connecticut that may be affected?

Response: This rulemaking applies to lobster and Jonah crab fisheries in the Northeast Region Trap/Pot Management Area (Northeast Region). Please see FEIS Chapter 1 for the regulated waters map. In the DEIS, we only included fishermen from Maine to Rhode Island. In the FEIS, we identified a few New York fishermen that fished within the regulated area and we revised our analysis to include the economic impacts to those lobster and Jonah crab fishermen. No Connecticut fishermen were identified in the regulated waters. Due to data confidentiality

requirements, those New York fishermen were combined with Rhode Island LMA 2 vessels and LMA 3 vessels in the analysis.

Comment 2.8: This rule will drive small fishermen out, and the fleet will become consolidated into larger corporate operations, destroying iconic tourist-drawing fishing communities and resulting in cultural loss.

Response: A number of the measures including trawling up and weak insertion requirements were initially developed by Maine DMR after extensive outreach with Maine fishermen. Fishermen indicated that the trawling up and weak insertion measures could be done by reconfiguring existing trawls and buoy lines, reducing impacts of wholesale replacement of gear. Based on recommendations from the public, fishermen and state agencies, we have modified the alternatives in the FEIS to include conservation equivalencies in Southern New England, LMA 3, and Maine Lobster Management Zones out to 12 miles. As requested by Rhode Island fishermen and supported by the state, we analyzed the use of weak rope instead of trawling up measures for LMA 2. Fishermen indicated they could not support longer trawls unless they invested in a new vessel or vessel modifications. An analysis of risk reduction determined that this provided equal or better risk reduction. The final rule applies weak rope measures identical to the Massachusetts state measures for LMA 2 and does not require further trawling up. Similar concerns expressed by LMA 3 fishermen resulted in the implementation of trawling up restricted areas with varying trawling up requirements. Conservation equivalency measures provided by Maine fishermen and Maine DMR allow fishermen to choose between different trawl lengths with one or two buoy lines, or use more weak inserts instead of trawling up based on fishing practices in the Maine lobster management zones.

Comment 2.9: Does the economic analysis of gear conversion take into account the

replacement savings of current gear that is nearing the end of its lifespan?

Response: We have revised our analysis to include this in the FEIS. Since it is difficult to estimate the life stages for all gears in the regulated areas, we applied new gear prices for current gear requirements in the DEIS.

When vessels modify their gear configurations by trawling-up to add more traps between trawls, they can save some gear costs from the reduction in surface system like buoy lines, buoys and radar reflectors. These savings are calculated using new gear prices.

For weak rope measures, in Alternative 2 (Preferred) and the final rule, weak rope can be inserted into current ropes, so no large-scale replacement of buoy lines is needed. Estimated costs of inserts assume the rope or sleeve is new. In Alternative 3, which requires fully engineered weak rope to replace the current rope, the compliance costs would be the difference between fully weak rope and regular rope. We also use new gear prices for both ropes.

Comment 2.10: Fishermen should be compensated for the time it takes to mark all the gear.

Response: Currently there is no mechanism by which NMFS is able to compensate fishermen for gear marking costs. A program of that nature would require Congressional appropriations. Similar programs have been made available to fishermen in the past. Note that effective gear marking could help fishermen and the government avoid additional regulatory burden in the future by better identifying areas where interactions are likely and unlikely to occur.

Comment 2.11: The costs of lost gear from new weak rope requirements should have been considered in the evaluation of economic effects.

Response: We discussed this issue qualitatively in FEIS Section 6.2.6.1.

Comment 2.12: The economic impacts of gear marking, including the time already spent marking gear, should have been included in the economic impact analysis because the rules were implemented in direct anticipation of the Proposed Rule.

Response: Other than the gear marking costs for fishermen fishing within Maine Exempt waters, who will be regulated by the state of Maine, we revised the analysis to include estimates of the gear marking costs (both material and labor costs). This revision is in response to public comments correctly noting that Maine implemented gear marking measures in anticipation of this final rule. However, improved information regarding the location of large whale entanglement related mortalities and serious injuries may allow future tailoring and reduced economic impacts of regulations.

Comment 2.13: The evaluation of the economic effects of this rule should have included all parts of the supply chain, such as lobster processors, dealers, gear suppliers, trap builders, rope and line manufacturers, and restaurateurs.

Response: We quantitatively evaluated the economic impact of the final rule as it applies to the lobster and Jonah crab trap/pot fisheries in the Northeast. We recognize that these changes could impact the broader supply chain, as well as local communities and economies in ways that are not easily quantifiable. In FEIS Section 6.7.2.2, we include a qualitative evaluation of the socioeconomic impacts to fishing communities.

Comment 2.14: Fishermen should get economic assistance/subsidies to cover the costs of gear changes and lost revenue.

Response: Given the vast amount of industry input into the development of weak insertions, which would not require fishermen to replace buoy lines, and trawling up measures, many gear modifications implemented in the final rule were created to control costs. However,

the economic analysis in Chapter 6 indicates the first-year cost of this rulemaking is \$9.8 to \$19.2 million, which is 3 percent of the landings value of the lobster fishery in 2019. Some of those costs are likely to be passed on to the consumer but economic impacts to fishermen are anticipated.

In December 2019, \$1.6 million in Federal funds were reprogrammed to support recovery actions for the North Atlantic right whale in the lobster/Jonah crab trap/pot fishery. The funds were made available to fishermen through our partnership with the Commission. The funds were obligated to the Commission and have been distributed to Maine, New Hampshire, Massachusetts, and Rhode Island to assist the lobster/Jonah crab trap/pot fishery in adapting to and comply with the measures in this final rule and to help defray costs to support affected fishermen broadly. Maine and Massachusetts have used funds to improve reporting (Maine) and to support a gear liaison to collaborate with fishermen to develop and test weak insertions. New Hampshire and Rhode Island plan to use funds to purchase rope for fishermen once the rule becomes effective. At this time additional funds have not been appropriated by Congress or further reprogrammed to reimburse fishermen

Comment 2.15: NMFS should reevaluate the use of Automatic Identification Systems (AIS) to track vessel locations and movements, and not dismiss it from consideration as an alternative based on expense.

Response: NMFS supports the collection of high-resolution spatial data in the lobster fishery and intends to continue to work with the Commission, through their technical working group, to develop data collection objectives and requirements, while balancing the financial burden to industry. Included in ongoing discussions are specifications needed to determine whether options less expensive than AIS systems can be used effectively. A basic vessel tracking

system costs between \$500 and \$1,300, while a more advanced AIS system costs between \$750 and \$3,500. AIS devices also have ongoing operating costs. In relation to the overall size and value of the lobster fishery (approximately \$600 million), for example, the cost of vessel tracking technology is small in light of the benefits it provides in the form of real-time fishery monitoring as well as safety to prevent vessel collisions. We anticipate continued investigation into the appropriate vessel tracking specifications to meet the needs for lobster and right whale management and, if appropriate, would pursue rulemaking within the next few years to require vessel tracking for federally permitted vessels fishing for lobster.

Many lobster vessels are smaller than 65 feet and therefore not currently required by law to carry AIS. While the individual cost of AIS systems are low compared to the value of the fishery, outfitting the entire fleet with AIS would not be a cost effective approach to monitoring, due to the trap-setting nature of the fishery. Other vessel tracking methods are being piloted by the Commission that are more responsive to tracking the movements of lobster boats, such as setting and hauling back. NMFS will work with them to regulate this monitoring approach.

Comment 2.16: In doing its economic analysis, NMFS did not consider the ecological value of right whales, and the role they play in a healthy environment, including their role in carbon sequestration.

Response: In Section 9.6.1 of the DEIS, we discussed the value of large whale protection in non-consumptive use benefits and non-use benefits. We provided the total expenditure of the whale watching industry as a proxy for non-consumption use value, and we provided a list of research results on the willingness to pay for whale protection programs from society as a proxy for the non-use value. In FEIS Section 9.6, we revised our analysis to include recent studies on the ecological and economic value of large whales.

Comment 2.17: The DEIS does not include a reference to the Meyers and Moore 2020 paper that suggests a reduction in effort brought about by time/area closures and removals of traps and lines from the water may reduce costs.

Response: When we prepared the DEIS in spring 2020, this Meyers and Moore (2020) paper had not yet been published. We have updated the FEIS and this paper has been cited. See FEIS Section 6.5.1.

Comment 2.18: The economic and social impacts analysis fails to consider the impact that the ongoing COVID-19 pandemic has had on demand for the fisheries. In the first six months of 2020, U.S. exports of lobster declined by 44.6 percent (FAO Globefish 2021) and that significant uncertainty regarding the duration and extent of these impacts remains.

Response: The full consequences of COVID-19 on the U.S. lobster and Jonah crab trap/pot fisheries cannot yet be determined. In the first half of 2020, the U.S. fishing and seafood sector experienced broad declines due to COVID-19 protective measures instituted in March 2020 across the United States. While lobster fishing effort and demand for lobster were low in the first half of 2020, landings increased and prices rose as the year went on. Maine, the state that has the most active and valuable lobster fishery, reported preliminary data that indicated that the value of lobster landings in 2020 exceeded \$400 million for only the seventh time (Maine DMR constituent email, March 24, 2021). The catch volume was reportedly 5 percent lower than 2019 landings but the vessel price was \$0.44 higher per pound than the average price over the previous ten years. While the uncertainty caused by COVID-19 on communities that rely on lobster and other fisheries cannot be understated, in the Gulf of Maine, where lobster stocks are healthy, the fishery appears to be somewhat resilient.

Comment 2.19: The costs of compliance fail to account for economic losses associated

with shorter equipment durability and lifespan caused by the proposed weak ropes, insertions, and trawling up.

Response: See the description of gear loss costs in Chapter 6, section 6.2.6.1. Gear loss is not included in the final costs estimation because the effect of trawling up on gear loss is unclear and not thought to be substantial. We also currently have no evidence that weak rope or weak inserts would cause significantly more gear loss. In a study of weak inserts conducted by New England Aquarium for the Massachusetts Office of Energy and Environmental Affairs, Knowlton *et al.* (2018) documented sleeves designed with reduced breaking strength breaking in only 11.8 percent of hauls relative to 8.5 percent of control buoy lines, which they did not find statistically significant. Some fishermen who have used the South Shore Sleeves for several years have incurred no significant increase in extra gear loss. NMFS will continue to test and evaluate the use of weak inserts to ensure they are not likely to contribute to an increase in ghost gear. See Section 5.3.1.3.2 for a description of the anticipated indirect effects of trawl length and weak rope measures, including the likelihood of gear loss. Also note that lobster landings dropped in 2020 due to COVID-19 but the 2020 lobster average price was the second highest in the past decade, about \$4.4/lb.

Comment 2.20: The DEIS exclusively uses the Federal dealer data to analyze the commercial impact to the industry, not the full value of the supply chain, and so underestimates the true cost.

Response: For our analysis of the impacts on commercial fisheries, the dealer data provides the most accurate information. Although we have some information of the total economic value of the supply chain in Maine, it is difficult to estimate the impacts of the proposed rule on it. The biggest impact on the supply chain from the rulemaking would be the

short-term landing reduction. There could be some negative impacts in the near term, but also could benefit the industry in the long run. We discussed this issue briefly in FEIS Section 6.7.2.2.

Comment 2.20: NMFS's economic analysis fails to properly consider that reduced effort does not equate to reduced catch.

Response: For reduced effort in restricted areas, under the scenario where fishing is suspended, we assumed fishermen would lose all their revenue during the closed fishing period, which was the more conservative estimate. We recognize the costs could be overestimated in section 6.3.1.2 "Caveats". Under the scenario where effort is relocated, we assumed a 5 percent to 10 percent landing reduction in the first year, and we also applied a decreasing rate of landing reduction for the impacts of restricted areas.

3. Enforcement

About 14 commenters voiced concerns that this rule would be difficult to enforce, and 11 commenters including the United States Coast Guard, suggested that NMFS needs to develop a comprehensive enforcement plan for the areas affected by this rule. As noted in the FEIS, lobster trap/pot gear makes up the vast majority of buoy lines fished in the Northeast Region, making compliance with regulations paramount to the rule's ultimate success or failure in reducing right whale mortalities and serious injuries.

Comment 3.1: NMFS should develop a comprehensive monitoring and enforcement plan to ensure compliance. One commenter stated that there is currently no enforcement in Massachusetts, New Hampshire, and LMA 3, and another stressed the importance of including states in the development of any enforcement plan.

Response: State partnerships serve a significant role in effective regional enforcement

activities. The Office of Law Enforcement-Northeast Division (OLE-NED) has Joint Enforcement Agreements (JEA) in place with ten New England and Mid-Atlantic coastal states (Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Delaware, Maryland, and Virginia). The following states perform inspections of lobster gear in Lobster Management Areas: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey. The following states perform inspections of black-sea-bass gear in Lobster Management Areas: Delaware, Maryland, and Virginia. OLE-NED has developed and implemented a pilot program using remotely operated vehicles (ROVs) to inspect offshore fishing gear, including in LMA 3. The pilot project will inform future offshore enforcement activities for ALWTRP compliance monitoring efforts. Additional information on this pilot program is provided in response to Comment 3.2. OLE-NED has identified a number of elements to review, in partnership with the states and the United States Coast Guard, to help develop a more comprehensive enforcement strategy for the ALWTRP regulatory requirements. Appendix 3.5 of the FEIS provides a high-level overview of compliance monitoring plans and associated enforcement assets.

Comment 3.2: Several commenters noted that enforcement in the offshore areas, particularly LMA 3, is sparse, and question whether Marine Patrol will be able to do gear inspections on longer trawls.

Response: Traditional methods of hauling gear in offshore waters for compliance monitoring poses both safety and sustainability challenges. To meet these challenges, OLE-NED developed and implemented a pilot program using ROVs to inspect offshore fishing gear. OLE-NED has conducted offshore subsurface ROV surveys to check for sinking groundlines, gear markings, and weak links in previously uninspected areas. Gear tags were also inspected when

possible. After initial trials, OLE has determined that ROV-based inspection of gear in the water is a safer and more efficient way to enforce offshore lobster gear requirements, rather than physically pulling the gear. The pilot project was carried out in FY2020 and FY2021, and will inform future offshore enforcement activities for ALWTRP compliance monitoring efforts.

Comment 3.3: How will NMFS be able to enforce the different requirements in different areas, as fishermen move from area to area?

Response: NOAA's Office of Law Enforcement partners with state agencies and the United States Coast Guard to enforce all applicable lobster regulations nearshore and offshore. Fishermen are required to adhere to the regulations in the areas they fish. In Maine Lobster Management Zones, where conservation equivalencies established by zone and distance from shore present the greatest enforcement challenge, the Maine Marine Patrol assured us that they use outreach, education, and enforcement to establish and maximize compliance, are very familiar with Maine's lobster management zones and boundaries, and that "...enforcement of most restrictive rules relative to lobster zones does not present any significant challenge. . . ." (email from Erin Summers, April 20, 2021). Offshore enforcement poses challenges that enforcement partners have been evaluating in recent years. While OLE does not disclose specific law enforcement techniques, as discussed above, OLE has started deploying ROVs to inspect offshore gear. OLE welcomes and encourages the public to report violations to their hotline.

4. Gear Marking

A total of 75 commenters supported gear marking, indicating that gear marking is the best way to determine where and in which fisheries entanglements occur, and potentially absolving other areas and fisheries of blame. Gear marking was universally supported by conservationists and fishermen. Several Maine fishermen commented that they had already

completed their required gear marking, and many are expecting the results to show that Maine's lobster fishery does not entangle whales.

Comment 4.1 NMFS should give Maine's lobster fishery a three-year evaluation period to make sure that Maine's rope (now with purple marks) is not causing entanglements before adding any other requirements.

Response: The results of Pace *et al.* 2021 show that in the years 1990-2009, roughly eight right whales per year died, many unseen. Since 2010, on average 21 right whales per year have died. Recent observations indicate that the increase in mortality since 2010 is in part due to a significant amount of mortality in Canadian waters and/or from Canadian fishing gear. However, the sources of the unseen mortality (roughly eight whales per year) that has existed for decades remains uncertain and the effects of the Plan's measures cannot be evaluated (Pace et al. 2017) and likely has not reduced mortality and serious injury below one per year as required to meet MMPA goals.

If current trends continue, even accounting for a mean of 11 births per year over the last 10 years, we could expect to lose another 30 whales over the next 3 years, or 10 whales per year. Pace *et al.* (2021) estimates that approximately 368 right whales were alive at the end of 2019. At the current rate of decline, we would expect the 2020 population to be 358. If we wait 3 more years to implement risk reduction regulations, the population could be as low as 328. We are required by the MMPA to take action now. See FEIS Chapter 1 for more information on the need for immediate action.

We expect gear marking and acoustic and aerial surveys to help us further identify the areas of most risk to right whales. Until we have additional information, we must regulate based on the best available science: Maine has the highest concentration of all vertical line gear in U.S.

waters, and right whales are still using Maine waters.

Comment 4.2: There should be an exemption for hand-hauled lobster traps in less than 100 feet of water, because when traps are pulled by hand, the vertical lines are not cleared of organisms on the rope as they would be when a pot hauler is used.

Response: It is unclear what exemption is being requested by the commenter, as no exemption fitting this general description was included in the final rule. The request may be for an exemption from gear marking requirements because marks may be obscured by fouling. While this may reduce the ability to see marks from a vessel, gear marks would be detectable from line retrieved from a whale.

Comment 4.3: We received comments from some who support the idea of individual ID tags that would allow NMFS to identify the fisherman whose gear entangles a whale, as well as from others who oppose individual ID tags.

Response: Current regulations require buoys to be marked with information that can be traced back to individual fishermen. Buoy and individual line tagging technologies exist, but this method of marking comes at some cost and the benefits are unclear. Gear is not always recovered and often buoys or traps are not present on the entangled whale. Line marking technology, such as identification tape (*i.e.*, marker tape) that is woven into line, is expensive and is difficult to enforce without severing the buoy rope. Radio frequency identification and passive integrated transponder tags are also expensive, require standardized tag readers to adequately enforce, and in field trials have not held up well in commercial fishing conditions. As the technology improves and the costs are reduced, NMFS will continue to monitor the possibility of line identification tape. We are not requiring individual markings in this rulemaking.

Comment 4.4: One commenter proposed dividing Massachusetts and Maine into smaller

subdivisions with distinct markers to allow NMFS to develop more accurate and targeted marine policy, and another suggested weak rope should be marked or colored to identify it as weak rope.

Response: Current regulations include some small zones of multiple colored marks but given the rarity of gear retrieval, the value of small area marking requirements is not yet proven. Gear marking is one of the most expensive elements within the proposed regulations and increasing complexity adds expense without proven benefits or any risk reduction. Regarding requiring weak rope to be identifiable with a color or marking scheme, NMFS does not regulate rope manufacturers. However, we are asking them to create intentionally engineered weak rope with a tracer or a strand of a contrasting color. Weak insertion approval has included a requirement of a contrasting color to allow both enforcement and disentanglement teams to recognize the weak insertion.

Comment 4.5: NMFS should not require any additional gear marking beyond what is already in place.

Response: Currently, the majority of gear recovered has no identifiable marks and until Maine established gear marking requirements in Maine exempted waters, over half of all U.S. buoy lines were unmarked. In order for the ALWTRT to make better recommendations, including those that could allow more targeted gear modifications and closures, the Team needs a better understanding of the types and locations of rope that entangle whales. The more robust gear marking scheme included in the final rule, including some markings largely supported by the ALWTRT and states, should increase our ability to identify the gear, and subsequently, identify more targeted and more effective measures to reduce entanglements.

Comment 4.6: Gear marking should be required for all fisheries in the right whale

migratory path.

Response: The ALWTRP covers commercial fisheries within the right whale migratory path from Florida to Maine. While, historically, the majority of gear recovered from right whale entanglements has been unknown, state regulations and the final rule expand the gear marking schemes substantially for the lobster/Jonah crab fishery, which contributes the vast majority of vertical lines in these waters. The new gear marking requirements should increase the frequency with which we encounter gear marks on recovered rope from entanglements and enable visual identification of state of origin from aerial and vessel-based platforms. The ALWTRT has begun meeting to develop recommendations related to reducing the risks posed by other U.S. fisheries in right whales range. In recent years, Canada has also implemented gear marking requirements for Canadian lobster and snow crab fisheries.

Comment 4.7: NMFS should require gear markings every 17 fathoms, so that gear markings will be at the same intervals regardless of the total length of the rope.

Response: The large number of different fisheries operating at various depths managed under the ALWTRP makes it difficult to implement a single gear marking structure. For those fisheries occurring in deep offshore waters, this rule more than doubles current gear marking requirements but may not result in marks as frequent as every 17 fathoms (31 m). However given the large number of buoy lines in shallower waters, one marking every 17 fathoms (31 m) would be a reduction in gear marking compared to what we have in the final rule.

Comment 4.8: Several commenters suggested that sinking groundlines should be marked to distinguish them from vertical lines, while others supported not requiring any gear marking on sinking groundlines.

Response: Groundline marking has not been extensively discussed by the ALWTRT in

recent years. Under current ALWTRP and in this final rule, no gear marking will be required for sinking ground lines.

Comment 4.9: Why are the gear marks required to be 3 feet long (0.91 m), and would that be useful in murky water?

Response: Gear marking and fishery identification relies mainly on recovering gear from entangled whales, making the water clarity a negligible component of gear identification. However, the proposed larger 3-foot (0.91 m) mark within 2 fathoms (3.65 m) of the surface system should help identify gear from vessel and aerial platforms, as the surface system will keep the line in relatively clear water. The mark could also provide useful information for disentanglement teams, and may allow gear identification in cases where whales are photographed, but not seen again.

Comment 4.10: Any final rule should include requirements for all buoy lines to be marked the full length of the vertical line, or at the very least, markings every 40 feet, and in such a way that the location of where gear was set can be known even in cases when a buoy is not seen or retrieved.

Response: The final rule increases the number of marks with additional distinction between Federal and state waters, offering better spatial resolution than those in the Proposed Rule. The marks will also be longer in length to increase the likelihood that a mark will be spotted without a buoy. However, it was determined that marking every 40 feet would be costly without a commensurate benefit given that since 2010 gear has only been retrieved from about 40 percent of the observed right whale entanglements.

Comment 4.11: Time consuming gear marking regulations should be implemented during the off season, as otherwise gear making will reduce the time available for fishing.

Response: We recognize this issue, and this rule will include a delayed implementation date to allow time during slow seasons as practicable for gear configuration and gear marking changes.

Comment 4.12: Can we alert whales to the presence of ropes with visual or acoustic cues?

Response: Research conducted by Kraus, Fasick, Werner and McFarron (2014), and Kraus and Hagbloom (2016), suggested that red and orange lines may be visually detectable by North Atlantic right whales at greater distances than other colors although it is unclear to what depths color can be detected or whether detection results in avoidance. For more information on gear marking measures included in this rule, please see Table 3.3. Unlike toothed whales that use echolocation to sense their surroundings, baleen whales like right whales are not detecting fishing gear acoustically and acoustic cues are unlikely to result in gear avoidance in the same way that pingers have been successful at reducing entanglements of harbor porpoises, for example.

5. *Legal Issues*

Approximately 28 commenters believe that the Proposed Rule violated the requirements of the MMPA, the ESA, the National Environmental Policy Act (NEPA), and/or the Administrative Procedure Act (APA). Most of these concerns were raised by NGOs, including but not limited to: Whale and Dolphin Conservation, Oceana, Center for Biological Diversity, Conservation Law Foundation, Defenders of Wildlife, Humane Society of the United States, Natural Resources Defense Council, PEER, Clearwater Marine Aquarium, Georgia Aquarium, Southern Environmental Law Center, as well as the Maine Lobstering Union, and many Federal and state legislators.

Comment 5.1: NMFS refusal to evaluate some strategies, including but not limited to

certain trap reductions, weak line enhancements, static area closures, and gear marking strategies, was “arbitrary and capricious” under the APA.

Response: The development of the Proposed Rule was the result of an extensive public process involving challenging negotiations within the ALWTRT and ample opportunity for public input as prescribed by the MMPA, NEPA, and the APA.

Many options were considered, deliberated, and evaluated by the ALWTRT, the public, and NMFS, and some were modified or eliminated from further consideration as the process unfolded. Where the measures considered in the final rule would also affect state fisheries, the input of state fisheries agencies was important to ensure that conservation measures were feasible and safe in the various locations in which they would apply. State scoping and outreach helped inform the rulemaking efforts, and helped identify the measures that would be given extensive consideration in the NEPA process.

The final rule and FEIS reflect this extensive involvement by the numerous stakeholders and considered a reasonable range of alternatives.

Comment 5.2: Proposed rule and DEIS violated Executive Order (EO) 12898 by not reviewing issues of environmental justice, particularly for Maine’s Washington County.

Response: EO 12898 requires agencies to consider whether their actions result in disproportionately adverse human health and environmental impacts on minority or low income populations. The DEIS addressed EO 12898 by examining the various counties affected by the ALWTRP rulemaking, and concluding that minority and low impact communities will not be disproportionately affected.

While Washington County has higher than state average low income and minority populations, Washington County is not disproportionately affected by adverse health and

environmental impacts from the rulemaking when compared to other counties. Where the impacts of the ALWTRP rulemaking extend over a large area across multiple states, the county level is an appropriate level at which to assess whether the rulemaking would result in disproportionate impacts.

The commenter's concerns appear to be economic in nature, as opposed to adverse human health and environmental impacts, which are the focus of EO 12898. See FEIS Section 10.12 for a complete analysis of this rule as it pertains to EO 12898.

Comment 5.3: NMFS' authorization of lobster and Jonah crab trap/pot fisheries violates the ESA by allowing entanglements.

Response: NMFS has satisfied its obligations under the ESA by reinitiating consultation on the operation of Federal fisheries under eight Federal fishery management plans and two interstate fishery management plans, which was completed on May 27, 2021, and consulting on the amendment of the ALWTRP itself, which was completed on May 25, 2021.

The ALWTRP does not authorize fisheries. NMFS disagrees with the commenter's claims that the ALWTRP "allows" entanglements. The ALWTRP does not state that entanglements are allowed, nor does it prevent fishermen from taking actions to avoid or prevent entanglements beyond what is required by this rule.

Comment 5.4: Allocating the full PBR to the trap/pot fishery violates the MMPA.

Response: MMPA Section 118 directs NMFS to develop take reduction plans to reduce the incidental mortality and serious injury of marine mammals incidentally taken by commercial fishing operations to levels less than a stock's PBR level. Section 118 does not address other sources of human-caused mortality (*e.g.*, vessel strikes) and those other causes are not considered in the goals of the take reduction plan. The short-term goal of a take reduction plan is to reduce

incidental mortality and serious injury of each marine mammal stock to below the stock's PBR in the commercial fisheries addressed by the plan, with a longer term goal of reducing incidental mortality and serious injury to 10 percent of a stock's PBR taking into account economics, available technology, and existing fishery management plans. NMFS has already reconvened the ALWTRT to develop recommendations for gillnet and other trap/pot fisheries.

Additionally, the FEIS analyzes other sources of impacts on right whales. Although beyond the scope of this rule, NMFS has identified evaluation of current measures to protect right whales from vessel strikes, as well as research into factors affecting health and abundance, collaboration with Canada on range-wide recovery efforts, and consideration of emerging threats as 2021 to 2025 priority actions in the right whale 5-year Species in the Spotlight action plan.

Comment 5.5: The Proposed Rule violates the MMPA by considering economics as a factor when choosing the preferred alternative.

Response: The commenter argues that NMFS is prohibited from considering the economic impacts of measures to be implemented in a Take Reduction Plan unless such measures are part of the MMPA's long-term goal of reducing mortality and serious injury to insignificant levels approaching a zero mortality and injury rate (often referred to as ZMRG). However, the distinction drawn by the commenter does not accurately reflect the statute. Under the MMPA, to reach the long-term goal requires the TRP to take into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans. The portion of the MMPA discussing the short-term goal of reducing mortality and serious injury to below a stock's PBR does not use this language. However, that does not mean that economics, technological limitations, and state or regional fishery management plans cannot be part of the consideration as to which measures should be chosen to

achieve the short-term goal. Here, NMFS developed a 60-80 percent risk reduction target based on the latest PBR calculations and estimates of mortality and serious injury, and the ALWTRT developed recommendations based on this target. In choosing between measures that will accomplish the goal of reducing mortality and serious injury below PBR, the MMPA does not prohibit the consideration of economics, and here the agency's choice of measures to include in the final rule balances various factors, but does not do so at the expense of the risk reduction target to reach the short-term goal.

Comment 5.6: The Proposed Rule violates MMPA by not meeting ZMRG within 5 years.

Response: Under section 118 of the MMPA, NMFS is required to meet both the short and long-term take reduction plan goals of reducing mortality and serious injury incidental to commercial fishing operations. The short-term goal is to reduce mortality and serious injury below a stock's PBR, while the long-term goal is to reduce mortality and serious injury to insignificant levels approaching a zero mortality and serious injury rate (*i.e.*, ZMRG, defined as 10 percent of PBR in 50 CFR 229.2), taking into account the economics of the fishery, availability of existing technology, and existing state or regional fishery management plans.

Due to the continued entanglements of large whales in commercial fishing gear, NMFS is required to take additional action to further reduce mortality and serious injury incidental to commercial fisheries covered by the ALWTRP. NMFS will continue to discuss future plan modifications with the ALWTRT and has already reconvened the Team in light of these goals.

Comment 5.7: The Proposed Rule violates MMPA by not reducing PBR in six months.

Response: The MMPA created a framework for developing and issuing take reduction plans, monitoring the plans regularly, meeting with take reduction teams regularly, and amending plans if necessary to meet the goals of the MMPA. NMFS' actions have been

consistent with the process laid out by the MMPA.

The first ALWTRP was issued in 1997, and NMFS has modified the ALWTRP numerous times since, with input from the ALWTRT to further the MMPA goals of reducing mortality and serious injury of large whales incidental to commercial fisheries.

As we state in the preamble to the final rule, for the purposes of creating a risk reduction target, NMFS assigned half of the right whale entanglement incidents of unknown origin to U.S. fisheries. Under this assumption, a 60 percent reduction in mortality or serious injury would be needed to reduce right whale mortality and serious injury in U.S. commercial fisheries, from an observed annual average of 2.2 to a PBR of less than one whale per year. See Chapter 2 of the FEIS for our revised analysis of PBR.

Comment 5.8: These additions to the ALWTRP may not prevent the continued decline of right whales.

Response: NMFS tasked the ALWTRT with developing measures to reduce risk of entanglement to meet the MMPA's goals that fisheries mortality and serious injury should be below PBR. It is not within the agency's discretion to disregard PBR, and the current rulemaking is the agency's attempt to reduce the risk of mortality and serious injury from the Northeast lobster and Jonah crab trap/pot fisheries to comply with the MMPA. That such measures in and of themselves may not result in recovery of the right whale population does not mean that NMFS can disregard the statutory direction of the MMPA.

Comment 5.9: State measures should be included in the final rule.

Response: NMFS agrees that the MMPA authority applies in both state and Federal waters. Many state measures are included in the final rule, including Massachusetts weak insertion requirements and extension of the MRA north to the New Hampshire border. Because

dynamic management is difficult to accomplish under Federal procedural requirements and such measures were not part of the proposed rule, the Massachusetts extension of the state water closure into May was not included. Other Massachusetts measures, such as a maximum state water line diameter, were not included because they were not analyzed or part of the proposed rule.

Comment 5.10: NMFS “Purpose and Need” statement is too narrow.

Response: The Purpose and Need chapter of the FEIS states that the measures need to achieve a risk reduction of at least 60 percent, rather than an exact risk reduction target, and therefore, it was not meant to constrain the risk reduction to a specific number. Rather, this is the minimum target needed. Both of the action alternatives considered in the DEIS met the Purpose and Need. The Alternatives have been modified in the FEIS.

The Alternatives were selected because, using the Decision Support Tool, these suites of measures, which include ongoing and anticipated fishery management measures, measures that will be regulated by Maine and Massachusetts, and the benefits of the MRA, are estimated to achieve or exceed a 60 percent risk reduction necessary to reduce impacts to right whales to below the PBR level of 0.8 mortalities or serious injuries per year based on observed incidents. Thus, mortality and serious injury of right whales in U.S. fishing gear must be reduced by 60 percent (documented) to 80 percent (estimated) to achieve the MMPA goal of reducing fishery-related incidental mortality and serious injury to below the right whale PBR.

For more information on the Decision Support Tool and the input data, assumptions, and uncertainty please see FEIS Appendix 3.1.

In terms of the ESA, the final rule has been identified as a first anticipated step in the adaptive management approach within the conservation framework in the Section 7 Consultation

on the authorization and permitting of a number of Federal fisheries, including lobster and Jonah crab. Additionally, a consultation on the ALWTRP which included the implementation of final rule determined that the gear regulations implemented by the Plan for U.S. fixed gear fisheries including those measures in the final rule will have wholly beneficial effects to ESA-listed species or their critical habitat and therefore the Plan is not likely to adversely affect ESA-listed species or designated critical habitat.

Comment 5.11: NMFS cannot rely on CEQ's recent amendments to NEPA.

Response: Because the Notice of Intent to prepare an Environmental Impact Statement (84 FR 37822, August 2, 2019) was published prior to September 14, 2020, this action was prepared under the NEPA regulations first implemented in 1978. Text has been added to the Purpose and Need section (FEIS Section 2.2) to reflect this. As written, the FEIS addresses direct and indirect impacts in Chapter 5 (Biological Impacts), Chapter 6 (Economic and Social Impacts), and Chapter 7 (Summary of Biological, Economic, and Social Impacts). Cumulative Effects are addressed in Chapter 8, which also summarizes the direct and indirect impacts of the action as well.

Comment 5.12: NMFS failure to consider a "no commercial fishing" alternative is in violation of NEPA.

Response: Not allowing any commercial fishing is not a reasonable alternative under NMFS' regulatory responsibilities, namely the Magnuson-Stevens Act, and does not meet the Purpose and Need of the action nor the goals of the Plan. Per the agency's mission, NMFS is responsible for the stewardship of the nation's ocean resources and their habitat. We provide vital services for the nation: productive and sustainable fisheries, safe sources of seafood, the recovery and conservation of protected species, and healthy ecosystems—all backed by sound science and

an ecosystem-based approach to management.

Comment 5.13: NMFS did not evaluate a reasonable range of alternatives or all reasonable measures in violation of NEPA.

Response: The development of the Proposed Rule was the result of an extensive public process involving the ALWTRT as prescribed by the MMPA, NEPA, and the APA. Many alternatives were considered, deliberated, and evaluated by NMFS, the ALWTRT stakeholders, and the public, but some were eliminated from further consideration as the process unfolded. For example, while the non-preferred alternative considered a reduction and cap on buoy lines, achieving that reduction specifically through a large reduction in the number of traps allocated to fishermen or through a reduction in the number of permits issued was not analyzed despite studies that suggest that trap reductions may not substantially or over the long term reduce lobster landings and would reduce operational costs to fishermen (*e.g.*, Myers and Moore 2020; Myers *et al.*, 2007). These measures were not included in large part due to failed efforts to establish effort reduction measures with the primary fishery management body responsible for lobster fishery management, the Commission, demonstrating the complexity of developing these measures in a fishery with varied state reporting requirements. There was also strong opposition from the regulated community, most notably when Maine DMR attempted to develop this option through Maine Zone Council meetings. Strong industry opposition to measures that would require consideration of fishing histories and landings data would further extend the rule development and implementation timeline and compromise compliance.

Additionally, trap reduction would not in itself necessarily reduce buoy line numbers. Increasing the minimum number of traps per trawl would still be required in conjunction with trap reductions, otherwise fishermen could use trawls with fewer traps resulting in no decrease in

vertical buoy lines. While some commenters raised concerns about additional weight associated with more traps per trawl and stronger buoy lines, weak insertions required in all buoy lines regulated under this rule would provide for breakable buoy lines. This example demonstrates the complex interrelationship of many of the measures analyzed and adopted or rejected, although given the large volume of comments not all measures provided in scoping and comments on the proposed rule were analyzed.

Where the measures considered here would also affect state fisheries, the input of state fisheries agencies was important to ensure that conservation measures were feasible and safe in the various locations in which they would apply. As such, state scoping and outreach helped inform the rulemaking, and measures given extensive consideration in the NEPA process. The FEIS reflects this extensive involvement by the numerous stakeholders and contains a reasonable range of alternatives for the agency and the public's consideration. The Alternatives were selected because, using the Decision Support Tool, they achieve or exceed a 60 percent risk reduction necessary to reduce impacts to right whales to below the PBR level of 0.8 serious injury or mortality per year.

Comment 5.14: NMFS rejected trap reductions in violation of NEPA.

Response: While agencies shall include reasonable alternatives not within the jurisdiction of the lead agency, these trap reduction strategies were not considered reasonable under the Purpose and Need due to multiple factors. They are complex, time-intensive, and carry a large administrative burden. For example, implementing a line or trap cap would require pinpointing accurate data sources, identifying qualifying criteria, outlining an allocation method, and engaging the industry, on top of managing current measures. Given the need for rapid rulemaking and conservation measures, these trap reduction strategies are not currently cost

effective, nor could they be implemented in a timely manner. For more information on trap reduction strategies undertaken by the Commission, see also response to Comment 5.14, above, and comment 6.4, below.

Comment 5.15: DEIS did not analyze all risks in concluding the rule will reduce mortality and serious injury below PBR in violation of NEPA and APA.

Response: In accordance with NEPA, as part of its cumulative impacts analysis, the DEIS described impacts to right whales and other large whales from various anthropogenic sources, including vessel strikes, aquaculture, and offshore energy development. However, attribution of sources of mortality in the PBR framework is not a legal requirement of NEPA, but of the MMPA. Section 118 of the MMPA directs that NMFS develop take reduction plans to reduce the mortality and serious injury of marine mammals incidental to commercial fishing operations to levels less than PBR for the marine mammal stock. While the DEIS did address other sources of impacts on right whales, the MMPA does not mandate that take reduction plans must reduce incidental mortality and serious injury from fisheries to levels that would accommodate mortality and serious injury from other anthropogenic sources within PBR. In other words, NMFS does not apportion PBR; PBR is a reference point that serves as the short-term goal for a take reduction plans and also alerts NMFS to take management actions needed to reduce all sources of human-caused mortality so that we can meet the overarching MMPA goal of recovering marine mammals to their optimum sustainable populations.

Comment 5.16: NMFS did not consider dynamic area management as required under NEPA and APA.

Response: The commenter is correct that in the past the take reduction plan included dynamic closure measures. Such measures were found to be problematic with the fixed gear

lobster fishery, and so were not considered in this final rule. When a closure is made gear cannot be removed instantaneously, and factors such as weather and sea conditions affect the timing of gear removal. Dynamic closures must allow for safety concerns, which make them less effective from a conservation perspective, as such delays can result in gear remaining after whales are sighted, and may also result in a situation where, by the time fishermen are able to remove their gear, the whales may have already left the area subject to the closure. Further, while Canada began using dynamic closures in 2018 as part of its right whale conservation effort, in 2019 there were twelve Canadian right whale mortalities despite these measures. See Comment 9.2 under Restricted Areas and Borggaard *et al.* (2017) for further discussion of dynamic management.

Comment 5.17: Proposed rule violates MMPA and ESA because regulations are not effective and immediate.

Response: The MMPA take reduction rulemaking process is subject to procedural requirements arising from the APA, MMPA, NEPA, and ESA that make “immediate” protections in the form of a Take Reduction Plan amendment a legally difficult proposition. While there are circumstances in which MMPA emergency rulemaking authority may be exercised, as described in more detail in response to comment 7.5, NMFS has not concluded that this would be appropriate here, and even if this authority were used it would not allow for “immediate” protections, as there are other non-MMPA procedural steps that must occur. NMFS has undertaken the current rulemaking process using the best available scientific information while engaging with various stakeholders in the take reduction team process to develop effective conservation measures to reduce entanglements of right whales in Northeast lobster and Jonah crab trap/pot fisheries.

Comment 5.18: NMFS did not use the best scientific information available in violation of

NEPA, MMPA, and ESA.

Response: The rulemaking process unfortunately cannot react instantaneously as new information comes to light. The MMPA take reduction planning process requires the involvement of numerous stakeholders in the TRT in the development of conservation measures, followed by the required NEPA and APA processes. At all points, however, NMFS uses the best available scientific information to inform its decisions, and when the TRT was reconvened, NMFS developed a 60-80 percent risk reduction target based on the latest PBR calculations and estimates of mortality and serious injury.

As NMFS prepared to publish the DEIS and Proposed Rule, new information regarding North Atlantic right whale population came in the form of preliminary estimates from the NMFS Northeast Fisheries Science Center in the fall of 2020. These estimates have since undergone additional review, and are being incorporated into the North Atlantic right whale stock assessment that includes a new PBR calculation, a process that includes public notice and comment. This new information is included in the FEIS.

Comment 5.19: The proposed regulation is not only unconstitutional, but a direct attack on the citizens and sovereignty of the state of Maine. You should refrain from implementing this regulation.

Response: NMFS is acting in accordance with direction from Congress under the MMPA and other applicable laws. See FEIS Chapter 10.

6. *Line/Effort Reduction*

At least 34 commenters were in favor of effort reduction through trap limits, line caps, and buybacks, as a way to reduce the number of vertical lines in the water, thus reducing risk to right whales, while a few were against any effort reduction measures. Maine DMR noted that the

administrative burden of a line cap system is also something that has deterred them from pursuing this management measure. Several commenters pointed out that, due to latent effort, NMFS' assumptions on effort may be artificially high, though Maine's DMR stated that the latent effort calculations were consistent with their view. Some commenters suggested that fewer fishermen are entering the fishery, leading to a natural reduction in effort, and therefore line reduction was already taking place, which would contribute to the risk reduction goals of the final rule.

Comment 6.1: NMFS should review the amount of latent effort in the fishery, and ensure that latent effort is properly accounted for in determining the risk reduction value of any measures.

Response: Since the collapse of the Southern New England (SNE) lobster stock, the Commission has taken action to attempt to address latency in LMA 2 and 3. The Commission's Lobster Management Board initiated Addendum XVIII to scale the SNE fishery to the diminished size of the SNE lobster resource with a consolidation program aimed at addressing latent effort (unfished allocation) and reductions in traps fished. Addendum XVIII included an approximate 50 percent trap reduction in LMA 2 implemented over 6 years and an approximate 25 percent trap reduction in LMA 3 implemented over 5 years. These trap reductions concluded in fishing years 2020 and 2021.

Given that the Gulf of Maine/Georges Bank (GOM/GB) lobster stock (overlapping with LMA 1, 3, and the Outer Cape) is at a near time series high for abundance, we can assume that the amount of latency is comparatively lower than that found in SNE. As discussed in Chapter 5 of the FEIS, positive market and lobster stock conditions for the GOM/GB stock incentivize fishermen to increase fishing effort and may encourage inactive fishermen to reenter the fishery.

For that reason, it is likely that fishermen in the Gulf of Maine have been fishing at a high capacity in recent years. Maine, which accounts for the majority of permits issued in the Gulf of Maine, submitted data on latency rates of state permits (Appendix 3.2 of the DEIS), indicating a stable number of latent permits over the last 10 years (2008-2018). Of its approximately 6,000 permits issued, approximately 1,500 permits have no reported purchased landings and are considered latent. While other jurisdictions have not completed similar analyses, latency rates are likely similar.

Given the actions to reduce latency in LMA 2 and 3, the relatively low but stable amount of latency in LMA 1, and the current fishery incentives given high abundance in the Gulf of Maine, fishery data included in the Decision Support Tool are considered accurate and representative of existing fishery conditions, including existing rates of latency. See FEIS Chapter 5 for more details.

Comment 6.2: A range of views were expressed on the Non-preferred Alternative of capping buoy lines. One comment stated that NMFS should choose its Non-preferred Alternative of capping buoy lines at 50 percent of the average monthly lines fished in Federal waters in 2017. Another expressed opposition to it, citing that Massachusetts is the only state where end lines are accurately counted or regulated, and it would be time and labor-intensive to develop such a system across the other states without funding or capacity to do so.

Response: Regulating buoy lines was analyzed in the DEIS and the FEIS as an element within the Non-preferred Alternative 3, taking an alternate approach to achieving risk reduction across the proposed areas that would reduce line numbers while allowing fishermen to respond to the reduction according to their preferences and individual operational capacity. Alternative 3 would cap the total number of lines available for trap/pot fishing in Federal waters to 50 percent

of the average baseline number of lines (2017) outside of state waters. Because this was not a Preferred Alternative, the exact regulatory mechanism for implementing a line cap was not identified. It was assumed, however, that NMFS would work with the Commission and New England states to qualify the number of buoy lines based on an April 29, 2019, control date (84 FR 43785, August 22, 2019) using vessel trip reports or, for Maine, other data sources to distribute allocations of line tags to fishermen.

NMFS did not select this Non-preferred Alternative because development of a buoy line control program would be time- and labor-intensive and come at a substantial cost to the industry. The Commission process, including soliciting public feedback, requires, at a minimum, approximately six months to develop an adaptive management action. Larger, more controversial actions can take 8 to 18 months. One commenter is likely correct that, given the lack of mandatory vessel trip reports in the Federal lobster fishery in the baseline year of 2017, the Commission would have had to rely on state data as the best scientific information available to develop a qualification program through an addendum.

Given the variable data regarding individual fishermen's lobster fishing histories due to inconsistent state and Federal reporting requirements, this would be a large and controversial action. Even once approved by the Commission, additional time would be required for NMFS to undertake a Federal rulemaking and associated analysis. The FEIS estimates that a 50 percent reduction of buoy lines in Federal waters would alone achieve an average 45 percent risk reduction in Federal waters with economic impacts ranging from \$3.9 to 13.4 million. The combined set of measures included in the preferred alternative was projected to achieve a 69 percent risk reduction at a cost of \$9.8 to \$19.2 million in the first year of implementation. Given implementation challenges, the economic impacts of this preferred alternative and the fact that

the preferred alternative achieves the stated risk reduction target, buoy line reductions will not be implemented in the final rule.

Comment 6.3: States should cap and reduce the number of licenses, and reduce risk to right whales.

Response: Through the Commission's Interstate Fishery Management Plan for American Lobster, states and NMFS have made substantial efforts at capping the number of permits and traps authorized in the lobster fishery, which serves as a primary effort control. The concept of controlling lobster fishing effort by limiting access to historical participants began in 1994 when NMFS generally limited access into the Federal lobster fishery to those who could document participation in the fishery before 1991 (59 FR 31938, June 21, 1994). Years later, in August 1999, the Commission passed Addendum 1 to Amendment 3 to the Interstate Plan, which limited access to Lobster Conservation Management Areas 3, 4, and 5 to only those who could document fishing history in those areas. Subsequent Commission addenda similarly attempt to control effort by limiting access to other Areas:

Table 4. Actions under Interstate Fishery Management Plan for American Lobster

Lobster Conservation Management Area	Commission Action ²	Corresponding Federal Action
EEZ	March 1994-Amendment 5 ³	June 21, 1994 (59 FR 31938)
LMA 1	November 2009-Addendum XV	June 12, 2012 (77 FR 32420)

² All Addenda can be found at www.asmfc.org, under Interstate Fisheries Management, American Lobster.

³ New England Fishery Management Council document. This action occurred prior to the 1999 transfer of Federal lobster management to the Commission under the Atlantic Coastal Act.

LMA 2	December 2003–Addendum IV ⁴ February 2005–Addendum VI November 2005–Addendum VII	April 7, 2014 (79 FR 19015) May 10, 2005 (70 FR 24495)
LMA 3	August 1999–Addendum 1	March 2003 (68 FR 14902)
LMA 4	August 1999–Addendum 1	March 2003 (68 FR 14902)
LMA 5	August 1999–Addendum 1	March 2003 (68 FR 14902)
LMA 6	1995–by State action	Not Applicable in Federal Waters
Outer Cape Cod	February 2002–Addendum III May 2008–Addendum XIII	April 7, 2014 (79 FR 19015)
All Areas	February 2009–Addendum XII	April 7, 2014 (79 FR 19015)

The Commission has used a similar step-by-step approach in all of the areas. First, participants are qualified based upon their ability to document a history of fishing within the area. Second, those who qualify are allocated some number of traps within a given management area, based upon their ability to document the level of past fishing effort in the area.⁵ These addenda have largely required that states implement similar limited access programs (with the exception of LMA 1, where recommendations were for the Federal fishery only).

The Commission Interstate Plan has not included reductions to the number of permits issued in the lobster fishery. However, since area qualifications were implemented, the number of Federal permits issued in each area has either held steady or declined. The 2020 American Lobster Benchmark Stock Assessment summarized state and Federal permits issued in the lobster fishery, with approximately 1,400 fewer permits being issued in 2018 than in 2010.

⁴ Addendum IV was rescinded in Addendum VI and then revised and approved in Addenda VII and XII.

⁵ Through various addenda to the ISFMP for American lobster, history-based effort control plans based on fishery performance have been enacted by NMFS (LCMAs 1, 3, 4, and 5) and states (MA in Outer Cape Cod; NY and CT for LCMA 6; and MA, RI, CT, & NY for LCMA 2).

Further, the Commission has approved numerous actions that reduce area-specific maximum trap caps or reduce the number of traps allocated to each permit. Most recently, Addendum XVIII required an approximate 50 percent trap reduction in LMA 2 implemented over six years and an approximate 25 percent trap reduction in LMA 3 implemented over 5 years. These trap reductions concluded in fishing years 2020 and 2021.

The Commission recommended a reduction in the LMA 3 maximum trap cap as well as ownership caps in LMA 2 and 3 that are expected to further reduce the number of traps authorized in the areas, as part of Addenda XXI and XXII. NMFS is in rulemaking to consider the implementation of these measures. This FEIS anticipates this future rulemaking and has given credit to the risk reductions associated with Addenda XVIII, XXI, and XXII.

Comment 6.4: NMFS should remove half the traps from the water, which would reduce the risk to right whales while still allowing fishermen to make a living.

Response: Since 1994 under the Commission's Interstate Fishery Management Plan for American Lobster, states and NMFS have made substantial efforts at capping the number of permits and traps authorized in the lobster fishery. Participation caps serve as a primary effort control. Reducing trap caps by half could result in less effort and, when paired with traps/haul requirements, could reduce the number of lines being fished, with an associated reduction in risk to large whales. A number of fisheries and managers that have participated in the public meetings of the Commission and the Take Reduction Team have expressed confidence that, on productive fishing grounds, lobster trap reductions could occur without negative economic consequences. A number of studies have demonstrated this, see for examples Myers and Moore (2020), Myers *et al.* (2007), and Acheson (2013).

However, for a reduction in the number of actively fished buoy lines to be fairly

distributed based on vessel fishing histories or other commonly used metrics, detailed knowledge of the amount of fishing effort by sector or individual vessel is required. Allocation decisions in effort control management of a capped resource (lines or traps) are also usually informed by iterative public fishery management processes and include appeal options that are administratively burdensome. Because the lobster fishery has variable reporting requirements across states, and because only about 10 percent of Maine fishermen have been required to report in any year and Federal reporting has been variable, data to easily determine effective trap and line cap measures is not available. This was demonstrated by the failed attempt of the Commission to identify an effort limit addendum, as described in FEIS Section 3.1.1.2.

7. Management

We received thousands of comments on management issues, ranging from the use of adaptive management strategies to including southeastern states in future rulemaking to evaluating the effectiveness of the final rule. Thousands of commenters, primarily through campaigns organized by NGOs, but also at least 149 unique commenters, advocated NMFS taking emergency action to institute immediate vertical line reductions or closed areas, and of them, many suggested shutting down all fishing activities that involve vertical lines. Several also recommended shutting down all commercial fishing. We also received thousands of comments, again primarily through campaigns organized by NGOs, but also from 83 unique commenters, about our risk reduction calculations being based on outdated population estimates.

Comment 7.1: NMFS should use adaptive management to assess and recalibrate the measures every few years to reach goals of reduced entanglements in fishing gear.

Response: During the ESA Section 7 consultation on the operation of eight fisheries managed under Federal fishery management plans and two fisheries managed under interstate

fisheries management plans, NMFS identified the need for additional measures to meet the mandates of the ESA, and developed a Conservation Framework to outline the agency's commitment to implement measures necessary for the recovery of right whales. In addition to the current rulemaking that seeks to reduce risk of mortality and serious injury by 60 percent, the Conservation Framework provides for additional rulemakings to further reduce risk over the next decade at levels expected to lead to survival and recovery of the species. Central to the Conservation Framework is an adaptive management approach by which new information relating to the status of right whales and the impacts of fisheries and non-fisheries activities will be used to determine the extent of additional management measures needed.

Comment 7.2: NMFS should establish another process through which stakeholders can propose measures that could achieve equal or greater protections for right whales. The ALWTRP process is time-consuming, and does not allow for flexibility and adaptability.

Response: The MMPA requires NMFS to convene Take Reduction Teams and develop Take Reduction Plans. While this process can be time consuming, it provides a framework for developing mitigation measures and clear goals for the ALWTRP. The ALWTRT has the discretion to recommend mitigation measures that are flexible and adaptable in meeting the MMPA goals.

Comment 7.3: NMFS should include southeastern states in any future rulemakings, since right whales spend time in the southeast.

Response: To simplify and expedite rulemaking, NMFS chose to direct the ALWTRT efforts initially on the Northeast Region lobster and Jonah crab trap/pot fisheries because these fisheries constitute 93 percent of the U.S. buoy lines in areas where right whales occur. The Team includes southeastern state fishery managers as well as members that represent the South

Atlantic Fishery Management Council and Southeast U.S. fishermen. NMFS has begun working with the ALWTRT to get their recommendations on further rulemaking that may include modifications to the southeastern fisheries that are subject to the ALWTRP. We will include outreach to stakeholders in these states in our future rulemaking efforts.

Comment 7.4: NMFS should enlist fishermen in disentanglement efforts, rather than relying on college students and other groups.

Response: Disentanglement efforts on large whales are conducted under a NMFS permit by highly skilled and trained responders throughout the United States. These responders come from a variety of backgrounds, including fishermen, and NMFS regularly conducts training that specifically targets fishermen and other members of the on-water community. Disentanglement techniques, tools, and protocols have been developed over decades and have been used as a model for successful rescues and international disentanglement efforts. National and international trainees come from all over the world to learn from and train with our teams in the United States. We do ask for assistance from untrained fishermen from time to time on specific cases, and will continue to do so to provide an effective disentanglement effort that is safe for both the disentanglement team and the whales.

Comment 7.5: NMFS should take emergency action to close all fisheries that use vertical lines or other gear that may entangle right whales, or to close all areas where whales may co-occur with fishing.

Response: There are several statutes that lay out the situations in which NMFS can take emergency action. In Section 118(g) of the MMPA, which many commenters mentioned, the Secretary of Commerce may implement emergency rules when incidental take from commercial fisheries are having "an immediate and significant adverse impact on a stock or species." Where

there is already a take reduction plan in place, the Secretary should develop such emergency rules that are consistent with the plan to the maximum extent practicable, and follow "on an expedited basis" with amendments to the plan as recommended by the TRT to address the situation. In developing emergency rules, the Secretary must consult with the Marine Mammal Commission, TRT, fishery management councils, and state fishery managers. Emergency rules can only stay in place for 180 days, but can be extended for additional 90 days if an emergency situation persists.

Section 4(b)(7) of the ESA also includes emergency rulemaking authority provisions. NMFS has used this authority in the past to implement emergency rules for right whale protections (*e.g.* SERO 2006 gillnet closure, 71 FR 66469, Nov. 15, 2006). This authority is available when there is an "emergency posing a significant risk to the well-being of any species of fish or wildlife or plants." In an ESA emergency rulemaking, the Secretary must provide detailed reasons why the regulation is necessary, and must provide actual notice to state agencies in states where species occur. An ESA emergency rule can only last 240 days.

While ESA emergency rulemaking provisions explicitly waive the procedural rulemaking requirements of the APA and the ESA, likewise, the MMPA's emergency rulemaking authority provides an alternative to the normal rulemaking process of the MMPA, which would ordinarily include the APA's notice and comment requirements. These MMPA emergency provisions do not, however, waive other procedural requirements that agencies are subject to when undertaking a rulemaking, including NEPA, the Paperwork Reduction Act (PRA), or EO 12866. The NEPA regulations at 40 CFR 1506.12, for example, allow agencies to consult with the Council on Environmental Quality to develop "alternative provisions" in addressing an emergency situation, but agencies are expected to "limit such arrangements to actions necessary to control the

immediate impacts of the emergency." EO 12866 provides that in an emergency situation, "the agency shall notify the Office of Information and Regulatory Affairs (OIRA) as soon as possible and, to the extent practicable, comply with subsections (a)(3)(B) and (C) of this section." The PRA includes emergency review provisions, subject to approval by the Office of Management and Budget (OMB) with a finding that the normal process will result in public harm or is not possible because of an unanticipated event, and even then the agency must take all practicable steps to consult with members of the public. To the extent that an emergency action would impact a wide range of the fishing community, the need to satisfy these procedural requirements would limit the speed of such actions.

Due to the above-referenced requirements for emergency action under the MMPA and ESA, including public notice and comment requirements NEPA, PRA, or EO 12866, and the limitations on how long an emergency rule can stay in effect (270 for MMPA, 240 days for ESA), NMFS believes that proceeding with the current action will provide the fastest relief and longest-lasting protections for right whales. NMFS generally views emergency actions to be appropriate where a clearly identifiable problem can be addressed with directed, focused measures, and such measures will effectively address the emergency in the timeframes to which such authorities are limited. Because it is difficult to predict where entanglements will occur given the relative scarcity of identified locations of entanglement, an emergency action to completely close all fisheries using vertical lines at this time would appear to be an overbroad use of its emergency authority. NMFS has not identified a geographic location or discrete temporal period within which emergency action would address a specific entanglement concern, and therefore NMFS believes that the complex issues associated with right whale fishery interactions are better addressed through the comprehensive approach in the final rule.

Comment 7.6: NMFS should take emergency action to immediately implement a year-round closure south of Martha's Vineyard and Nantucket.

Response: As noted in the response to Comment 7.5, we believe that the final rule will provide the fastest relief and longest-lasting protections for right whales, so we are not planning to take emergency action at this time. The final rule does include a seasonal closure south of Martha's Vineyard and Nantucket that will be in effect from February to April, when right whales have been sighted most frequently in high numbers in this area.

We have selected the larger of the closed areas analyzed as a restricted area in Alternative 3 (Non-preferred) in the DEIS, but is in the Preferred Alternative in the FEIS and is being implemented in the final rule. This larger restricted area was best supported by the most recent sightings data. Since 2018, right whales have been documented to the west of the originally proposed closure, such that the closure could relocate lines into areas of equally high whale density during the restricted season. The Preferred Alternative in the FEIS and final rule area encompasses the majority of the area where the highest density of right whales have been sighted, and the most recent sightings in years not yet within the Decision Support Tool demonstrate these aggregations have persisted. Restricting buoy lines within this area between February and April provides an estimated 4.6 percent risk reduction for the entire Northeast and captures much of the risk within that area. See FEIS Section 3.1.2.5 for our revised analysis.

Comment 7.7: NMFS should take emergency action to immediately implement seasonal closures in the three areas in the Gulf of Maine: Downeast summer closure from August 1-October 31, a western Gulf of Maine spring closure from May 1 to July 31, and an offshore migration closure from October 1 to April 30.

Response: As noted above, we believe that the final rule will provide the fastest relief and

longest-lasting protections for right whales, so we are not planning to take emergency action at this time. NMFS analyzed the closure areas in the three Gulf of Maine areas proposed in an emergency rulemaking petition submitted by The Pew Charitable Trusts. Along with the year-round closure proposed in Southern New England, these four areas would achieve an estimated 12.6 percent risk reduction according to Decision Support Tool Version 3, using the updated right whale habitat density model (2010-2018). However, the team working on the current rule would have to divert to preparing a new emergency rule and the required NEPA analyses. As noted above, emergency measures may only be implemented within the limited timeframe provided by the statutory authority, and the approximate 67 percent risk reduction from the current rule far exceeds the estimated risk reduction suggested by the commenters. The final rule is a priority in order to implement broad risk reduction in a timely manner. See FEIS Section 3.4 for a further discussion of this and other alternatives that were considered but rejected.

Comment 7.8: NMFS should issue emergency regulations that remove vertical buoy lines from the water in areas of high entanglement risk to North Atlantic right whales.

Response: As noted above, NMFS would typically use its emergency authority in situations where a clearly defined problem can be addressed using discrete measures in a defined geographical area to effectively provide conservation protections within the limited timeframe provided by the statutory authority. Because the location of entanglements are so rarely observed, it is difficult to pinpoint times and places where emergency measures might provide effective protections from entanglements. NMFS has not currently identified new areas where emergency regulations would be appropriate, but the final rule includes comprehensive measures that address entanglements on a broad scale, including measures that will reduce vertical buoy lines through trawling up and seasonal area closures. See FEIS Chapter 3.

Comment 7.9: How will the regulations in this final rule be evaluated?

Response: NMFS anticipates annual meetings of the Team to review the North Atlantic right whale and other large whale distribution and abundance data, mortality and serious injury data, retrieved entanglement gear analyses, fishing effort data, and other relevant research results. As they become available, these new data will also inform the evolving Decision Support Tool. Modifications to seasonal restricted areas will be considered annually by the Team, and they may make recommendations to amend the Plan, as needed. Following the recommendations of the NMFS Expert Working Group asked to review right whale surveillance and monitoring programs (Oleson *et al.* 2020), we anticipate a three-year surveillance and review cycle, providing additional opportunities to evaluate right whale distribution data to gauge seasonal restricted areas and other conservation measures contained in the ALWTRP.

Comment 7.10: NMFS should evaluate the success of past regulations, like sinking groundlines and breakaways, before adding more regulations.

Response: Under Section 610 of the Regulatory Flexibility Act, NMFS is required to review any significant rule to evaluate the continued need for regulation. To allow for sufficient time for economic adjustments to occur and for data to become available, we review rules every 7 years. The most recent ALWTRP rule was published in 2015, and will be coming up for review shortly.

Comment 7.11: Several commenters suggested that NMFS ban commercial fishing, ban certain commercial fishing gears, or focus on reducing the demand for seafood.

Response: MSA is the primary law that governs marine fisheries management in U.S. Federal waters. First passed in 1976, the MSA fosters the long-term biological and economic sustainability of marine fisheries. Its objectives include preventing overfishing, rebuilding

overfished stocks, increasing long-term economic and social benefits and ensuring a safe and sustainable supply of seafood. The Atlantic Coastal Fisheries Cooperative Management Act, governing the U.S. lobster and Jonah crab trap/pot fisheries, directs the Federal government to support the management efforts of the Commission and, to the extent the Federal government seeks to regulate a Commission species, develop regulations that are compatible with the Commission's Interstate Fishery Management Plan and consistent with the MSA's National Standards. Regulations to seasonally close areas to fishing or to fishing with certain gear types have been implemented to comply with the MMPA, the ESA, and even the Magnuson-Stevens Act. However, a complete ban on commercial fishing or closure of an entire fishing sector when other options exist that allow fishing to occur while complying with the Acts would be inconsistent with our mandates under these laws.

Comment 7.12: NMFS should require all vessels in fixed-gear fisheries to use Vessel Monitoring Systems and/or AIS, submit Vessel Trip Reports, and have observer coverage in order to get better information on distribution and density of vertical lines.

Response: NMFS supports the collection of high resolution spatial data in the lobster fishery. The Commission recommended the collection of mandatory harvester reports in the Federal fishery, as part of Addendum XXVI to Amendment 3 to the Interstate Fishery Management Plan for American Lobster. NMFS is in rulemaking to develop harvester reporting requirements that complement the Commission's Interstate Plan for lobster. NMFS intends to work with the Commission, through a technical working group, to develop additional high resolution spatial data collection objectives and requirements, while balancing the financial burden to industry.

Comment 7.13: If the lobster/Jonah crab trap/pot fishery had been managed like the

Northeast Multispecies fishery, there would be fewer offshore fishing permits, and we wouldn't be having this problem.

Response: The interaction risk of a protected species is largely associated with the gear type, but also the quantity of gear in the water, gear soak/tow duration, and the temporal and spatial overlap of the gear and a given protected species. For the critically endangered North Atlantic right whale, fixed gear fisheries with lines linking gear on the ocean floor to surface marking systems (buoys, etc.) pose the greatest risk as they have accounted for the majority of identifiable past fishery interactions. The DEIS indicated that the 2017 IEC model estimated that over 93 percent of fixed gear buoy lines within right whale habitats along the Northeast U.S. Atlantic coast are fished by the lobster and Jonah crab fishery. Thus, the lobster and Jonah crab fishery poses the greatest risk to right whales and has been the focus of this action. For comparison, the Northeast multispecies fishery authorizes the use of fixed gear (*e.g.*, gillnets), however, it is a relatively small component of the fishery and one of several fisheries comprising the other 7 percent of fixed gear fisheries with buoy lines.

The MSA, governing the Northeast Multispecies Fishery Management Plan, and the Atlantic Coastal Act (ACA), governing the Interstate Fishery Management Plan for American Lobster, are the primary laws governing marine fisheries management in U.S. Federal waters. First passed in 1976, the MSA fosters the long-term biological and economic sustainability of marine fisheries. Its objectives include preventing overfishing, rebuilding overfished stocks, increasing long-term economic and social benefits, and ensuring a safe and sustainable supply of seafood. The ACA directs the Federal government to support the management efforts of the Commission and, to the extent the Federal government seeks to regulate a Commission species, develop regulations that are compatible with the Commission's Interstate Fishery Management

Plan and consistent with the MSA. These laws allow for the updating of management measures to meet legislative and management objectives. While adjustments to management measures may affect the quantity of gear fished, soak time or tow duration, or the spatial or temporal usage of gear, and, thus, may alter the interaction risk associated with any fishery to protected species, they are unlikely to dramatically alter the gear usage in these fisheries.

Comment 7.14: These rules will create safety hazards for fishermen, and will not reduce right whale entanglements or mortalities.

Response: We acknowledge that open ocean fishing is inherently dangerous, and that fishing is one of the most dangerous occupations. Fishermen configure their operations in the ways that work best for them, and any regulatory changes that require them to modify their practices can increase risk until adaptations to the new practices are made. Although some commenters have criticized the deference that NMFS gave to the states and offshore fishery members in developing the Proposed Rule analyzed in the DEIS, the extensive outreach to fishermen informed the development of measures included in the final rule. Fishermen informed measures with important information such as number of traps that can fit safely on deck at one time, amount of force on rope hauled under commercial fishing practices, rope size that fits safely through blocks and haulers on commercial vessels, sizes of vessels and crews fishing at various distances from shore, local fishing conditions, and conservation equivalencies.

Alternative 2 (Preferred) of the FEIS and the final rule consider those public comments, including many of the conservation equivalencies requested, and accommodate those changes along with measures from the Proposed Rule that benefitted from earlier scoping. Together, these measures should prevent this rulemaking from introducing hazards beyond those that already exist in the lobster and Jonah crab fisheries.

Comment 7.15: NMFS should also evaluate the effects of these regulations on all the other large whale species in the region.

Response: Chapter 5 of the FEIS evaluates the effects of the final rule on large whales, other protected species, and habitat.

Comment 7.16: Thousands of commenters were concerned that cryptic mortality and uncertainty in the data was not taken into account when choosing the risk reduction target, and recommended an 80 percent risk reduction target or higher, with a few suggesting 100 percent.

Response: The application of cryptic mortality estimates in determining annual entanglement mortality and serious injury rates relative to the PBR level was a new concept when first introduced to the ALWTRT in 2019. Peer review of the cryptic mortality estimate had not yet been completed and although it was discussed in the 2018 Marine Mammal Stock Assessment Report (Hayes *et al.* 2019) that was available to the Team for the April 2019 meeting, cryptic mortality was not incorporated into the entanglement related mortality and serious injury estimates in that report. The 60 percent target based on documented mortality was in itself seen as a difficult challenge for the Team given uncertainties about the location of origin of most documented entanglement events. The 80 percent target was an initial attempt to account for early estimates of cryptic mortality, but was even more daunting and the Team recognized the uncertainty in that higher target given the many unknowns related to the unseen mortalities, including cause and location of deaths. Therefore, while the Team accepted the challenges of a 60 percent mortality and serious injury risk reduction, they were unable to agree on the higher target. The recent paper by Pace *et al.* 2021 on cryptic mortality and the more recent analysis in the current population estimate (Pace 2021) now provide more support for the 80 percent target than at the time the ALWTRT undertook its efforts to develop recommendations. Our

understanding of cryptic mortality will affect management decisions going forward as new stock assessments and PBR calculations incorporate this new science.

Here, NMFS considered this new information, as well as the remaining uncertainty around apportioning mortalities to country and source, conservation equivalency recommendations from states and stakeholders, and the need for urgency in completing the current rulemaking constraining us to the scope of the analyses in the DEIS. Resulting modifications to the final rule included selection of a larger area closure south of the islands and modifications to management measures that improved risk reduction estimates to achieve a nearly 70 percent risk reduction as determined by the Decision Support Tool. Further efforts by NMFS to estimate serious injury and mortality and to apportion the estimates to country and mortality source will be included in guidance to the ALWTRT to support their development of recommendations for further amendments to the ALWTRP.

Comment 7.17: NMFS should focus risk reduction efforts on areas of high right whale occurrence.

Response: Chapter 3 in the FEIS describes how the alternatives were developed and explains that while precautionary measures are required throughout the regulated areas, more restrictive and protective measures are focused on areas of high right whale co-occurrence with buoy lines (*e.g.* the hotspot analysis that identified restricted areas). Particularly, the months and areas with highest whale occurrence and co-occurrence are the areas that were selected for seasonal restricted areas. However, as described in Chapters 2, 3, and 8 of the FEIS, there is also a great need to implement measures that will be resilient to changes in whale distribution and therefore requires broader precautionary risk reduction across the regulated area.

Comment 7.18: Pending fishery management measures should not be counted in

analyzing risk reduction.

Response: Noted in the ALWTRT recommendations and throughout the development of this rule, other relevant actions that we considered to be reasonably certain to occur within the timeframe evaluated within this rule were treated as such in our analysis of anticipated risk reduction throughout the regulated area. We commit to monitoring the progress of these related actions and reporting our findings to the ALWTRT at future meetings for consideration.

Comment 7.19: Massachusetts did not ban single traps on vessels longer than 29 feet in their rule, so how was that risk reduction re-allocated?

Response: During the development of the Proposed Rule, NMFS discussed this measure with the Massachusetts Department of Marine Fisheries and recognized that it was likely to be positive toward risk reduction. However, we were unable to estimate the impacts on risk. Since we did not assign any quantified risk reduction to that measure in the DEIS, there was no need to re-allocate it.

Comment 7.20: NMFS should adopt Maine's proposed conservation equivalencies.

Response: As discussed in FEIS Section 3.3, NMFS is adopting most of the conservation equivalencies offered by Maine out to 12 nm, and is appreciative of the work done by Maine Department of Marine Resources and the Zone Councils to develop and recommend weak insertion and trawling up requirements in collaboration with Zone Councils that are familiar with capacity and constraints of Zone-specific fishing operations and conditions.

Comment 7.21: Maine should get gear reduction credit if Maine funds tags or development of a GPS tracker.

Response: Technology and tracking in and of themselves do not reduce the risk of fishing gear on large whales. However, if Maine develops a line reduction program and

reporting/tracking technology that demonstrates line reduction, it would be considered toward risk reduction.

Comment 7.22: In LMA 3, NMFS should analyze the difference in risk reduction between a 50 percent reduction in buoy lines and the proposed closure with potential gear displacement.

Response: Several scenarios were analyzed in Georges Basin Restricted Area for the DEIS and FEIS, including a 50 percent reduction in lines through a line cap or through trawling up and a restricted area. The FEIS includes longer trawl lengths in this area compared to the DEIS (50 traps per trawl versus 45 traps per trawl) but still implements broader trawling up measures throughout LMA 3 in order to distribute risk reduction more evenly. The Georges Basin Restricted Area was predicted to increase co-occurrence in the DEIS (See co-occurrence maps in Chapter 5 and Appendix 5.2).

Comment 7.23: How is the Massachusetts Restricted Area credit being added to the risk reduction estimates?

Response: FEIS Section 3.3.5.1 discusses credit assigned to the Massachusetts Restricted Area and provides an assessment of risk reduction with and without application of the value of that area. The Team unanimously supported including credit for the Massachusetts Restricted Area, which was fully implemented in its current configuration in 2015 (79 FR 36585), given recent years' increased use of that area by right whales (*e.g.*, Ganley *et al.* 2019).

Comment 7.24: Were all the proposals evaluated using the same model?

Response: Each individual risk reduction measure and suite of measures were run through the Decision Support Tool (DST) Version 3 to identify the estimated contribution to risk reduction across the Northeast Region as defined by the Northeast Trap/Pot Management Area.

Comment 7.25: The Woods Hole Oceanographic Institute has developed a methodology in collaboration with the fishing industry to attribute risk to gear based on proportion of water column occupied. This information must be considered in this rulemaking.

Response: We anticipate adding this information to the DST in the near future. However, this is less important for the current rulemaking because an endline, assuming it approximates a straight line from the bottom to the surface, occupies all portions of the water column equally and the lobster industry has incorporated sinking groundline so groundlines may be assumed to have negligible presence in the water column. Incorporating proportions of the water column occupied are more critical for complex structures like gillnets or potential aquaculture installations, in which case it is important to model not only the proportion of water column occupied but also which portion of the water column is occupied and the vertical distribution of whales. This will be incorporated into the DST for future analysis of risk posed by different gear types that do not use the entire water column.

Comment 7.26: Some commenters questioned the validity of the threat component of the DST.

Response: The threat model based on the TRT opinion poll is no longer in use. Starting with the CIE review in 2019, the threat model has been based only on the analysis of empirical data on rope breaking strengths, rope samples retrieved from entangled whales, and whale spatial distributions. At this time, the model is unfortunately constrained to rope breaking strength but in two years of polling scientists and stakeholders, nobody has proposed a viable alternative. It is appropriate for the threat model to be equally weighted with line and whale density because entanglement risk only exists when lines are present, whales are present, and the lines pose a risk to whales. If any of these three factors are not present, the risk of entanglement is zero.

Comment 7.27: The DST is critically flawed in its reliance on an estimate of gear threat that significantly overemphasizes the contribution of rope strength to entanglement risk. By failing to account for the uncertainty inherent in the DST, NMFS overestimated the effectiveness of the selected methods for reducing risks to right whales.

Response: There are uncertainties in the DST calculations that we have not fully quantified. However, it is important to distinguish between uncertainty and bias and we have no reason to believe that the inputs and therefore model outputs are particularly biased high or low. Thus, while there is unquantified uncertainty around the risk reduction calculated by the DST, it is equally likely that actual risk reduction is higher than estimated as lower than estimated and no reason to believe that risk reductions are overestimated.

Comment 7.28: NMFS should implement these regulations as soon as possible as any delays come at the expense of right whales.

Response: NMFS recognizes the urgency of the current situation and intends to implement these regulations to provide needed conservation benefits to right whales as soon as possible. We intend to implement new seasonal restricted areas 30 days after the rule is finalized. Massachusetts Restricted Area fishermen have indicated that it takes several trips for them to remove all of their gear, and because of unpredictable winter weather and holidays, they remove and move beginning at least a month in advance of their February 1 closure. The LMA 1 closure will likely result in moved trawls rather than trawls brought to the beach and stored on land so may not require round-trips to the dock. Many fishermen moving gear from the South Island Restricted Area would be expected to remove gear prior to the February 1 closure; one month should provide sufficient time to remove gear. Gear configuration changes including trawling up, weak buoy lines or weak insertion installation, and gear marking, will be delayed for a longer

period of time because these buoy and groundline modifications will take substantial time. The delayed effective date will factor in winter or low effort months when many fishermen have removed gear from the water for maintenance. The actual effective dates will depend on when the Notice of Availability of the FEIS and the final rule are released. Our intention is that all measures will be in place for the next fishing year starting in the spring of 2022.

Comment 7.29: Some components of the rule state prohibitions “to fish with, set, or possess” where other portions leave out “set.” If this was strategic, please clarify how “setting” is separate from the regulatory intent of “to fish with.

Response: This was carryover language from the existing regulations. The word “set” is included within seasonal restricted areas; seasons when gear must be removed unless fishing without buoy lines. During the season that the gear can be fished with gear configuration requirements referenced in the regulations, the word “set” is not included.

Comment 7.30: It is our understanding that any trap, pot, contrivance etc. that is capable of catching a lobster is required to have a valid lobster trap tag affixed to it. This would indicate that any trap which falls into this category is subject to the marking, weak insert, and trawling up requirements of this rule. We would ask for clarification on this assumption from NOAA, which should help to guide discussions in the next ALWTRT process which will be aimed at the additional gear types of gill nets and fish pots.

Response: Any trap/pot within the Northeast Trap/Pot Management Region with a lobster trap tag will be required to comply with the marking, weak insert, weak line, and trawl length requirements.

Comment 7.31: While some of these proposals may end up being effective, this proposal makes very clear that there is insufficient mortality and tracking data on right whales, and many

of the suggested changes will be considerably more detrimental to the fishing industry than beneficial to the whales.

Response: The Decision Support Tool estimates at least a 60 percent reduction in entanglement risk, which is spread across the region to remain resilient to changes in right whale distribution. The population and distribution are frequently monitored via aerial/vessel surveys as well as with acoustic detection, and will be evaluated to ensure the measures are targeting areas where entanglement risk exists. See more about monitoring in response to Comment 9.10.

Comment 7.32: The proposed rule does not consider reduction in effort, particularly for recreational fisheries. PEER urges NOAA to consider the effect of reducing or eliminating recreational fisheries in right whale habitat.

Response: The ALWTRP only regulates Category I and II commercial fixed gear fisheries identified in the Plan. Additional regulation of recreational fisheries is outside the scope of the current rulemaking.

8. Research

Comments on research generally fell into one of three categories: whale distribution, insufficiency of current data, and entanglements. Many of the fishermen commenting said they had either never seen a right whale where they fish, never seen or heard of an entangled right whale in areas where they fish, did not believe that there was any recent evidence of entanglement in their trap/pot lines, and questioned the validity of the scientific models on whale distribution.

Comment 8.1: NMFS has not shown that entanglement in lobster trap/pot gear contributes to low birth rates.

Response: There is a wealth of research that demonstrates that stressors, including

entanglements in fishing gear like traps/pots, have effects on marine mammal health and reproduction. Entanglements in fishing line, such as those used in the lobster trap/pot fishery, is energetically costly for right whales and requires expenditure of a portion of their energy budget that would otherwise be allocated to reproduction (van der Hoop *et al.* 2017a). Entanglements can reduce overall whale health and increase calving intervals (Rolland *et al.* 2016, Moore *et al.* 2021). Entanglements that restrict feeding further impact energetic reserves and ability to feed (van der Hoop *et al.* 2017b). An inability to get enough food is also an important factor in the reproductive health of right whales (Meyer-Gutbrod *et al.* 2015). See FEIS Chapters 5 and 8.

Comment 8.2: Healthy whales don't get entangled in fishing gear; there is something else wrong with them.

Response: Several commenters stated the belief that healthy whales do not get entangled in fishing gear. Entanglement in fishing gear is a global problem that has been documented for many whale and dolphin species. In the Northeast Region, humpback and minke whale entanglements are not uncommon. More than 85 percent of North Atlantic right whales have experienced entanglement in fishing gear, many more than once. A recent assessment of all right whale photos reveals that entanglement scarring injuries have increased, with roughly more than 30 percent of the population having at least minor entanglements each year. Much of the population has been entangled multiple times, and there is a more than 90 percent chance that a healthy female will get entangled between each calving cycle potentially contributing to reduced calving rates. Repeated and chronic entanglement affects whale health and some whales with unrelated compromised health status may be more vulnerable to injury and death. However, there is no evidence that healthy whales are more adept at avoiding entanglement.

Comment 8.3: NMFS should hire mechanical engineers to examine the rope and net

configurations that are causing entanglements to occur.

Response: NMFS conducts extensive analysis of recovered gear from entangled whales using our gear team, which includes former and active fishermen. We also regularly consult with active fishermen who have decades of experience and are well versed in various fishing methods and local practices. The various configurations we have seen over decades of recorded entanglements varies widely, but the basic fact is that rope or net in the water column has the potential to entangle large whales. NMFS also funds bycatch reduction research, and considers research by right whale scientists that include modeling of entanglement configurations. NMFS does not believe that hiring mechanical engineers is necessary.

Comment 8.4: NMFS should develop a plan to monitor all whale entanglements, including observer coverage and satellite monitoring.

Response: NMFS, state, and independent research organizations coordinate monitoring whale entanglements. Monitoring of entangled whales is done through comprehensive survey effort to resight individuals and check for entangling gear or scarring. Satellite position beacons are sometimes attached to gear entangling a whale to facilitate finding the whale for a disentanglement effort. Because whale entanglement incidents are rare relative to fishing effort hours and whales typically carry gear away from incident sites before a vessel returns to the gear, an observer program is not an effective means for large whale entanglement monitoring.

Comment 8.5: How can NMFS justify a seasonal restricted area if there have been no confirmed entanglements in that area in over a decade? No North Atlantic right whales have been entangled in gear attributable to Maine trap/pot gear in at least 15 years, because the whales no longer are in Maine waters.

Response: No gear remains on most right whales that bear entanglement scars. In the

cases where gear does remain, it is rarely collected, and even more rarely has any identifying marks. Between 1980 and 2016, the New England Aquarium analyzed 1,462 right whale entanglement interactions (A. Knowlton pers comm). Only 110 of these incidents had gear still attached, and in only 13 cases could that gear be traced to the original set location. Because we lack information on exactly where interactions occur, we use areas of high co-occurrence of right whales and fishing gear as a proxy for identifying areas of high entanglement potential. The Decision Support Tool also considers the type of gear in determining the risk of a serious entanglement that would cause mortality or serious injury. The seasonal restricted areas identified in the final rule are based on hot spots, areas with high current and historic habitat use by North Atlantic right whales, high fishing gear density and high configuration threat. The population and distribution are monitored via aerial/vessel surveys as well as with acoustic detection, and will be evaluated to ensure the restricted areas are effective. See more about evaluation below in response to Comment 9.10.

Until September 2020, when Maine required gear marking in exempted waters, most Maine lobster fishery buoy lines were unmarked. Therefore, if a buoy line fished by a vessel operating under a Maine permit entangled a right whale, the odds of tracing that rope to a Maine lobster fishery buoy line have been extremely low. The commenters are correct that no rope retrieved from a right whale has been specifically traced to gear set by Maine trap/pot fishermen since the 2000s. However, cases in 2011 and 2012 were identified as U.S. unknown trap/pot gear with red ALWTRP marks, consistent with the marking scheme for Maine fishermen outside of exempted waters during those years. Additionally, a number of anchored minke whales and humpback whales have been identified in Maine gear in the past 15 years. Maine lobster buoy lines entangle and kill whales.

As noted by the commenters, right whale distribution has changed in the past decade, and there may be fewer or less dense aggregations of whales in the Gulf of Maine. Right whales continue to occur in Maine waters; however, and given the endangered status of the population, the high rate of entanglements evidenced by scars on right whales, and the continued mortality and serious injuries above PBR, NMFS must provide protective measures throughout the population's range in U.S. waters.

Comment 8.6: One commenter indicated that the data shows that gillnet and netting gear were the most prevalent gear (other than Canadian snow crab gear) and the Northeast lobster fishery were the least prevalent in right whale entanglements.

Response: As detailed in Chapter 2, while gillnet gear may be identified at rates higher than anticipated given the relative number of buoy lines, there are more cases identified as trap/pot found on right whales than identified gillnet gear and the most prevalent gear seen on right whales is described as unknown rope.

Comment 8.7: The Decision Support Tool relies on coarse data for both line density and whale density, and should not be used. There is no way to model where the whales are and where the gear is with any degree of certainty.

Response: The Decision Support Tool (DST) was and continues to be the best available analytical tool to assess the co-occurring risk of large whale entanglement in commercial fixed gear. The model compiles the best available large whale habitat density modeling by Roberts *et al.* (2016) which incorporates data from nearly every systematic marine mammal survey of the eastern United States. The DST also draws from every available state and Federal fisheries data source to incorporate the best available estimate of the distribution of fixed gear fisheries vertical lines within the Exclusive Economic Zone. We agree that there are uncertainties associated with

this model, and any model, but we are confident in the DST's ability to inform the Team's discussion and recommendations toward a risk reduction goal.

Comment 8.8: NMFS right whale population model overestimates the cumulative mortalities.

Response: The estimates of total mortality are derived from a peer-reviewed methodology designed to estimate the abundance of North Atlantic right whales. The model itself is a version of methodology used for many species of wildlife in which particular statistical characterizations are used to characterize the capture and/or resighting (both alive and dead) histories of individually marked whales to estimate survival rates. These models take into account that individuals are not seen every year, and this particular model allows individuals to have different probability of being "captured" on each capture occasion.

It is true that these models cannot distinguish between true mortality and the appearance of mortality that would come from an individual permanently leaving the survey areas. For that to happen in great abundance would suggest that many whales use the United States and Canadian coasts for enough time to become catalogued and then decide to move elsewhere and never return. There is simply no evidence for that scenario. Indeed, there is abundant evidence that the great mobility and long life of right whales allows them to take modest sojourns to Icelandic and even Norwegian waters and return to the survey areas to be "recaptured" once again.

Very few wildlife populations even approach having all mortality documented by detected carcasses. Despite the vast survey effort directed at right whales, given the large amount of area that right whales travel, right whales and other large whales likely die without their carcasses ever being seen.

Comment 8.9: NMFS should use a longer time series to make any determinations, as well as acoustic and prey data.

Response: The FEIS is a compilation of the best available scientific information including information on documented and projected changes in prey distribution. Acoustic data are increasingly used to identify right whale distribution and are included in the near real-time sightings posted on our website at fisheries.noaa.gov/resource/map/north-atlantic-right-whale-sightings, and passive acoustic monitoring research is available at apps-nefsc.fisheries.noaa.gov/pacm/#/narw. For a complete list of citations, see the list of references included at the end of every FEIS chapter.

Recent population models demonstrate that the right whale population decline began in 2010 and accelerated around 2015 (Pace *et al.* 2021). We cannot wait another decade to respond to that decline.

Comment 8.10: Thousands of commenters who submitted comments as part of a campaign noted that the Proposed Rule relied on outdated population estimates to calculate PBR, and requested that the calculations be updated and a new PBR determined.

Response: The calculations in the DEIS showing how NMFS proposed to achieve that risk reduction relied on the 2018 Stock Assessment report available when the DEIS was drafted, using 2016 population estimates. The FEIS has been updated with the most recent population estimate (Pace *et al.* 2021) and stock assessment data (Hayes *et al.* 2020), including the PBR of 0.8, down from 0.9 in the DEIS. For more, see FEIS Section 2.1.1.

Comment 8.11: NMFS should use peer-reviewed science before implementing any regulations.

Response: NMFS concurs. The FEIS is a compilation of the best available scientific

information. Included in the FEIS are data from the Stock Assessment Reports, which are peer reviewed by the Atlantic Scientific Review Group and subject to review by the public, and results from the Decision Support Tool, which underwent an independent peer review conducted by the Center for Independent Experts.

Comment 8.12: The data used to determine whale distribution is flawed and incomplete, and therefore should not be used to make regulations.

Response: NMFS disagrees with this assessment. The whale distribution data is the best available information. Although more data will help increase the accuracy of analysis results, there is no indication that results to date are incorrect, nor is there evidence that either the data or the analytical approaches taken to date are flawed. The data have been collected with strict adherence to established protocols, and analyses have used accepted peer-reviewed statistical methods.

Comment 8.13: What are the migratory patterns of right whales in LMA 2?

Response: An interactive map of right whale sightings data, including sightings in LMA 2, can be found online at fisheries.noaa.gov/resource/map/north-atlantic-right-whale-sightings.

Comment 8.14: NMFS should do more to gather data on right whale distribution, including increasing aerial, boat-based, and drone surveys.

Response: We agree that more data are needed to refine our understanding of right whale distribution. With available resources, NMFS is maintaining aerial surveys, increasing acoustic surveys and investigating additional tools to document whale distribution and individual identification. NMFS is working to identify the primary factors that correlate with right whale distribution to help identify other areas where right whales are likely to occur to direct future survey efforts.

Comment 8.15: NMFS should develop ways to tag and track right whales.

Response: NMFS agrees that tagging would help us learn more about right whale movements and habitat use. Long-term attachments used in past studies require an invasive approach to implant tag anchors. These efforts were halted on right whales out of concerns regarding potential health impacts. NMFS has supported development of less invasive tags to track (greater than 24 hours) right whales since 2014. First, we began supporting an investigation into using dart-style Low Impact Minimally Percutaneous Electronic Transmitters (LIMPETs) on right whales. Although a few of the tags successfully tracked right whale movements through the mid-Atlantic, most tag attachments were relatively brief. Fortunately, there was no evidence of negative health impacts in any of the whales that were tagged. We also began, and continue to support, the development of blubber-only tags. These are slightly more invasive than the LIMPET tags. The fieldwork component of this study was interrupted by the global pandemic. Still, tag enhancements continue to be supported including investigations into tag materials, tag retention methods, etc. It should be noted that despite several decades of development, many of the technical and logistical challenges of tagging continue to limit the utility of this approach. It is therefore important for NMFS to continue and enhance existing monitoring programs to provide whale location information for a large portion of the population.

Comment 8.16: NMFS should use spotter planes to make fishermen aware of when whales are in their area.

Response: NMFS uses multiple means to track right whales, including aerial surveys and acoustic monitoring systems. Near real-time sighting information can be found on our website at fisheries.noaa.gov/resource/map/north-atlantic-right-whale-sightings.

Comment 8.17: Warming in the Gulf of Maine is causing changes in copepod

distribution, driving whales to Canada, and out of Maine.

Response: NMFS agrees that large whales are susceptible to ecosystem changes caused by climate change and right whale habitat use changes have been documented. Baleen whales will most likely continue to expand or shift their current range in response to prey species but the nature of the impacts varies by species (MacLeod 2009). Right whale habitat shifts in recent years follow their preferred prey farther north as the Gulf of Maine warms (Meyer-Gutbrod *et al.* 2018, Meyer-Gutbrod and Greene 2018, Record *et al.* 2019a, Record *et al.* 2019b). Climate change impacts their preferred prey abundance, which is known to impede reproductive success in this species (Meyer-Gutbrod *et al.* 2015a). Since 2010, there has been a documented change in right whale prey distribution that has shifted right whales into new areas with nascent risk reduction measures, increasing documented anthropogenic mortality (Plourde *et al.* 2019, Record *et al.* 2019). However, data shows that while abundance and duration of stays may have shifted, right whales still occur in waters offshore of Maine and throughout the Gulf of Maine at various times of the year. Past and near real-time right whale sighting information can be accessed online at fisheries.noaa.gov/resource/map/north-atlantic-right-whale-sightings.

Comment 8.18: North Atlantic right whales do not occur in coastal, shallow waters or in LMA 1, and therefore, Maine coastal waters, particularly inside the 3 nm line, should be exempted from these regulations.

Response: Gear marking and weak insertion requirements inside the Maine exempted waters are not included in this rulemaking. These measures are (gear marking) or will (weak insertions) be implemented by Maine DMR. Note, however, that the risk reduction benefits of weak insertions are considered in the FEIS.

Comment 8.19: Massachusetts lobster and Jonah crab trap/pot fishing gear has never

killed a right whale. These regulations will not save whales and will force Massachusetts lobstermen out of business.

Response: No gear remains on most right whales that bear entanglement scars. In the cases where gear does remain, it is rarely collected, and even more rarely has any identifying marks. Between 1980 and 2016, the New England Aquarium analyzed 1,462 right whale entanglement interactions (A. Knowlton pers comm). Only 110 of these incidents had gear still attached, and in only 13 cases could that gear be traced to the original set location. Because we lack information on exactly where interactions occur, we use areas of high co-occurrence of right whales and fishing gear as a proxy for identifying areas of high entanglement potential. For example, the Massachusetts Restricted Area was identified in the 2014 modifications to the ALWTRP based on high co-occurrence given frequent habitat use by North Atlantic right whales and fishing gear density. There are other areas in Massachusetts that have been identified as hotspots where entanglement risk is high for right whales based on predicted whale density and the presence and strength of trap/pot gear (see Chapter 3).

There are cases in 2011 and 2012 where gear was recovered and were identified as U.S. unknown trap/pot gear with red ALWTRP marks, consistent with the marking scheme for Massachusetts fishermen outside of exempted waters during those years. In 2001 and 2016, right whale mortalities or serious injuries in Massachusetts lobster gear were avoided only because they were successfully disentangled. Additionally, a number of anchored minke whales and humpback whales have been identified in Massachusetts gear in the past 15 years, so Massachusetts lobster buoy lines do entangle and kill whales.

Comment 8.20: Whale population data is flawed because right whales are traveling between Iceland and Labrador, and are not dead as the model suggests.

Response: The right whale population model estimates the number of right whales that have disappeared from the population. Given the high percentage of the population seen in most years, those whales are to some extent presumed dead. It is possible that some right whales are not dead, but have emigrated to another area for an extended period. Some individuals have been resighted after an absence of many years. This is unusual, however, and it is unlikely that all the whales considered dead have only emigrated. We currently have few records of right whales seen beyond Newfoundland, and to date the whales photographed in the Eastern Atlantic have all been seen again in U.S. waters. See our response to Comment 8.7 for more detail.

9. Restricted Areas

The vast majority of commenters associated with campaigns, as well as at least 97 unique commenters, support restricted areas as a management tool, with many suggesting that some or all of the closures should be larger and/or longer. A few commenters did not support specific restricted areas, and some did not support restricted areas of any kind. Many commenters supported the idea of dynamic management for restricted areas, such that the areas could be opened if no right whales were documented in the area at the time of a closure or areas could be closed upon the sightings of right whales. Several commenters questioned the risk reduction value for the Massachusetts Bay Restricted Area, which we did continue to include in our risk reduction estimate for the Preferred Alternative, as described in FEIS Section 3.3.4.2

Comment 9.1: Several commenters suggested that restricted areas should apply to gillnet/mobile gear.

Response: The ALWTRT is meeting to develop recommendations to reduce the risk of gillnet and other trap/pot fisheries on right whales and other large whales. Seasonal restricted areas are likely to be among the risk reduction strategies considered by the Team.

Comment 9.2: NMFS should use dynamic closures such as those being used in Canada. Dynamic closures would allow fishermen to keep fishing as long as the whales are not there.

Response: The ALWTRP has used Seasonal Area Management to protect right whales in areas of annual predictable aggregations since the inception of the Plan. The Plan also has employed dynamic management to protect temporary right whale aggregations. Measures implemented through amendments to the Plan in 2002 triggered closures or gear modification requirements for lobster and gillnet fishing within a prescribed distance from sightings of right whale aggregations. Borggaard *et al.* (2017) summarizes the ALWTRP's amendments, including the evolution of the Dynamic Area Management (DAM) program. More than 60 dynamic area management zones were implemented between 2002 and 2009. Borggaard *et al.* notes that the program was administratively burdensome and attracted significant complaints regarding feasibility and effectiveness, ranging from delayed implementation preventing whale protection, to such rapid implementation that fishermen could not safely remove or modify their gear in time for the required effective dates. Given these concerns about the DAM program, the Team modified the Plan to instead apply broad-based extensions of the gear modifications used in DAMs (such as sinking groundline required in most trap trawls through 2009 Plan amendments). Broad-based gear requirements afford protection to whales, and is a measure that is resilient to changes in whale and fishery distribution.

Although it was not effective at preventing mortalities in 2019, Canada's vessel speed and fishery dynamic management program seems to have afforded substantial protection to right whales in the Gulf of St. Lawrence in 2018 and 2020. Canada implements time-area closures with boundaries that vary based on direct observations that respond to annual or seasonal resources distribution changes. To be done well Canada currently implements an intensive and

expensive surveillance program through aerial surveys and acoustic monitoring. Canada also has an agile regulatory implementation authority.

While NMFS and our collaborators may be able to support an intensive surveillance program when resources are available, the U.S. regulatory requirements are not as agile. As discussed above, while DAMs were being implemented, NMFS rulemaking was often unsuccessful at responding rapidly to changing conditions. NMFS rulemakings under the MMPA and ESA are also subject to procedurally complex Federal laws and requirements that Canadian resource management is not subject to, including NEPA, PRA, APA, and EO 12866. These laws include consultation requirements, notice and comment requirements, and environmental and economic analyses of the impacts of Federal rulemaking before final decisions can be made about Federal actions that could have environmental effects. Evaluating the impacts of future actions that have not yet been determined is logistically very challenging. NMFS, other Federal agencies, and many collaborators are continuing to develop models that may be able to project prey and whale distribution into future months that could provide tools to develop predictable triggers for dynamic area management measures.

Comment 9.3: Many commenters voiced concern that NMFS had not adequately accounted for the effort displacement and crowding that will be caused by closures.

Response: In response to these comments, we modified our analysis in the FEIS to consider the impacts that would be caused by vessels relocating gear from the LMA 1 Restricted Area to offshore waters of Maine Lobster Zones C, D, and E. The analysis in FEIS Section 6.3 estimates the landing reduction for all vessels outside 12 nm in Maine Lobster Zones C, D, and E by using data from the Maine DMR harvester reports, which are only available for 10 percent of Maine lobster fishermen, and from 100 percent of the dealer reports.

Comment 9.4: How will the restricted areas affect mobile gear fishermen?

Response: Restricted areas may result in opening up of fishing habitat that mobile gear vessels have not been able to access due to the presence of lobster trawls, although the benefits may be marginal.

Mobile gear fishermen have expressed concerns about conflicts with ropeless gear trawls that may be fished under EFPs and that could increase gear conflicts if trawlers do not know the gear is on the bottom. The final rule changes existing and new seasonal restricted areas from fishing closures to buoy line closures. This would allow the use of gear fished without buoy lines (commonly referred to as “ropeless” gear). Fishermen who obtain EFPs to fish without buoy lines could pose some gear conflict threat to mobile gear fishermen. Ropeless experimentation with the proper authorization can be done anywhere, however access to areas otherwise closed to lobster fishing could incentivize fishermen to conduct ropeless fishing within the seasonal restricted areas.

Ropeless experimentation in the lobster and black sea bass trap/pot fisheries is occurring already. In the northeast, NMFS and ropeless fishing collaborators are working with groundfish and scallop bottom trawl fishermen to assess bottom marking technology being developed to allow mariners to detect lobster. Concerns that this experimentation will occur broadly in the near term appear to be unfounded. Due to the cost of ropeless technology, for the foreseeable future we believe that ropeless experimentation will be limited to collaborators accessing the NMFS ropeless gear cache, with perhaps an additional 10 percent of trawls being fished with other ropeless units. The NMFS gear cache also loans technology to collaborating mobile gear fishermen. For the next few years, we anticipate that the largest number of trap/pot trawls that could be supported by these efforts would approach about 330 pot/trap trawls coastwide (Maine

through Florida). Additionally, we anticipate that EFP conditions will require participants to work with adjacent trawl fisheries, as well as other notice requirements that will prevent gear conflicts and support enforcement efforts. Collaboration across gear sectors, use of the NMFS ropeless gear cache, and reporting and monitoring conditions under exempted fishing permits should keep costs and gear conflicts to a minimum while ropeless technology is evaluated for potential use as an alternative to fishery closures.

Comment 9.5: Many commenters were concerned that restricted areas would create “walls” of dense gear right outside the borders, posing a greater risk to right whales.

Response: We have modified our analysis in the FEIS to consider gear displacement in response to the restricted areas. These analyses resulted in changes in the South Island Restricted Area selected for final rulemaking, and was one of the reasons that a seasonal buoy line closure was not selected for the Georges Basin Restricted Area in the preferred alternative. Updated calculations on the gear displacement effects of restricted areas suggested the alternative restricted areas displaced gear to areas of equal or higher co-occurrence, although “walls” of gear were not projected. The borders of the restricted areas are not uniformly productive lobster habitat. Fishermen are more likely to redistribute their gear to fishing ground that is productive. Please see Chapters 3, 5, and 6 of the FEIS for more details.

Until recently, NMFS had no evidence that existing closures created “walls” of gear. In April 2021, however, concentrations of gear were observed in a small open area east of the state of Massachusetts extended spring closure area and west of the Massachusetts Restricted Area (MRA). This appears to be an unintended consequence of the state extension of the MRA in state waters to the northern state boundary. Although this patch of Massachusetts Bay is not a productive fishing ground during this season, fishery managers believe that fishermen permitted

to fish in both state and Federal waters did not remove their gear in response to the closure, but instead moved gear out of the state waters and into this small open band of water while waiting for the MRA to open up May 1 (Bob Glenn, Massachusetts DMF, pers comm April 26, 2021). federally permitted fishermen may also have been staging their gear, taking it out over multiple trips and days until the MRA opened. NMFS will consider future rulemaking to extend the northern boundary of the MRA across to the coast to close that gap and prevent an annual development of this high-risk dense gear storage area. The unconstricted nature of waters surrounding other seasonal restricted areas are not expected to similarly aggregate gear.

Comment 9.6: NMFS should add a restricted area north of Georges Bank and/or expand the Georges Bank restricted area. Georges Basin has a right whale hot-spot analysis five times greater than LMA 1.

Response: The final rule does not implement a restricted area in Georges Basin, but instead includes additional reduction of lines in this area (50 traps per trawl within the restricted area). The previous analyses suggest that it is difficult to restrict fishing in this hotspot without pushing effort to areas that increase risk outside of the hotspot based on predicted whale density (see co-occurrence maps in Chapter 5 and Appendix 5.2 the DEIS). Broad line reduction, however, achieves line and associated risk reduction without incidentally increasing co-occurrence of gear with right whales within this area.

Comment 9.7: The Pew Charitable Trusts' online message campaign of more than 47,000 submissions requested that NMFS implement a year-round closure South of the Islands, and seasonal closures in three areas in the Gulf of Maine: Downeast summer closure from August 1-October 31, a western Gulf of Maine spring closure from May 1 to July 31, and an offshore migration closure from October 1 to April 30.

Response: NMFS analyzed the Gulf of Maine closures proposed by The Pew Charitable Trusts along with the year-round closure proposed in southern New England. Some of the areas identified were predicted to move gear into areas of equal or greater risk. One area south of Cape Cod is similar to the seasonal restricted area implemented in this rule, although the area they proposed was larger in size and duration. The risk reduction estimate for the configurations and seasons proposed by Pew would achieve an estimated 12 percent risk reduction according to Decision Support Tool Version 3, using the updated right whale habitat density model (2010-2018).

However, to implement these measures, NMFS would have to set aside the current rulemaking conducted under the ALWTRT, and divert staff working on final rule and FEIS to prepare a new rule and NEPA analyses, not a small undertaking. The final rule, which is estimated to achieve approximately 67 percent risk reduction, is the NMFS priority. See FEIS Section 3.4 for a further discussion of the petition and other alternatives that were considered but rejected.

Comment 9.8: Many commenters wanted to know how NMFS will evaluate and modify restricted areas based on changes to whale distribution, and how often those evaluations will take place.

Response: NMFS anticipates annual meetings of the Team to review the North Atlantic right whale and other large whale distribution and abundance data, mortality and serious injury updates, retrieved entanglement gear analyses, fishing effort data, and other relevant research results. These data will be incorporated into the next iterations of the Decision Support Tool. The Team will consider modifications to seasonal restricted areas on an annual basis, and the team will continue to make recommendations to amend the Plan. Following the recommendations of

the NMFS Expert Working Group, which reviewed the right whale surveillance and monitoring programs (Oleson *et al.* 2020), the NEFSC anticipates a three-year surveillance and review cycle, providing an additional opportunity to review right whale distribution data to evaluate seasonal restricted areas and other conservation measures contained within the ALWTRP.

Comment 9.9: Restricted areas should be based on the best available science, which includes recent and historical sightings, acoustic data, and prey data.

Response: As described in FEIS Section 5.1, the seasonal restricted areas that are being implemented through the final rule are based on the best available information, including recent and historical right whale and other large whale sightings data, acoustic monitoring data, and data on prey distribution. The FEIS includes analysis based on updated data that has become available since we drafted the DEIS.

Comment 9.10: Dynamic triggers for closures would not be feasible, and NMFS should remove that from consideration in the final rule.

Response: NMFS agrees that real time data are not available to develop an effective trigger for restricted areas. To reduce risk to right whales, the LMA 1 area will be implemented as a closure to lobster/Jonah crab fishing with buoy lines from October through January each year.

Comment 9.11: Commenters suggested that LMA 1 was designated a “hotspot” for right whales based on old data, and should be analyzed using data after the ecosystem shift that began in 2010. As a result of old data, the analysis in the proposed LMA 1 closed area appears to be disproportionately high in risk reduction value compared to the Massachusetts Restricted Area, given the relatively low abundance of right whales in that area and the high abundance in Cape Cod Bay.

Response: In the DEIS, we evaluated whale data from 2003 to 2017 (Whale model 8, DST Version 2). The proposed LMA 1 Seasonal Restricted Area was estimated to have the same risk reduction value of the MRA. However, when the Duke whale model was updated to include only whale distribution since 2010 (Whale model 11, DST Version 3), while the spatial distribution off Maine generally didn't change, the relative abundance of right whales did. Using the newer data, the LMA 1 restricted area contributes less risk reduction benefit (approximately 6.6 percent) than was considered in the DEIS when considered across all of the Northeast Lobster Trap/Pot Management Area. However, the value of the LMA 1 Seasonal Restricted Area remains an important piece of the risk reduction for Maine permitted fishermen. See FEIS Sections 3.1.2.5.1 and 5.3.1.1.2 for more information regarding the selection and analysis of the LMA 1 restricted area.

The LMA 1 Seasonal Restricted Area was created to supplement the risk reduction contribution of the Maine lobster fishery to the overall 60-80 percent risk reduction for the Northeast Trap/Pot Management Area, following the ALWTRT's recommendation in April 2019 to spread risk reduction across jurisdictions. The original recommendation approved by the Maine caucus achieved that level of risk reduction primarily through a 50 percent line reduction. However, after the ALWTRT meeting, the Maine DMR and the Maine Lobstermen's Association members on the Team withdrew their support for such extensive line reduction measures. Maine DMR developed alternatives and used an alternative risk reduction calculation to demonstrate their belief that their alternative, which included broad use of weak insertions and some trawling up to reduce vertical buoy line numbers, achieved a 60 percent risk reduction. NMFS' analysis of the Maine risk reduction measures for the DEIS estimated that the Maine DMR revisions were insufficient to achieve 60 percent risk reduction for Maine-permitted

fishermen in LMA 1. In discussions regarding preliminary analyses with Maine DMR prior to their submission of alternatives, NMFS suggested a closure along the LMA1 Restricted Area border with LMA 3 to improve the risk reduction calculation for that area during winter months when right whales have been demonstrated to aggregate in offshore waters.

Comment 9.12: NMFS erred in conducting hot-spot analysis by Lobster Management Area rather than the region as a whole, and as a result, fails to provide evidence that the LMA 1 Restricted Area is supported by the data.

Response: We disagree. As analyzed in FEIS Section 5.1, and in comment 9.11 above, the LMA 1 Restricted Area provides significant risk reduction for right whales. This area was identified as part of a Northeast Trap/Pot Management Area fishery-wide hotspot analysis. See FEIS Section 3.1.2.4 for further details.

Comment 9.13: Several commenters suggested that LMA 1 should be closed in the spring rather than fall, both to alleviate lost profits and to protect calves.

Response: In evaluating the risk reduction provided by the restricted areas, we relied on the peer-reviewed DST. The DST does not indicate substantial risk reduction from restricted areas implemented in the spring or summer months. The DST indicates that October through January demonstrate the most effective risk reduction to right whales. See FEIS Section 5.1 for more information. Estimated right whale habitat density and co-occurrence is included in the table below.

Table 5. LMA 1 Monthly Right Whale Density and Co-Occurrence with Buoy Lines

Month	Right whale habitat density	Right Whale Co-Occurrence
January	6.31	23.50
February	1.37	3.87
March	0.12	0.33
April	0.16	0.43

May	0.98	1.74
June	0.85	1.26
July	0.44	0.66
August	0.17	0.37
September	0.35	0.74
October	4.50	11.00
November	8.75	24.42
December	5.37	15.99

Comment 9.14: NMFS should allow ropeless fishing in LMA 1.

Response: The LMA 1 Seasonal Restricted Area would be a buoy line closure rather than a fishery closure. Fishermen with an EFP for fishing without the use of persistent buoy lines would be able to fish within the seasonal restricted area from October to January.

Comment 9.15: NMFS should reconfigure the LMA1 restricted area so that it would be narrower and run the entire length of the Area 1 line, and should also be at least the same size—if not larger—on the Area 3 side of that line, too. This would spread the burden of the closure, and would benefit the whales according to the co-occurrence model. It would also reduce crowding at the area borders, and the accompanying gear conflicts and losses.

Response: This is a novel idea that could have been assessed if it had been received during scoping. Because this proposed seasonal restricted area was not analyzed in the DEIS, we are unable to implement it through final rulemaking at this time. The ALWTRT could consider this as an amendment during future discussions.

Comment 9.16: A number of commenters suggested that the LMA 1 restricted area was not supported by the acoustic data, either because acoustic gliders were not deployed at the right time of year, or because the acoustic data showed that only 27 percent of the right whale detections were inside LMA 1.

Response: The right whale habitat model (Duke Model Version 11) that the LMA 1 Restricted Area was based on projects a higher density of whales in this area throughout October to January. Like some commenters, given the lack of recent systematic surveys in this area, we were concerned that whales might not be using this area after they shifted distributions in the last decade. The glider data validated that right whales are still in LMA 1 during the season predicted by the Duke Whale Habitat Model (Version 11).

The commenter notes that only 27 percent of reported positions from deployed acoustic gliders were inside the LMA 1 Seasonal Restricted Area and season. The glider data supports the Duke whale habitat model (Version 11), which estimates higher whale densities on the LMA 3 side of the LMA boundary than the LMA 1 side. The glider data does, however, validate that whales are still in this area seasonally. Gear density on the LMA 3 side is much lower than on the LMA 1 side. We initially assessed a restricted area that included both sides of the boundary, but determined that there was minimal benefit from the LMA 3 side. LMA 3 vessels are adopting trawling up and weak line measures that provide greater risk reduction, so the restricted area does not include the LMA 3 side of the boundary.

During the comment period, we received information that we had underestimated the number of vessels that would be affected by the LMA 1 Restricted Area. In our revised analysis, we considered that in conjunction with the fact that there are only about 75 LMA 3-permitted vessels. LMA 3 vessels have higher rates of vessel trip reporting, which contributes to our estimates of gear distribution. However, because we also received anecdotal reports of higher gear densities on the LMA 3 side than our data indicate, we are investigating whether LMA 1 permitted vessels are inaccurately reporting location, or whether we are underestimating gear density and entanglement threat on the LMA 3 side.

We have modified our analysis of the value of the LMA 1 Seasonal Restricted Area in the FEIS. See Chapters 3 and 5.

Comment 9.17: NMFS should add restricted areas in LMA 3, as a huge majority of the boats there already fish 45 pot trawls or longer, and the proposed regulations will have little effect on reducing the risk posed by fishing in LMA 3.

Response: Alternative 3 analyzed restricted areas in offshore waters of LMA 3. The final rule does not implement restricted areas in LMA 3, and instead requires a combination of trawling up and weak rope requirements. Some areas originally considered for seasonal closures to buoy lines in LMA 3 were difficult to create without just shifting the risk (see co-occurrence maps in Chapter 5 of the FEIS). Broad line reduction and weak rope requirements achieved associated risk reduction without incidentally increasing co-occurrence with right whales within this area. Contrary to the comment, the average baseline gear configuration according to the line model in the DST is 35 traps per trawl, so requiring a minimum of 45 traps per trawl is predicted to reduce lines in this area. The new preferred alternative offers a conservation equivalency that would result in an average of 44 traps on a trawl, but with longer trawl lengths occurring in areas of high whale density, thus offering slightly greater risk reduction for LMA 3.

Comment 9.18: The Massachusetts Bay Restricted Area should be expanded.

Response: The final rule would expand the restricted area to include state waters to the Massachusetts/New Hampshire line, mirroring the regulations implemented by Massachusetts Division of Marine Fisheries in the Code of Massachusetts Regulations, Title 322 Section 12.

Comment 9.19: We ask NMFS to expand its proposed trigger of three right whales to extend the Massachusetts Bay Restricted Area to include a cow/calf as a trigger, in addition to three right whales.

Response: The final rule does not include a dynamic opening mechanism or trigger for the Massachusetts Bay Restricted Area.

Comment 9.20: Seasonal restricted areas should be re-evaluated as a management measure once the commercial fishery transitions to ropeless fishing systems.

Response: We anticipate that the ALWTRT will consider the appropriateness of existing and new seasonal management areas at meetings annually within the context of the best available information on large whale distribution, abundance, mortality, birth rates, and population metrics. Should ropeless fishing develop as an operationally feasible alternative to closures, that will also be evaluated.

Comment 9.21: What is the risk reduction value to other large whale species of the South Island restricted area?

Response: The South Island Restricted Area was designed to reduce co-occurrence and associated risk of entanglement to right whales and is not a hot spot for other species. For the FEIS, new analyses conducted by the NMFS Decision Support Tool team evaluated the amount of humpback and fin whale co-occurrence reduction in the expanded South Island Restricted Area. These analyses found that, though these species may occur within this area and indirectly benefit from a reduction in buoy lines, this buoy line closure does not measurably reduce co-occurrence and the associated overall entanglement risk for humpback whales or fin whales within the Northeast Trap/Pot Management Region.

Comment 9.22: NMFS should establish a larger restricted area south of Nantucket, which has become recognized as an important winter habitat for right whales.

Response: The final rule implements the larger South Island Restricted Area, which had been analyzed in Alternative 3 (Non-preferred) in the DEIS. See FEIS Chapter 3 for the South

Island Restricted Area selected for implementation.

Comment 9.23: The South Island Restricted Area should be closed year-round, as NMFS has confirmed that the area south of the islands is a year-round habitat for the species.

Response: The monthly risk scores within the South Island Restricted Area are shown in the table below. The risk within this specific area is estimated to be very low between June and November. A year-round closure is not supported by this data. The closure is being implemented when the risk level and predicted whale density are the highest.

Table 6. South Island Restricted Area Monthly Risk Scores

Month	Default Risk	Right Whale Habitat Density
1	4.12	83.85
2	3.54	87.82
3	3.25	92.54
4	3.68	104.14
5	1.32	47.87
6	0.19	4.54
7	0.03	0.61
8	0.02	0.5
9	0.03	0.67
10	0.08	1.4
11	0.38	8.4
12	1.95	45.39

Comment 9.24: Because right whales use the South Island area year-round, NMFS should require only one buoy line between May and October to reduce risk of entanglement in this heavy offshore gear.

Response: The use of one buoy line on long trawls in areas of high mobile gear fishing effort would likely increase gear conflicts until technology becomes available that allows surface detection of bottom gear. Work on this challenge is currently being conducted to support the development of ropeless fishing methods, including a collaboration with mobile gear fishermen

to assess bottom gear marking technology. These efforts could make this possible for future consideration as a risk reduction measure.

Comment 9.25: NMFS has drastically underestimated the amount of fishermen actively fishing in the LMA 1 restricted area, and thus the effects of the restricted area on fishermen. If there are only 45 fishermen in the LMA 1 restricted area, the risk reduction value of the closure should be much lower, since that would mean there aren't many buoy lines in that area.

Response: Based on the comments we received from Maine fishermen saying that we had underestimated the number of fishermen in LMA 1, we have modified our economic analysis of the impacts of the LMA 1 seasonal restricted area. Fishermen fishing in the fishing zones that are bisected by the LMA 1 restricted area are not all required to submit vessel trip reports, making a precise count of affected vessels difficult. Based on fishermen's input, the evaluation, which can be found in FEIS Section 6.3, now assumes that up to 50 percent of the vessels that fish outside of 12 nm in Maine Zones C, D, and E, up to 60 vessels, may have landings from the restricted area. The other half of the vessels may be crowded by the vessels that move from the restricted area into the waters 12 nm offshore of Maine Zones C, D, and E, reducing their catch rates. As a result, our estimate of vessels that may be affected by the LMA 1 Restricted Area has been increased to 120 in the FEIS. See FEIS Section 6.3

Estimated buoy line numbers are only one component of the risk estimated for the LMA 1 Seasonal Restricted Area. Three factors are considered: whale density, gear density, and threat of the configuration of gear used in an area. Those were sufficient to identify this area as a hotspot, as described further in FEIS Section 3.1.2.4.

Comment 9.26: If NMFS closes an area during the summer, the available fishing window would be cut by 40 to 50 percent.

Response: There are no summer restricted areas in this final rule. For analysis of the restricted areas being implemented in this final rule, see FEIS Section 1.4.3.

Comment 9.27: NMFS should require that fishing vessels operate at less than 10 knots under EFPs in restricted areas, regardless of their vessel length.

Response: Vessel speed restrictions are likely to be included as a condition of EFPs for activities in seasonally restricted areas. Evidence suggests that 10 knot speed restrictions within areas of large whale occurrence have successfully mitigated vessel strikes (Laist *et al.* 2014). Fishing vessels actively fishing either operate at relatively slow speeds, drift, or remain idle when setting, soaking and hauling gear. Listed species in the path of a fishing vessel would be more likely to have time to move away before being struck. However, fishing vessels transiting to and from port or between fishing areas can travel at greater speeds and could strike a right whale or other vulnerable species. A 10-knot transit requirement for fishing vessels authorized to harvest lobster from seasonally restricted areas is merited as these areas are seasonally important to right whales.

Comment 9.28: Closures in offshore areas would also minimize the impact on fishermen, because the majority of lobster fishing occurs closer to shore.

Response: For an explanation for how seasonal restricted areas were selected, see FEIS Section 3.1.2.4 and for a description of the number vessels impacted and the economic impacts by seasonal restricted areas considered in the preferred and non-preferred alternatives, see FEIS Section 6.3.

10. Ropeless Technology

We received thousands of comments, including the majority of campaign comments, on ropeless fishing, with the vast majority of non-fishermen supporting an immediate transition to

ropeless gear throughout the northeast lobster and Jonah crab trap/pot fishery, and the majority of fishermen opposing ropeless fishing on the grounds that it is expensive, unproven, and impractical for a variety of reasons. While ropeless technology is not required in the final rule, fishermen who wish to try ropeless fishing may apply for an EFP, and will be able to fish in the restricted areas to test the technology.

Comment 10.1: NMFS should promote the permitting process and make sure that all fishermen are aware of and have the opportunity to participate in EFP trials of ropeless gear.

Response: An EFP is a permit issued by NMFS' Greater Atlantic Regional Fisheries Office. EFPs authorize a vessel to conduct fishing activities that would otherwise be prohibited under the regulations at 50 CFR part 648 or part 697. Generally, EFPs are issued for activities in support of fisheries-related research, including landing undersized fish or fish in excess of a possession limit for research purposes, seafood product development and/or market research, compensation fishing, the collection of fish for public display, or in this case, testing various aspects of ropeless gear. Anyone that intends to engage in an activity that would be prohibited under these regulations (with the exception of scientific research on a scientific research vessel, and exempted educational activities) is required to obtain an EFP prior to commencing the activity. While NMFS believes that ropeless gear should be widely tested by vessels under varying operating conditions, researchers submitting the EFP requests will be responsible for soliciting and securing participants.

Comment 10.2: Many fishermen had questions and concerns about the feasibility of ropeless fishing. Fishermen were concerned about whether ropeless technology could work in areas subject to different tides, on different bottoms, and in different weather conditions. Others raised concerns about conflicts with bottom-tending mobile gear, conflicts with other ropeless

traps/pot gear, a reported 80 percent retrieval rate, an increase in lost gear, which leads to ghost gear, and the need for a marking system. Still others were concerned that ropeless technology is not ready to be implemented, and would take too long to implement. Concerns about repairs, enforcement, expense, and safety hazards were also raised.

Response: We acknowledge that considering broad scale deployment of ropeless fishing requires additional planning and research to overcome obstacles to implementation. This would include many of the potential issues identified within these comments. However, technologies are developing to enable fishermen to increase the rate of successful retrieval of ropeless gear and to minimize gear conflicts and increase enforceability over time. NMFS has invested a substantial amount of funding in the industry's development of ropeless fishing gear. We anticipate that these efforts to facilitate and support the industry's development of ropeless gear will continue, pending appropriations, including cooperative research and field trials, economic analyses and cost projection, and policy implementation, among the many factors that require consideration and further study.

Comment 10.3: NMFS should offer buybacks or subsidies for fishermen unable to transition to ropeless gear.

Response: Section 312(b) of the MSA establishes the mechanism for NMFS to conduct a buyback or fishing capacity reduction program. It requires funding appropriations from Congress and a determination that the program is necessary to prevent or end overfishing, rebuild stocks of fish, or achieve measurable or significant improvements in the conservation and management of the fishery.

Comment 10.4: NMFS did not analyze the costs or effects of conflicts between ropeless gear and bottom-tending mobile gear, or the effects of ropeless-only fishing areas on mobile gear

fisheries, some of which significantly overlap with prime scallop grounds.

Response: NMFS agrees that this would be useful information to analyze but was unable to provide a specific cost estimate in the FEIS. We have modified our discussion of the effects of gear conflicts associated with ropeless gear. See FEIS Section 3.3.3.

Comment 10.5: NMFS needs to invest in the technology to make it viable, which should include working with manufacturers to develop virtual gear marking systems and to tailor the devices to the needs of fishermen in different areas.

Response: NMFS has invested a substantial amount of funding in the collaborative development of ropeless fishing gear. Virtual gear marking systems are being tested by mobile and fixed gear fishermen and we anticipated that these efforts will continue, pending appropriations.

Comment 10.6: Ropeless gear regulations will be difficult to impossible to enforce.

Response: Currently ropeless fishing is conducted under EFPs or state authorizations to exempt fishermen from the fishery management regulations that require the use of buoy lines to notify mariners of the presence of fixed fishing gear. Conditions of authorization include notification of effort, monitoring and reporting. If a permittee does not abide by the terms of the permit, the permittee will be subject to enforcement action. As data is collected throughout the EFP process for ropeless gear, law enforcement has the opportunity to review that data. Lessons learned from ropeless testing will be incorporated into an enforcement strategy in the event that ropeless technology is authorized for use in the fishery.

Comment 10.7: For ropeless fishing to work, we will need a new trap allocation system. There are too many traps in the water for ropeless to work.

Response: We recognize that feasibility in terms of both affordability and effective

avoidance of gear conflicts will be most challenging in areas of dense fishing effort. A number of studies have demonstrated that effort reduction could be done without substantial economic impacts, see for example, Myers and Moore (2020) and Acheson (2013). Commenters including fishermen have suggested that a reduction in traps would provide fast and effective risk reduction. Less rope might ameliorate the need for further measures in some areas, and would reduce the cost of any future broadscale implementation of ropeless fishing.

Comment 10.8: NMFS received several comments on space-sharing to address potential gear conflicts associated with ropeless gear. One commenter suggested that NMFS should not require trap fishermen and mobile gear fishermen to undertake space-sharing negotiations themselves. The other commenter suggested the use of seasonal areas for different gear types.

Response: If broad adoption of ropeless fishing methods is considered and area management is deemed essential for success in preventing gear conflicts, NMFS anticipates that engagement and collaboration with the fishery management councils and commissions would be required to successfully design and implement any area-based management following fishery management public processes. This is well beyond the scope of what is being implemented by this rule.

Comment 10.9: NMFS should fast-track and simplify permitting to make ropeless fishing an easier option for fishermen.

Response: The provisions within this rule expand fishermen's options and provide incentives to fish with ropeless gear in an area otherwise restricted under the ALWTRP. The NMFS Greater Atlantic Region Fisheries Office is considering conducting an Environmental Assessment (EA) identifying and analyzing ropeless fishing under EFPs, including measures to minimize environmental impacts. The EA would facilitate development of EFP requests and

reduce the need of the applicant for separate environmental analysis, expediting the EFP process substantially. The Northeast Fisheries Science Center has developed a “gear library” for collaborating fishermen to access ropeless gear and virtual gear marking technology. We expect to continue to learn about the feasibility of ropeless gear on a broader scale as more fishermen take advantage of the opportunity to try ropeless. If operational challenges including surface markings are overcome, NMFS would work with the Council to determine if fishery management regulations could be modified to not require buoy lines, allowing ropeless fishing without an EFP.

Comment 10.10: NMFS should develop a comprehensive roadmap for fishermen to permanently transition to ropeless gear so that they can continue to fish without endangering right whales. Relying on EFPs is not a long-term solution.

Response: NMFS is currently developing a “Roadmap to Ropeless Fishing” comprehensive plan to document the agency’s approach to researching and testing ropeless gear. This plan will also include economic analyses and potential policy pathways of ropeless fishing, along with identifying partners and establishing short and long-term goals for ropeless research and development

Comment 10.11: For ropeless to work, there needs to be a single universal platform for all devices, so that all fishermen may see other’s gear and locate their own.

Response: Ropeless gear and the technologies enabling it have evolved rapidly in recent years. If ropeless fishing continues to develop, other technologies platforms such as those to view the location of set ropeless gear and to prevent gear conflicts and facilitate law enforcement, will need to develop concurrently.

Comment 10.12: NMFS should establish additional ropeless restricted offshore areas, and

require the offshore fishery to transition to ropeless gear within three years.

Response: We will continue to evaluate the latest population abundance, mortality and serious injury, and PBR estimates calculated for large whales to inform the risk reduction targets that we provide to the ALWTRT. As we work to reduce lethal entanglement risk as required by the MMPA, we will continue to convene the Team to analyze the latest data and to make recommendations to us as to how best to fulfill these goals.

Comment 10.13: Due to the high incidence of right whales in Cape Cod Bay from February to May, we recommend that NMFS not permit testing of ropeless fishing systems during these times.

Response: We recognize that in some areas at some times, like Cape Cod Bay in late winter/early spring, any additional risk to right whales (increased vessel traffic, etc.) may be unacceptable. These risks may be evaluated and avoided or mitigated on an individual basis as applicants seek EFPs for ropeless experimentation within ALWTRP restricted areas.

Comment 10.14 There is no way to implement ropeless in the gray zone, where Canadians are also setting their gear.

Response: The rule does not require ropeless fishing in the gray zone or anywhere else.

Comment 10.15 Ropeless fishing will still put thousands of end lines in the water column, but without tension on them, posing a greater risk for all marine mammals and boaters.

Response: Ropeless fishing as it is currently being tested would only result in buoy lines in the water column when a fishing vessel is on site to retrieve the trawl. While we agree that operationalization of a ropeless fishery will require much more planning and evaluation in the future, ropeless vertical lines would spend a significantly lower proportion of time in the water column than a traditional fixed vertical line with a surface buoy. This would significantly lower

exposure to marine mammals and therefore significantly lower entanglement risk.

Comment 10.16: NMFS erred in asserting that ropeless gear should be considered “neutral risk” as sinking groundline may still pose a risk to large whales. While ropeless gear is not expected to be widely used in the immediate future, technology may advance to make it more feasible, and so NMFS should re-evaluate the risk posed by the gear.

Response: To date, evidence of sinking groundline in large whale entanglements is limited, though we continue to investigate as the scarce data and opportunities allow. The discussion in the FEIS was modified per comments about possible addition of risk in areas where none currently occurs in existing closed areas. The qualitative discussion of risk including anticipated conditions while ropeless fishing is developed is summarized in the FEIS Section 5.3.1.1.2.1.2.

11. *Stressors on Right Whales*

Dozens of commenters suggested a variety of factors that may be contributing to right whale decline, with many fishermen pointing to other known and possible causes of mortality. These commenters stated or suggested that this regulation will not contribute to the recovery of right whales due to issues beyond the scope of this rulemaking. Among the issues raised are climate change, disease, pollution, inbreeding/small population size, previous entanglements, sonar, noise, oil spills, plastic pollution, shark predation on calves, vessel strikes, and offshore wind. The final rule and analyses in the FEIS are related to amendments to the Plan. The Plan and the take reduction process are restricted to monitoring and mitigating incidental mortality and serious injury of marine mammals incidental to particular U.S. commercial fisheries. The majority of these issues are outside the scope of this regulation, and many are beyond the authority of the NMFS but given the frequency with which these issues were introduced, we

have provided some answers below.

Comment 11.1: Climate change/global warming is primarily to blame for the decline of right whales, and it has nothing to do with fishermen.

Response: The effects of climate change may have led to a shift in the distribution of right whales sometime between 2010 to 2013. This distribution shift increasingly brought right whales into areas of greater risk from human activities, including fishing. Entanglement in fishing gear is one of the primary causes of serious injury and mortality in right whales. See FEIS Section 1.1 for an overview.

Comment 11.2: Since the right whales have found their food sources in the Gulf of St. Lawrence, they are thriving again and this rulemaking is unnecessary.

Response: NMFS disagrees. Since the population started regularly using the Gulf of St. Lawrence, the population has declined by 23 percent overall, and roughly 200 right whales have died, many of them outside the Gulf of St. Lawrence. Threats to right whales are spread across their range in U.S. and Canadian waters.

The need to amend the ALWTRP is driven by the average reported mortality and serious injury to right whales due to fishery entanglement compared to PBR is 0.8 per year and, unfortunately, fishery entanglement-related mortality and serious injury is 5.55 whales per year (Hayes *et al.* 2020). Since fishery entanglement-induced mortality and serious injury exceeds PBR, this rule is necessary.

Comment 11.3: NMFS should consider the effects of disease and increased pollution on right whales.

Response: NMFS agrees. In NMFS' Species in the Spotlight North Atlantic right whale five-year action plan, one of the five priorities identified for the next five years to halt the decline

of this species is to “Investigate North Atlantic Right Whale Population Abundance, Status, Distribution and Health.” NMFS also convened a 2019 Health Assessment Workshop to help evaluate current health information data, including associated data gaps, and identified appropriate available and needed tools and techniques for collecting standardized health data that can be used to understand health effects of environmental and human impacts, and inform fecundity and survivorship models to ultimately guide right whale recovery (Fauquier *et al.* 2020). The Species in the Spotlight North Atlantic right whale five-year action plan is available online at www.fisheries.noaa.gov/resource/document/species-spotlight-priority-actions-2021-2025-north-atlantic-right-whale. Please see Chapter 8 of the FEIS, which has a summary of Cumulative Effects.

Comment 11.4: Right whales are suffering from inbreeding, and will never be able to have a viable population again, so there is no point to these regulations.

Response: Small population sizes may carry some greater risk of inbreeding as a potential limiting factor to recovery, however, there is evidence that natural populations have mechanisms to reduce the loss of genetic diversity (Frasier *et al.* 2013). Additionally, the North Atlantic right whale population has continued to produce healthy whales despite the relative low level of genetic variability when compared to other large whales, a condition that has apparently been sustained since the 16th century (McLeod *et al.* 2009). Numerous mammalian species have recovered from much smaller population sizes than the North Atlantic Right whale population, including Northern Elephant seals and gray seals in New England. Many of the great whale populations were decimated by the end of commercial whaling and most have recovered. Despite being reduced to about 260 right whales alive in 1990, North Atlantic right whales were genetically sound enough to recover, albeit slowly due to persistent human impacts, until

peaking at 481 individuals in 2010. After 2010, the change in habitat use that involved more regular excursion into areas where management protections were not in place. This resulted in increased human-caused mortality and additional stresses, including both environmental food limitations and increased non-lethal entanglement. Together these stressors are likely contributing to documented reduced calving rates. While inbreeding could play a negative role here, there is little evidence to support that theory. After accounting for human-caused mortality, the 1990-2010 calving rates and population growth rates were well within normal cetacean population demographic rate. The changes in those rates since 2010 may be driven by increased anthropogenic mortality and climate change.

Comment 11.5: After vessel strikes, industrial sonar and ocean noise are the greatest threats to right whales. Has there been any research on the effects of Naval use of sonar in training, and the effects of ocean noise generally, on the increase or decrease in entanglements?

Response: We are not aware of any studies evaluating the correlation between ocean noise and rates of entanglement in fishing gear. However, given that right whales are not detecting fishing gear acoustically, it would seem highly unlikely that ocean noise levels would directly affect or have any relationship to entanglement rates. Furthermore, while increases in ocean noise is of concern for the communication ability for right whales and many other species, these effects are generally “sub-lethal,” whereas entanglement in fishing gear can lead directly to serious injury and mortality.

Comment 11.6: Did the 2010 BP Deepwater Horizon oil spill in the Gulf of Mexico or a change in food source affect right whale birth rates?

Response: NMFS is not aware of any studies, data, or evidence that suggest right whales have been affected by the BP Deepwater Horizon oil spill. For information on factors that may

affect birth rates, see Chapter 8 of the FEIS, which has a summary of Cumulative Effects.

Comment 11.7: NMFS should consider the environmental impact of the consumption of additional plastic products this rule will require.

Response: This rule is not likely to change the need for ropes or weak links made from plastic material. The final rule may temporarily increase the production of new inserts, which may have plastic components, but ultimately would decrease with the reduction of gear in the water. Please see Chapter 5 and for a description of indirect effects, the likelihood of ghost gear, and frequency of gear replacement, as well as Chapter 8 for our Cumulative Effects Analysis.

Comment 11.8: NMFS should consider the role of seismic testing in right whale population declines.

Response: Seismic survey operators for oil and gas exploration require permits from the Bureau of Ocean Energy Management (BOEM). As part of issuing these permits, BOEM consults with NMFS under Section 7 of the ESA to ensure the proposed action (*i.e.*, the seismic surveys) does not jeopardize the continued existence of any ESA listed species, including North Atlantic right whales. Through this process, NMFS fully evaluates the potential impacts of seismic testing on the right whales (*e.g.*, Biological Opinion on the Bureau of Ocean Energy Management's Issuance of Five Oil and Gas Permits for Geological and Geophysical Seismic Surveys off the Atlantic Coast of the United States, and the NMFS' Issuance of Associated Incidental Harassment Authorizations at <https://repository.library.noaa.gov/view/noaa/19552>). Seismic surveys for other purposes such as those conducted by the National Science Foundation or the United States Geological Survey for research purposes also require the same type of consideration under Section 7 of the ESA (*e.g.*, Biological Opinion on a National Science Foundation-funded seismic survey by the Scripps Institution of Oceanography in the South

Atlantic Ocean, and Issuance of an Incidental Harassment Authorization pursuant to section 101(a)(5)(D) of the Marine Mammal Protection Act by the Permits and Conservation Division, National Marine Fisheries Service at <https://repository.library.noaa.gov/view/noaa/22585>). Finally, any take of marine mammals that is likely to occur as a result of these seismic surveys requires authorization under the MMPA (*e.g.*, Incidental Take Authorization: Oil and Gas Industry Geophysical Survey Activity in the Atlantic Ocean at <https://www.fisheries.noaa.gov/action/incidental-take-authorization-oil-and-gas-industry-geophysical-survey-activity-atlantic>), and as part of this authorization, NMFS also analyzes impacts to marine mammal population stocks, including right whales.

Under both the MMPA and ESA, in authorizing take of marine mammals including right whales, NMFS requires mitigation and monitoring as well as terms and conditions to monitor and reduce the impacts from such take. However, it is important to note that there is no concrete evidence that seismic surveys are likely to have any population level effects on large baleen whales such as right whales. Furthermore, the impacts of seismic surveys on the vital rates (*e.g.*, survival, reproduction, growth) of individual baleen whales are not well understood, but current evidence does not support that they cause serious injury, mortality, or lower reproduction. Finally, at present, and in the recent past, there is very little seismic survey activity in the U.S. Atlantic Ocean other than infrequent surveys conducted for scientific research purposes that typically use lower source level (*i.e.*, quieter) airguns as compared to the louder oil and gas exploration surveys such as those in the Gulf of Mexico.

In summary, NMFS does evaluate impacts from seismic surveys on right whales and while there have been and currently are few surveys being conducted, through the MMPA and ESA ensures that such surveys are not furthering the decline of the population.

Comment 11.9: Many commenters voiced their concern that recent right whale mortalities and serious injuries were due to vessel strikes, and suggested that vessels should be a higher priority for NMFS than reducing entanglements in fishing gear. Several commenters pointed out that more right whale calves were born this year, a year in which the cruise ship industry was largely shut down due to the global pandemic, than in any recent years. Others raised concerns about mortalities and serious injuries caused by Naval, whale watch and shipping industry vessels. Many commenters favored expediting updated regulations on vessel speeds, including in shipping lanes.

Response: Right whales are particularly vulnerable to vessel strikes due to their use of coastal habitats and frequent occurrence at near surface depths. Furthermore, they are vulnerable to strikes by nearly all types and sizes of vessels operating within the whales' range. In 2008 (73 FR 60173, October 10, 2008), NMFS implemented regulations requiring most vessels equal to or greater than 65 feet in length to transit at speeds of 10 knots or less in designated Seasonal Management Areas (SMAs) along the U.S. East Coast. Concurrently, NMFS initiated a voluntary Dynamic Management Area (DMA) speed reduction program to provide additional protection for aggregations of right whales outside of active SMAs. To reduce the spatial/temporal overlap of whales and vessel traffic NMFS established recommended routes for vessels transiting Cape Cod Bay and into/out of ports in northern Florida and Georgia, and modified the shipping lane approaching the port of Boston.

In January 2021, NMFS released an assessment evaluating the conservation value and economic and navigational safety impacts of the speed rule (50 CFR § 224.105). While the assessment is considered final, we sought comments on the report findings through March 26, 2021, as we evaluate the need for future action and modifications to the existing speed

regulations.

The report evaluates four aspects of the right whale vessel speed rule: biological efficacy, mariner compliance, impacts to navigational safety, and economic cost to mariners. It also assesses general trends in vessel traffic characteristics within SMAs over time, provides a detailed assessment of the speed rule's effectiveness and offers recommendations for strengthening the rule based on these findings. In addition to the assessment of the vessel speed rule, the report also evaluates mariner cooperation with the DMA program and investigates small vessel transit patterns through active SMAs

NMFS is evaluating whether further efforts are needed to minimize the spatial overlap of right whales and vessel traffic. Reducing the speed of vessels transiting through right whale habitat remains the most viable option to reduce vessel strikes in U.S. waters. The review and information collected during public comment will be used to consider whether current measures are appropriate given recent shifts in right whale distribution. For more information, please see Chapter 8 of the FEIS, which has a summary of Cumulative Effects.

Comment 11.10: Many fishermen commented that they feared offshore wind energy projects would displace them, and questioned NMFS' role in permitting offshore wind energy projects.

Response: BOEM is the lead Federal agency and primary decision-maker for offshore wind development projects. NOAA works with BOEM and offshore wind developers to provide information and consultation on how offshore wind projects may affect endangered or threatened species, marine mammals, fisheries, marine habitats, and fishing communities. Each proposed project is evaluated individually, with opportunities for public input, which can be found on the BOEM website. NOAA's engagement on offshore wind activities is limited to our authorities

under the NEPA, the ESA, the MMPA, and the MSA. Further information on NOAA's role in offshore wind development can be found on our website at fisheries.noaa.gov/new-england-mid-atlantic/science-data/offshore-wind-energy-development-new-england-mid-atlantic-waters.

12. Trawls

Many of the campaign commenters as well as 38 of the unique commenters supported trawling up as a way to reduce the number of vertical lines in the water, while 52 unique commenters disagreed, saying that trawling up is may instead result in more severe entanglements and more danger to fishermen. Comments from NGOs and members of the public indicated concern about whether heavier trawl lines would increase the severity of entanglements. Fishermen voiced concerns about the specifics of trawling up requirements in particular areas. Several fishermen supported the option of splitting buoy lines, and having only one line on a trawl. Some fishermen were concerned that trawling up would have an impact on landings.

Comment 12.1: A 50 percent vertical buoy line reduction mandate would harm smaller vessels and lead to consolidation of the fishery.

Response: A 50 percent vertical line reduction is a measure in the non-preferred alternative, and is not be implemented under this final rule. See FEIS Chapter 2 for more details.

Comment 12.2: Trawling up is expensive, and will put some fishermen out of business.

Response: The final rule provides conservation equivalencies to provide more flexibility to fishermen. We expect these options to help fishermen choose the options that minimize their economic impacts. We understood from Maine DMR that the trawling up configurations developed through collaborations with Zone Councils were selected because fishermen could do them with minimal investment in time or new gear relative.

Comment 12.3: What will the effects of trawling up be on landings?

Response: The effects will depend on several factors, including the increase in the number of traps per trawl. For vessels trawling up fewer than 2 traps per set, we would expect to see a reduction rate of 0-5 percent on landings. For vessels trawling up 2 or more traps per set, we expect the landing reduction rate to be 5-10 percent. See FEIS Chapter 6 for more details including a summary of the limited previous investigations into the impacts of trawling up on catch rates.

Comment 12.4: NMFS should allow different trawls lengths depending on vessel sizes, vessel configurations (open/closed transom or equipment placement), distance from shore, and fishing depth. Several specific requests were submitted, such as four traps per trawl measure in New Hampshire waters, one buoy line along the northern edge of Georges Bank, and triples in the “sliver” area.

Response: The final rule establishes varying trawl lengths (traps per trawl), primarily by distance from shore. These are based on measures proposed by the ALWTRT, states, conservation equivalencies requested, and comments received during scoping and rulemaking. Configurations by distance from shore were considered likely to parallel vessel sizes, with smaller vessels operating closer to shore. Trawling up requirements by vessel size or configuration would be difficult to implement, enforce, and evaluate.

Comment 12.5: NMFS should exempt waters from 50 fathoms (91 m) and deeper along the continental slope from trawling up.

Response: The final rule implements a less restrictive trawling up requirement for vessels fishing in waters deeper than the 50 fathom curve south of Georges Bank (35 traps per trawl) than was initially proposed (45 traps/trawl) in response to conservation equivalency requests

from the Atlantic Offshore Lobster Fishermen's Association. There is no information to suggest that right whales and other large whales are not entangled in waters deeper than 50 fathoms therefore an exemption from trawling up requirements without a concurrent line or risk reduction alternative would not provide sufficient risk reduction.

Comment 12.6: NMFS should consider the 3 mile zones around Matinicus and Ragged Islands to be the same as other Maine coastal areas, and regulate them as such.

Response: As noted below in this rule, there is an island buffer for this fishing in waters within 1/4 nautical miles of the following Maine islands are exempt from the minimum number of traps per trawl requirement in paragraph (c)(2)(iv) of this section: Monhegan Island, Matinicus Island Group (Metinic Island, Small Green Island, Large Green Island, Seal Island, Wooden Ball Island, Matinicus Island, Ragged Island), and Isles of Shoals Island Group (Duck Island, Appledore Island, Cedar Island, Smuttynose Island).

Comment 12.6: The problem with using only one buoy line is that other fishermen won't be able to tell where my gear is, more catch-downs, and losing the ability to haul in a certain direction because of the wind.

Response: Area-specific allowances of up to ten traps per trawl with one buoy line was requested by Maine DMR, after discussion with the Zone Councils, as a conservation equivalency that would allow fishermen to fish shorter trawls while still reducing the number of buoy lines. Because this change is restricted to Maine Zones at the request of Zone Councils, it may reflect vessel capacity and current fishing practices. However, as occurs whenever measures are modified, there will be a transition period as fishermen adjust to new measures that the fishing community will likely work out relative to issues of gear placement and safety.

Comment 12.7: Trawling up increases chances of gear conflicts due to longer lines.

Response: The impact of minimum trawl length requirements on gear loss in trap/pot fisheries is difficult to predict with confidence. The uncertainty is largely attributable to the array of underlying factors responsible for gear loss. On the one hand, longer trawls may increase the likelihood that groundline will foul on bottom structure, increasing the potential for line to part while hauling traps. Longer trawls may also increase the potential for gear conflicts, particularly situations in which one fisherman's gear is laid across another's. This could be exacerbated by the Maine conservation equivalencies which will allow fishermen in some Maine Lobster Zones to fish trawls of up to 10 traps with only one buoy line. Overlain gear can cause one party to inadvertently sever another's lines, making it impossible to retrieve all or some of the gear. A longer trawl also increases the consequences of such incidents; *i.e.*, the more gear on a single trawl, the more gear is lost when that trawl is rendered irretrievable.

In other ways, trawling requirements may reduce the potential for gear loss. The fundamental objective of longer trawls is to limit the number of buoy lines in the water column and reduce encounters with large whales; such encounters are one possible source of gear loss. Likewise, a decrease in the number of buoy lines may reduce the frequency with which gear is entangled in vessel propellers or mobile fishing gear. Furthermore, in areas where trawling up requirements necessitate addition of a second buoy line (*e.g.*, for configurations greater than 20 traps or a vessel going from triples to ten-trap trawls), the second buoy line may make it easier to locate and retrieve gear when one buoy line is lost. Longer trawls are also heavier and may be less likely to be swept away during extreme storm or tidal events. For more, see FEIS Section 6.2.6.1.

Comment 12.8: NMFS should not leave it to fishermen to develop agreements between large and small boats to set trawl lengths that would meet an overall goal of line reduction, as

this would be difficult to evaluate and enforce.

Response: Agreed. The final rule does not implement any regulations based on boat length or size.

Comment 12.9: Trawling up leads to longer, heavier lines that pose a greater risk to right whales, causing worse and heavier entanglements.

Response: While we recognize that the trawls will be longer, for many of the configurations, the portion of the trawl hanging in the water column and putting force on the hauling rope is based on water depth and distance between traps rather than wholly on trawl length and the configuration changes may not substantially change that. Many of the configurations adapted were proposed by fishermen during scoping and were proposed because they can be fished using existing rope and do not require a turnover in buoy lines currently being fished. Finally, every buoy line will be fished with weak insertions or weak rope. In a 2016 study, Knowlton *et al.* showed evidence that 1,700 lb weak links within buoy lines or 1,700 lb weak line will allow whales to part the gear and reduce the likelihood of serious injury. Trawling up reduces the chance of an entanglement as fewer buoy lines will be present in the water column. The combination of these two measures will reduce the threat of mortality and serious injury of entanglement for large whales.

Comment 12.10: Many fishermen voiced safety concerns about trawling up, including not having enough room on their vessel for 45 traps, that the increased weight of the vessel could lead to greater danger of capsizing in bad weather, and that longer lines may injure and entangle the crew.

Response: Throughout the development of the final rule, we have taken safety considerations into account in identifying alternatives. Several proposed measures were rejected

in whole or in part due to safety concerns. See Table 3.4. Conservation equivalencies adopted in the final rule better accommodate small scale fishing operations and traditional practices, considers fishing safety concerns, and requires less costly gear modifications.

Comment 12.11: NMFS should require all trap/pot vessels be rigged for trawl nets or aluminum beam trawl type equipment, and cease to allow trap/pot gear with buoy lines.

Response: NMFS does not have the authority under either the ACA or MSA to unilaterally require trawl gear in all fisheries. The ACA directs the Federal government to support the management efforts of the Commission and, to the extent the Federal government seeks to regulate a Commission species, develop regulations that are compatible with the Commission's Interstate Fishery Management Plan and consistent with the MSA's National Standards. The Commission's Interstate Fishery Management Plans for lobster and Jonah crab specifically contemplate the use of trap/pot gear. NMFS would not have the authority to implement a requirement to prohibit trap/pot gear and require trawl gear without such a measure being incorporated into the Interstate Fishery Management Plan and recommended by the Commission. Similarly, the MSA charged regional fishery management councils with developing fishery management plans that meet the requirements of the Act. Under the MSA, the Secretary shall approve, disapprove, or partially approve a plan or management action developed by the Councils. Unless and until the Mid-Atlantic and New England fishery management councils modify gear requirements for their fishery management plans, NMFS is not authorized to take action under the MSA.

Comment 12.12: NMFS should focus on keeping tension in buoy lines and reducing length between surface buoys to 3-4 feet (0.91-1.2 m) to reduce entanglements of all marine mammals.

Response: Documentation from entanglements indicates that buoy lines and unknown lines represent the majority of interactions. Surface system direct interactions are rarely documented.

Current industry practice and the ALWTRP already requires the use of sinking line on the top of buoy lines to reduce floating line at the surface. Under many conditions, fishermen also minimize scope in their buoy lines to prevent the lines from interacting with nearby set gear, although in areas of high tidal range and currents, more scope may be needed.

The final rule reduces the possibility of entanglements by using a combination of closed areas, trawling up (less buoy lines in water column), weak line, weak insertions, and weak contrivances.

13. *Weak Rope/Links/Inserts*

More than 71 of the unique commenters supported the use of some form of weak rope to reduce the severity of right whale entanglements in fishing gear, while thousands of campaign comments and 144 unique commenters noted that weak rope may not reduce entanglement events and may still have detrimental effects on juveniles and calves, as well as cause sublethal effects to adults. Many fishermen are concerned that weak rope will result in gear loss, which will result in economic losses to them and increase the amount of ghost gear, which poses an entanglement risk to right whales.

Comment 13.1: Many commenters had questions or concerns about weak link locations, configurations, and surface systems.

Response: We received dozens of comments questioning the reasons for locations of the weak links/inserts, suggestions for other configurations of weak points, and the effectiveness of weak links/inserts, particularly the 600 lb (272 kg) weak link, in reducing right whale

entanglements. We also received dozens of suggestions for different options for weak links/inserts, including but not limited to, knots, time tension line cutters, loops and tucks, eye splices with sheep bends, and Novabraids. We received several suggestions regarding surface systems, with some commenters suggesting that they be eliminated, others wanting to keep them, and some asking for evidence that they are effective at reducing entanglement.

For reasons specified in FEIS Section 3.3.3, we removed the requirement for lobster and Jonah crab fishermen to connect their buoy to the buoy line using a weak link because the new measures require using weak rope or weak insertions in the buoy line. For our evaluation of surface system weak links, please see FEIS Section 3.3.3.1.

Comment 13.2: Many commenters had questions or concerns about safety and economic loss related to weak inserts, link, or rope. Fishermen were particularly concerned that weak rope and weak inserts may result in injuries to fishermen and economic impacts due to lost gear.

Response: Forces on lines hauling up lobster trawls were measured during commercial operations. Forces greater than 1,700 lb (771.1 kg) breaking strength were required to retrieve gear, particularly for trawls of 35 traps and more in waters greater than 50 fathoms (91.4 m) (Maine DMR 2020). Timed haul data indicated those higher forces were not detected on the line until well past halfway through hauling the buoy line (for example, Figure 7 in Maine proposal, Appendix 3.2). This suggests that under most operational conditions, weak rope or a weak insertion within the top half of a buoy line would not be subjected to forces approaching or greater than 1,700 lb (771.1 kg) during a haul. This is consistent with modeling work conducted by Knowlton *et al.* (2018) who demonstrated that operational changes in fishing practices to minimize speed and the amount of gear in the water column would further minimize rope tensions. In field work conducted by Knowlton *et al.* (2018), gear loss for buoy ropes using

Novabraid sleeves inserted every 40 feet throughout the buoy lines fished in waters from 42 to 310 feet (12.8 to 94.5 m) was not significantly different than gear loss using standard buoy lines. The final rule does not require the configuration studied by Knowlton *et al.* (2018), and while that means that the final configurations do not get the level of risk reduction that would be achieved through their experimental configuration, the measures reduce the likelihood that weak insertions will occur where forces may exceed the breaking strength of the rope. That compromise is intended to minimize safety risks to fishermen and economic impacts of increased gear loss. For more, see FEIS Section 3.3.3.2.

Comment 13.3: Many commenters had questions or concerns about the effects of weak inserts and weak rope on right whales.

Response: Conservationists voiced concerns that weak rope wouldn't reduce the risk of entanglement, and would still cause sublethal effects to adults, and could cause lethal effects to juveniles and calves. There were also suggestions that weak rope will hamper disentanglement teams and could result in more right whale mortalities and serious injuries. Some commenters questioned our analysis of the spacing, particularly concerning why we elected to use weak insertions every 40 feet as equivalent to weak rope.

We evaluated weak line relative to the findings of Knowlton *et al.* (2016), which documented that no ropes retrieved from entangled right whales of all ages had breaking strengths that were below 7.56 kN (1,700 lb). Knowlton *et al.* (2016) suggest that right whales can break free from these weaker ropes before a serious injury occurs. This is consistent with estimates of the force that large whales are capable of applying, based on axial locomotor muscle morphology study conducted by Arthur *et al.* (2015). The authors suggested that the maximum force output for a large right whale is likely sufficient to break line at that breaking strength. That

study and others recognized that a whale's ability to break free from an entanglement is also somewhat dependent on the complexity of the entanglement configuration (van der Hoop *et al.* 2017).

The research available suggests that a full-length weak line provides the maximum precautionary benefit to whales (Knowlton *et al.* 2016, DeCew *et al.* 2017). However, when full weak rope is not readily available or when replacement of an entire buoy line is not feasible, weak links are also effective at reducing breaking strength. To evaluate the risk reduction benefit of weak rope alternatives, we compared the relative risk reduction achieved from a rope with one or two weak inserts at particular buoy line depths to a rope with inserts at regular intervals of 40 feet. We selected 40 foot intervals based on the work of Knowlton *et al.* (2016 and 2018) which was selected because it was within the range of a right whale's girth and length, is within the range of rope length typically removed from entangled whales and was the configuration discussed most directly by the Team when considering weak rope. Spacing of every 40 feet provides the greatest benefit to whales, since entanglements can be very complex, and inserts every 40 feet provide the greatest likelihood that at least one weak point will be present on an entangled whale, allowing it to break the rope. Weak line models suggest that weak points will not necessarily benefit a whale that encounters the rope below the weak point, particularly with a heavy trawl. The lower the lowest weak insertions, the higher the potential for the rope to part (DeCew *et al.* 2017). See Chapter 3 for a more detailed description of the calculations of the proportional risk reduction estimated for inserts that were not at regular intervals, and how we determined the measures included in the final rule.

We agree that there may be added or reduced risk reduction to whales depending on how weak insertions are configured. The greater the number of weak points on a line, the greater the

likelihood that a weak point will be located below where the whale encounters the line, and that there will be a weak insertion outside of the mouth where the whale may have a better chance of breaking free from the entanglement. Configurations that are knot-free may also pose less risk. Gear that is knot-free, and/or free of attachments may be less likely to get caught in baleen if a mouth entanglement occurs, more likely to slide through the whale's baleen without becoming lodged in the mouth or elsewhere, decreasing the risk of serious injury or mortality. However there is evidence that splices and knots introduce weaknesses into buoy lines. Lines undergoing breaking strength testing broke on the smaller or weaker side of a knot or splice (Maine DMR 2020).

We evaluate risk reduction under the assumption that weak rope is not zero risk to whales and that few insertions do not provide the risk reduction benefits of fully weak rope or weak rope with insertions every 40 feet. However, in concert with the other measures in the final rule, NMFS believes that it will achieve the required levels of risk reduction and applies a precautionary measure across the Northeast Region. For more on our analysis, see FEIS Section 3.3.4 and Appendix 3.1.

Comment 13.4: Commenters indicated current buoy weak link requirements should be rescinded. Reasons included: to retain buoy to increase our ability to identify fishery and location of incidents, so buoy drag in concert with weak rope or weak inserts in buoy line can pull parted gear free from whales, to improve visibility to disentanglement teams.

Response: The final rule rescinds buoy weak link requirements for Northeast Region lobster and Jonah crab buoy lines that require weak rope or weak inserts in the buoy line. See Chapter 3 of the FEIS for a discussion of this modification.

Comment 13.5: The weak rope equipment suggested as an alternative in the Proposed

Rule has not been proven to effectively reduce harm to right whales. In fact, many fishermen have stated that they will use more rope if the weak rope requirement is implemented, overall increasing the likelihood of entanglements.

Response: For LMA 1 fishermen, the weak rope/weak insertion measures were proposed by Maine DMR after extensive outreach with Maine fishermen. The insertion locations are informed by research done by Maine DMR measuring at what point the forces on rope when trawls are hauled in exceed 1,700 lb (771.1 kg). Insertion locations were selected for placement in the buoy line above that point. Fishermen indicated a preference for a solution that would not require them to purchase additional rope, suggesting that most fishermen do not anticipate purchasing more rope other than the short lengths needed to create weak insertions, adding only a three to six feet to the amount of buoy line already fished.

See FEIS Section 3.3.42, Knowlton *et al.* (2016) and Arthur *et al.* (2015) for evidence indicating large whales including right whales can break free of rope with breaking strengths below 1700 lb, reducing opportunity for serious injury and mortality.

14. *Outside Scope*

As noted above, we received dozens of comments that were outside the scope of the current rulemaking. The final rule and analyses in the FEIS are related to amendments to the Plan. The Plan and the take reduction process are restricted to the monitoring and management of incidental mortality and serious injury of marine mammals in U.S. commercial fisheries. Because these comments were out of the scope of the final rule and the FEIS, we did not provide responses in this document. A list of the out of scope comments appears below.

1. NMFS or the states should institute a lobster and crab tax or other funding mechanism to make up for the economic deficit caused by the regulations.

2. The Economic Impact Analysis produced by Nathan Associates incorrectly states that the Casco Bay Lines ferry to Long Island has 24 daily runs year round, casting doubt on NMFS' entire economic analysis.

3. We are concerned that the Agency's broad assumptions may unnecessarily alarm industry members and their families.

4. NMFS should monitor the travel routes of whales and enforce all regulations that might impact whales, such as ocean dumping.

5. NMFS and states should work with manufacturers to produce ropes in a single color to match state requirements, which would reduce the difficulty of maintaining marks at the designated increments for fishermen moving to different depths.

6. NMFS should use emergency action to close all high seas transport to allow right whales to recover.

7. NMFS should not issue incidental take permits for right whales under the ESA.

8. Several commenters submitted recommendations on gillnet and other mobile gear configurations, which are not the subject of this rule, but may be considered by the ALWTRT in the future.

9. Expand and strengthen response networks comprising researchers, environmental organizations, industry groups and stakeholders, and government decision-makers to help manage the crisis and start rebuilding the population.

10. The percentage of vertical lines proposed to be reduced (60 percent up to 98 percent) in the Biological Opinion was not derived based on any scientific findings.

11. NMFS should study the effects of the rebounding white shark populations on the survival of right whale calves.

Classification

NMFS issues this final rule to amend the regulations implementing the Atlantic Large Whale Take Reduction Plan (Plan, ALWTRP). This rule revises the management measures for reducing the incidental mortality and serious injury to the North Atlantic right whale (*Eubalaena glacialis*), as well as to humpback (*Megaptera novaeangliae*) and fin whales (*Balaenoptera physalus*) in commercial trap/pot fisheries in the Northeast Trap/Pot Management Area (Northeast Region). The NMFS Assistant Administrator has determined that this rule is consistent with the Plan and the provisions of the MMPA, as well as the goals of the ESA, the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA), and other applicable law.

NMFS prepared an FEIS for this rule. The Notice of Availability published in the **Federal Register** on July 2, 2021 (86 FR 35286). Three alternatives, consisting of a “No Action” or status quo alternative (Alternative 1), one Preferred Alternative (Alternative 2) that is implemented by this rule, and one additional alternative (Alternative 3 or Non-preferred Alternative), were analyzed using the NMFS Decision Support Tool, described in detail in Chapter 5 of the FEIS. The biological impact analysis uses both quantitative (produced by the NMFS Decision Support Tool) and qualitative indicators to compare the regulatory alternatives against the 2017 conditions. Impacts on all large whales are analyzed, but the intention of this rulemaking is a 60 to 80 percent risk reduction for right whales to reduce incidental entanglement mortality and serious injury to below the potential biological removal level of 0.8 mortalities and serious injuries a year. The analyses estimate percent reduction in the number of vertical buoy lines and reduction in co-occurrence between whales and buoy lines as proxies for reduced likelihood of encounter and entanglement. Mean line strength, and change in strength

and associated gear threat of rope in buoy lines that are weakened, are estimated toward reduction of the likelihood of a serious injury or mortality in the event of an entanglement. The biological analysis estimates the risk reduction contributions of the measures that would require Plan modifications, as well as of ongoing risk reduction measures implemented by states and previous or imminent fishery management rules that reduce effort in the lobster fishery. Note that the economic analysis considers only the costs of the measures that would be implemented through the Federal rulemaking to amend the Plan.

The “No Action” alternative (Alternative 1) would result in no changes to the current measures under the Plan. The rate of right whale mortality and serious injuries caused by incidental entanglement in U.S. commercial fisheries would continue to greatly exceed PBR. There would be no additional economic effects on the fishing industry.

Alternative 2, the Preferred Alternative, is implemented in this final rule. It reduces the number of buoy lines fished in the Northeast Region lobster and Jonah trap/pot crab fisheries by increasing the minimum number of traps per trawl based on area fished and miles fished from shore in the Northeast Region. This alternative modifies existing restricted areas from seasonal fishing closures to seasonal closures to fishing with persistent buoy lines, expands the geographic extent of the Massachusetts Restricted Area (MRA) to include Massachusetts state waters north to the New Hampshire border, and establishes two new restricted areas that are seasonally closed to fishing for lobster or Jonah crab with persistent buoy lines. Alternative 2 requires buoy lines to be modified to incorporate rope engineered to break at no more than 1,700 lb (771.1 kg) or weak insertion configurations that break at no more than 1,700 lb (771.1 kg). Finally, the rule requires additional marks on buoy lines to differentiate vertical buoy lines by principal port state, includes unique marks for Federal waters, and expands into areas previously exempt from gear marking.

The Decision Support Tool estimates that Alternative 2 and this rule achieves a 69- to 73-percent risk reduction when the value of the current MRA is included, and a 60-percent risk reduction without the value of the current MRA. This risk reduction is achieved by an estimated seven percent reduction in the number of buoy lines that would be fished in the Northeast Region American lobster and Jonah crab fisheries, a 65-percent reduction in right whale and buoy line co-occurrence (54 percent without including the value of the current MRA), and a weakening of each buoy rope in these fisheries for a nine percent reduction in mean line strength and a 17-percent reduction in gear threat. The first-year costs under Alternative 2 range from \$9.8 million to \$19.2 million, depending on implementation assumptions (*e.g.*, buoy lines relocated versus buoy lines removed in seasonal restricted areas).

Alternative 3, the Non-preferred Alternative, would reduce the number of buoy lines in Federal waters through the implementation of a buoy line cap allocated at 50 percent of the buoy lines fished in 2017. Like Alternative 2, this alternative would modify existing restricted areas (except the Outer Cape Cod LMA, which is closed for lobster management purposes) from seasonal fishing closures to seasonal closures to fishing with persistent buoy lines. Alternative Three would expand the geographic extent of the MRA to include Massachusetts state waters north to the New Hampshire border and extend the MRA closure season to include May, with a soft opening if surveys show that whales have left the area. Three new seasonal restricted areas would be established, including an LMA 1 seasonal restricted area with the same boundaries as in the preferred alternative but with a one month extension, a seasonal restricted area in LMA 3 north of Georges Bank, and a South Island Restricted Area smaller than the one in the Preferred Alternative but extended through May. Finally, Alternative 3 would require a large visible mark on the surface system of each buoy line that would incorporate a tape that identifies the permit

holder's state and fishery.

The Decision Support Tool estimates that Alternative 3 achieves a 72-percent risk reduction. This risk reduction is achieved by an estimated seven percent reduction in the number of buoy lines that would be fished in the Northeast Region American lobster and Jonah crab trap/pot fisheries, a 60-percent reduction in right whale and buoy line co-occurrence, and a weakening of each buoy rope in these fisheries for a 19-percent reduction in mean line strength and a 29-percent reduction in gear threat. The first-year costs under Alternative 3 range from \$32.8 million to \$44.6 million, depending on implementation assumptions (buoy lines relocated vs. buoy lines removed).

On August/September XX, 2021, NMFS issued a Record of Decision identifying the selected alternative. A copy of the Record of Decision is available from NMFS (see **ADDRESSES**).

This rule has been determined significant for the purposes of Executive Order 12866.

The Regulatory Flexibility Act (RFA), 5 U.S.C. 601-612, requires agencies to assess the economic impacts of their proposed regulations on small entities. The objective of the RFA is to consider the impacts of a rulemaking on small entities, and the capacity of those affected by regulations to bear the direct and indirect costs of regulation. We prepared a final regulatory flexibility analysis (FRFA) in support of this action, as required by section 604 of the RFA. The FRFA consists of the initial regulatory flexibility analysis (IRFA), a statement of the need for, and objectives of, the rule; a summary of the significant issues raised by the public comments in response to the IRFA, a statement of the assessment of the agency of such issues, and a statement of any changes made to the rule as a result of such comments; the response of the agency to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration in

response to the proposed rule, if any (none were received), and a detailed statement of any change made to the proposed rule in the final rule as a result of the comments; a description of and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available; a description of the projected reporting, recordkeeping and other compliance requirements of the rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for preparation of the report or record; a description of the steps the agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and why each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected; a description of the steps the agency has taken to minimize any additional cost of credit for small entities, and; the agency shall make copies of the final regulatory flexibility analysis available to members of the public and shall publish in the **Federal Register** such analysis or a summary thereof.

All of the documents that constitute the FRFA and a copy of the EIS/RIR/FRFA are available upon request (see **ADDRESSES**) or via the internet at: *Fisheries.NOAA.gov/ALWTRP*. Information in the sections above (Background, Comments and Responses, and Changes From the Proposed Rule) summarize information found in the FRFA and will not be repeated here. Additional summary information from the FRFA follows.

A Summary of the Significant Issues Raised by the Public in Response to the IRFA, a Summary of the Agency's Assessment of Such Issues, and a Statement of Any Changes Made in the final rule as a Result of Such Comments

After publication of the proposed rule and DEIS, we received over 1,300 unique submissions and many submissions generated by non-governmental organization campaigns including some submissions with multiple signatures representing over 200,000 people. Three hundred and thirty six unique commenters identified themselves as fishermen, either directly or through context, of which 312 voiced opposition to all or part of the rule, 19 commented on particular provisions, but did not expressly support or oppose, and 5 supported the general idea of the rule, though had specific comments on some measures. Of the ten fishing industry groups, eight opposed all or part of the rule, one gave specific recommendations, but did expressly support or oppose, and one supported the general idea of the rule. State and Federal legislators also commented, including some that opposed the rule or some provision of the rule. Fifty four unique commenters that identified themselves as members of the public expressed opposition to the rule. A small number suggested that this rule should be withdrawn because it does not provide adequate levels of protection for right whales, and NMFS should start over. A little over 34 percent of commenters opposed the rule in whole or in part, and about 4 percent suggested that the rule should be withdrawn because it does not provide adequate levels of protection for right whales, and NMFS should start over.

Many commenters were concerned that these regulations would have a negative impact on the personal economics of fishermen, as well as the economies of their communities, their counties, and their state. Many commenters from Maine opposed the LMA 1 Seasonal Restricted Area due to economic impacts on their fishing operations, and recommended that if we did implement a seasonal closure to buoy lines there, we should establish a trigger of some sort, such as sightings of right whales, to close the area. Commenters opposing the rule expressed concerns about the safety of using more traps per trawl for their fishing operations and the safety of using

weak buoy lines, as well as the potential for increased gear conflict and gear loss. Fishermen also wanted clarity and certainty in the regulations, and many wanted assurances that these regulations should be easy to understand, monitor, and enforce.

There was also strong opposition to any suggestion that fishermen would be required to use ropeless technology, although neither the proposed nor final rule would mandate ropeless fishing. Commenters expressed concerns about the lack of detailed economic analysis of the use of ropeless technology and economic impacts on both trap/pot fisheries and mobile gear fisheries that are not currently Category I and II fisheries managed under the Take Reduction Plan. Finally, Maine DMR, Rhode Island Division of Marine Fisheries, Connecticut and New York Marine Fisheries Programs, the Atlantic Offshore Lobstermen's Association, and other commenters requested modifications for the final rule to accommodate conservation equivalencies that would achieve the same risk reduction, but better reflect more localized fishing conditions or practices.

Given the vast amount of industry input into the development of weak insertions, which would not require fishermen to replace buoy lines, and trawling up measures, many gear modifications implemented in this final rule were created to control costs. Additionally, a number of modifications to the rule were made in response to these comments, including:

Rather than increase traps fished between buoy lines (trawling up) in southern New England's Lobster Management Area (LMA) 2, the final rule requires additional weak insertions for vessels fishing throughout LMA 2. Analysis indicates this achieves improved risk reduction. This modification was requested in public comments submitted by Rhode Island fishermen and state managers as safer for Rhode Island vessels;

The final rule implements conservation equivalency measures submitted by the Atlantic

Offshore Lobstermen's Association, recommending three trawling-up restricted areas where 50, 45, or 35 traps per trawl would be required rather than 45 across the Northeast LMA 3 as conservation equivalencies that accommodate smaller vessels that fish south of Georges Bank. Those requirements were adopted in the final rule after analysis confirmed that the measures achieved similar risk reduction;

The Maine Department of Marine Resources requested extensive modifications by Maine Lobster Management Zones based on their outreach to Maine Zone Councils. The changes modified the trawling up and weak insertion requirements. Most of the requested conservation equivalencies out to 12 miles were adopted in this final rule;

The final rule implements a buoy line closure offshore of Maine in LMA 1 from October through January. The proposed rule requested comments on not closing the area, or closing it after a trigger was reached, but no feasible trigger was offered and the closure is necessary to achieve sufficient risk reduction, and;

The final rule removes a requirement for weak links at the buoy. This measure is not needed for buoy lines that now require weak rope or weak insertions.

See chapter 1 section 1.6 of the FEIS for a full discussion of changes made to the final rule based on new information and comments received during the public comment period and see **Comments and Responses** or Chapter 1, Appendix 1.1, and Volume 3 of the FEIS for further details on comments on the DEIS and proposed rule. Those comments were aggregated across themes and our responses are not repeated here. All revisions and clarifications to the proposed rule, as well as the rationale for these revisions, are described in Chapter 1 of the FEIS and are not repeated here.

Description and Estimate of the Number of Small Entities to Which the Rule Would Apply

The RFA requires agencies to assure that decision makers consider disproportionate and/or significant adverse economic impacts of their proposed regulations on small entities. The Regulatory Flexibility Act Analysis determines whether the proposed action would have a significant economic impact on a substantial number of small entities. This section provides an assessment and discussion of the potential economic impacts of the proposed action, as required of the RFA.

Section 3 of the Small Business Act defines affiliation as: Affiliation may arise among two or more persons with an identity of interest. Individuals or firms that have identical or substantially identical business or economic interests (such as family members, individuals or firms with common investments, or firms that are economically dependent through contractual or other relationships) may be treated as one party with such interests aggregated (13 CFR 121.103(f)). These principles of affiliation allow for consideration of shared interest that does not necessarily require common ownership. However, data are not available to ascertain non-ownership interest so we use an affiliated⁶ vessel database created by the Social Sciences Branch (SSB) of the Northeast Fisheries Science Center. There are three major components of this dataset: vessel affiliation information, landing values by species, and vessel permits. All Federal permitted vessels in the Northeast Region from 2017 to 2019 are included in this dataset where affiliation is determined by unique combinations of owners.

The total number of directly regulated entities is based on permits held. Since the final rule would apply only to the lobster and Jonah crab trap/pot businesses⁷ in LMA 1, LMA 2,

⁶ We use terms affiliation, fishing business and entity interchangeably in this section.

⁷ During the time period of our analysis (2017-2019), no specific permit was needed to fish for Jonah crab.

LMA 3, and OCC, only entities that possess one or more of these permits are evaluated. Then for each affiliation, the revenues from all member vessels of the entity are summed into affiliation revenue in each year. On December 29, 2015, the NMFS issued a final rule establishing a small business size standard of \$11 million in annual gross receipts for all businesses primarily engaged in the commercial fishing industry (NAICS 11411) for RFA compliance purposes only. The \$11 million standard became effective on July 1, 2016. Thus, the RFA defines a small business in the lobster fishery as a firm that is independently owned and operated with receipts of less than \$11 million annually. Based on this size standard, the three-year average (2017-2019) affiliation revenue is greater than \$11 million, the fishing business is considered a large entity, otherwise it is a small entity. Then we determine the number of impacted entities by examining the landing values of lobster. If one or more members of the affiliation landed lobster in 2019, this business will be considered an impacted entity in our analysis.

Regulated entities in this rulemaking include both entities with Federal lobster permits and lobster vessels that only fish in state managed waters except for the exempted areas in Maine. Using vessel data from Vertical Line Model developed by the Industrial Economics (see Appendix 5.1 of FEIS for documentation), we identify 1,913 vessels that fished only in state waters outside Maine exempted areas. Due to the lack of owner and landing information of these vessels, we could not provide detailed analysis but have to assume all to be small entities. Using Federal permit data, there are 1,547 distinct entities identified as directly regulated entities in this action, those that held lobster permits in LMA 1, 2, 3, or OCC, or some combination. So all together, 3,460 entities are regulated under this action. Table 1 displays the details of regulated

Beginning on December 12, 2019, only vessels that have a federal American lobster trap or non-trap permit may retain Jonah crabs.

entities holding Federal permits. Of all 1,547 entities, only two of them are large. Within the 1,545 small entities, 262 had no earned revenue from fishing activity even though they had a lobster permit. Because they had no revenue, they would be considered small by default. Among the 1,283 small entities with fishing revenue, 110 entities had no lobster landings. Therefore, 3,086 small entities would be considered as impacted small entities during this rulemaking. The average gross annual revenue for small entities with lobster landings was \$287,000 in 2019, and 91.5 percent of that is from lobsters. For small entities without lobster landings, their annual gross revenue was \$135,000. The average revenue for all small entities was about \$252,000. The revenue of large entities are not reported here for data confidentiality reasons.

Table 7: The number of regulated entities with Federal permitted vessels and their lobster landing value percentage of annual gross revenue in 2019 (in 2020 U.S. \$)

	Large Entity (E)	Lob % Revenue Large E	Average Revenue Large E	Small Entity	Lob% Revenue Small E	Average Revenue Small E	Total Entities
Fishing with Lobster Landing	2	83.9%	N/A	1,173	91.5%	\$287,000	1,175
Fishing Without Lobster Landing	0	0	N/A	110	0	\$135,000	110
No revenue	0	0	N/A	262	0	0	262
Total Entities	2		N/A	1,545		\$252,000	1,547

Notes: 1. The determination of large or small entity is based on three-year average affiliation revenue from 2017 to 2019. Lobster landing percentage is calculated using only 2019 data.

2. Gross annual average revenue for large entities are not reported here due to confidentiality concern

Source: Social Science Branch vessel affiliation data, 2017-2019

Section 212 of the Small Business Regulatory Enforcement Fairness Act of 1996 states

that, for each rule or group of related rules for which an agency is required to prepare a FRFA, the agency shall publish one or more guides to assist small entities in complying with the rule, and shall designate such publications as “small entity compliance guides.” The agency shall explain the actions a small entity is required to take to comply with a rule or group of rules. As part of this rulemaking process, an outreach document that serves as a small entity compliance guide was prepared. Copies of this final rule are available from the Greater Atlantic Regional Fisheries Office (GARFO), and the compliance guide will be sent to all holders of permits for the lobster fishery in the Northeast Region. The compliance guide and this final rule will be posted on the Plan webpage at *Fisheries.NOAA.gov/ALWTRP*.

Description of the Steps the Agency Has Taken to Minimize the Significant Economic Impact on Small Entities Consistent with the Stated Objectives of Applicable Statutes

NMFS determined a 60- to 80-percent risk reduction was necessary to reduce mortality and serious injury in the American lobster and Jonah crab commercial fisheries to below PBR. Where risk reduction benefits were equal and where safety, capacity, economic, or operational constraints were better served, conservation equivalencies requested through public comments on the DEIS and proposed rule to mitigate those concerns were accepted and are included in this final rule. These include conservation equivalencies in Maine LMA 1 waters, LMA 2 and LMA 3 waters. To enable the Maine LMA 1 conservation equivalencies, this rule also modifies regulations implementing the Atlantic Coastal Fisheries Cooperative Management Act at 50 CFR 697.21(b)2), increasing the maximum number of traps on a trawl with a single buoy line from three to ten in some Maine Zones. This would allow vessel operators to trawl up to a 20-trap trawls or to use two 10-trap trawls with one buoy line. Additional changes made to accommodate conservation equivalency measures offered by the Maine Department of Marine Resources and

supported by commenters from the Maine fishing industry, including modifications to the number of traps on a trawl or the number of weak insertions based on Maine fishery zones and distance from shore out to 12 nm (22.2 km). This rule also implements conservation equivalency recommendations submitted by Rhode Island and supported by Rhode Island fishermen, modifying the LMA 2 measures with more expansive weak insert requirements throughout the LMA rather than trawling up requirements that challenged the capacity of some Rhode Island vessels. Additionally, this rule implements some of the conservation equivalency recommendations submitted by the Atlantic Offshore Lobstermen's Association as public comments on the DEIS and Proposed Rule for LMA 3. This rule implements three management areas in LMA 3 with three different trawling up requirements, requiring more traps/trawl in the Georges Basin area where there is more risk to right whales. This increase in number of traps per trawl of Georges Basin was offset by a lower number of traps required within the Northeast Region south of the 50 fathom (91.4 m) depth contour on the south end of Georges Bank.

All these conservation equivalencies were created with input from fishermen from these areas, informed by their knowledge of measures that would best fit their economic, operational or safety needs. For LMA 2 vessels, the weak rope alternative implemented has less impact on catch and landings and therefore could have a lower economic impact compared to the LMA 2 measures analyzed in the IRFA.

This rule also modifies existing seasonal restricted areas that were closed to lobster and Jonah crab trap/pot fishing to allow ropeless fishing with exempted fishing permits (EFP). Under a revised restricted area definition, trap/pot fishermen could fish with trap/pot gear using "ropeless" methods, although an EFP would be required to exempt fishermen from surface marking requirements under other laws. Since 2018, NOAA has invested a substantial amount of

funding in the industry's development of ropeless gear, in specific geographic areas and in general. We anticipate that these efforts to facilitate and support the industry's development of ropeless gear would continue, pending appropriations, and would be essential to defray costs for early adopters.

Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

This final rule contains a collection-of-information requirement subject to review and approval by OMB under the Paperwork Reduction Act (PRA), specifically the marking of fishing gear. This rule changes the existing requirements for the collection of information 0648-0364 by modifying gear marking for all buoy lines with the exemption of those fishing in Maine exempted waters in the Northeast Region Trap/Pot Management Area. As described in this preamble, mark colors will be changed for vessels identifying principal ports from Maine through Rhode Island to state-specific marks. Under the new marking scheme, a large 3-foot (91-cm) mark would be required within the top 2 fathoms (60.96 cm) of the buoy in state and Federal waters. Within state waters, at least two additional 12-inch (30.5-cm) marks would be required in the top and bottom of the main buoy line. In Federal waters, at least three 12-inch (30.5-cm) marks would be required at the top, middle, and bottom of the main buoy line. In Federal waters, an additional 12-inch (30.5 cm) green mark is required within 6 inches (15.25 cm) of each state specific mark (at least four in total, including the large mark in the surface system and at least three marks in the main buoy line). Each color mark must be permanently affixed on or along the line, and each color mark must be clearly visible when the gear is hauled or removed from the water. Paint and tape will be required for the surface system marks, and the commonly used

colored ties and twine can be used within the main buoy lines. The changes from current gear marking include: The state color, the addition of a surface system mark, one less mark required in the main buoy line in state waters, and four additional marks required to distinguish Federal waters. While Maine fishermen in non-exempt state waters have already marked their gear under Maine regulations, we include the costs of that effort in our calculation in response to comments that noted that the Maine regulations were implemented in anticipation of this rule. Additionally, we had previously assumed that about 20 percent of the gear marks were reapplied each year, but new information suggests they are applied annually. Using these assumptions, the public reporting burden for the Northeast Region lobster and Jonah crab gear marking requirements are estimated to affect 3,970 vessels that need to remark an average of 389 marks each year. Each mark takes between approximately 6.7 and 8.6 minutes to apply, depending on the size of the mark and method used. Applying the annual hourly wage rate for fishermen of \$26.5 results in a total estimated annual wage burden cost of \$4.5 to 5.9 million dollars.

We invite the general public and other Federal agencies to comment on proposed and continuing information collections, which helps us assess the impact of our information collection requirements and minimize the public's reporting burden. Written comments and recommendations for this information collection should be submitted at the following website www.reginfo.gov/public/do/PRAMain. Find this particular information collection by using the search function and entering either the title of the collection or the OMB Control Number 0648-0364.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently

valid OMB Control Number.

Consistency with Coastal Zone Management Act

NMFS has determined that this action is consistent to the maximum extent practicable with the approved coastal management programs of the U.S. Atlantic coastal states affected by the action. This determination was submitted for review by the responsible state agencies under section 307 of the Coastal Zone Management Act. New Hampshire and Rhode Island agreed with NMFS' determination. Maine and Massachusetts did not respond; therefore, consistency is inferred.

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List of Subjects

50 CFR Part 229

Administrative practice and procedure, Confidential business information, Endangered Species, Fisheries, Marine mammals, Reporting and recordkeeping requirements.

50 CFR Part 697

Fisheries, Fishing.

Dated: August 30, 2021

Samuel D. Rauch, III,

Deputy Assistant Administrator for Regulatory Programs,

National Marine Fisheries Service.

For the reasons set out in the preamble, 50 CFR parts 229 and 697 are amended as follows:

PART 229--AUTHORIZATION FOR COMMERCIAL FISHERIES UNDER THE MARINE MAMMAL PROTECTION ACT OF 1972

1. The authority citation for 50 CFR part 229 continues to read as follows:

Authority: 16 U.S.C. 1361 *et seq.*; § 229.32(f) also issued under 16 U.S.C. 1531 *et seq.*

2. In § 229.2, add definitions for “Lobster Management Area,” “Greater Atlantic Regional Administrator” and “Surface system” in alphabetical order to read as follows:

§ 229.2 Definitions.

* * * * *

Lobster Management Area as used in this part means the management areas defined in the American Lobster Fishery regulations found at § 697.18 of this title.

* * * * *

Greater Atlantic Regional Administrator as used in this part, means the Regional Administrator for the regional fisheries office of the National Oceanic and Atmospheric Administration for the large marine ecosystem from Maine to Cape Hatteras, North Carolina directed from the Regional Office in Gloucester, Massachusetts.

* * * * *

Surface system, with reference to trap/pot and fixed gillnet gear, includes the components at the sea surface to identify the presence of stationary bottom fishing gear, and includes buoys, radar reflectors, and high flyers.

* * * * *

3. Revise § 229.32 to read as follows:

§ 229.32 Atlantic large whale take reduction plan regulations.

(a) *Purpose and scope--(1) Whales and fixed gear fisheries.* The purpose of this section is to implement the Atlantic Large Whale Take Reduction Plan to reduce incidental mortality and serious injury of fin, humpback, and right whales in specific Category I and Category II commercial fisheries from Maine through Florida. Specific Category I and II commercial fisheries within the scope of the Plan are identified and updated in the annual List of Fisheries. The measures identified in the Atlantic Large Whale Take Reduction Plan are also intended to benefit minke whales, which are not designated as a strategic stock, but are known to be taken incidentally in gillnet and trap/pot fisheries. The gear types affected by this plan include gillnets

(e.g., anchored, drift, and shark) and traps/pots. The Assistant Administrator may revise the requirements set forth in this section in accordance with paragraph (i) of this section;

(2) *Regulated waters*--(i) *U.S. Atlantic waters*. The regulations in this section apply to all U.S. waters in the Atlantic except for the areas exempted in paragraph (a)(3) of this section;

(ii) *Northeast Region*. The Northeast Region referred to in paragraphs (b)(1) (b)(2)(i), (b)(3), and (c)(2)(iv) applies to ocean waters within an area bounded on the west by land or by a rhumb line from 41°18.2' N. lat., 71°51.5' W. long. (Watch Hill Point, RI) and on the south by the 40°00' N. lat. line running east to the EEZ line, and bounded on the east by the EEZ north to the U.S./Canada border except for the areas and specific purposes exempted in paragraph (a)(3) of this section; and

(iii) *Six-mile line*. The six-mile line referred to in paragraph (c)(2)(iv) of this section is a line connecting the following points (Machias Seal to Provincetown):

Table 1 to paragraph (a)(2)(iii)

44°31.98' N. lat., 67°9.72' W. long (Machias Seal)
44°3.42' N. lat., 68°10.26' W. long (Mount Desert Island)
43°40.98' N. lat., 68°48.84' W. long (Matinicus)
43°39.24' N. lat., 69°18.54' W. long (Monhegan)
43°29.4' N. lat., 70°5.88' W. long (Casco Bay)
42°55.38' N. lat., 70°28.68' W. long (Isle of Shoals)
42°49.53' N. lat., 70°32.84' W. long
42°46.74' N. lat., 70°27.70' W. long
42°44.18' N. lat., 70°24.91' W. long
42°41.61' N. lat., 70°23.84' W. long

42°38.18' N. lat., 70°24.06' W. long
42°35.39' N. lat., 70°25.77' W. long
42°32.61' N. lat., 70°27.91' W. long
42°30.00' N. lat., 70°30.60' W. long
42°17.19' N. lat., 70°34.80' W. long
42°12.48' N. lat., 70°32.20' W. long
42°12.27' N. lat., 70°25.98' W. long
42°11.62' N. lat., 70°16.78' W. long
42°12.27' N. lat., 70°10.14' W. long
42°12.05' N. lat., 70°54.26' W. long
42°11.20' N. lat., 70°17.86' W. long
42°09.55' N. lat., 69°58.80' W. long (Provincetown)

(iv) *Maine pocket waters*. The pocket waters referred to in paragraph (c)(2)(iv) of this section are defined as follows:

Table 2 to paragraph (a)(2)(iv)

West of Monhegan Island in the area north of the line 43°42.17' N. lat., 69°34.27' W. long and 43°42.25' N. lat., 69°19.3' W. long
East of Monhegan Island in the area located north of the line 43°44' N. lat., 69°15.08' W. long and 43°48.17' N. lat., 69°8.02' W. long
South of Vinalhaven Island in the area located west of the line 43°52.31' N. lat., 68°40' W. long and 43°58.12' N. lat., 68°32.95' W. long
South of Bois Bubert Island in the area located northwest of the line 44°19.27' N. lat., 67°49.5' W. long and 44°23.67' N. lat., 67°40.5' W. long

(v) *Maine Lobster Management Zones*: The Maine Zones referred to in paragraph (c)(2)(iv) of this section include waters seaward of the Maine Exempted Waters referred to in paragraph (a)(3)(ii)(A) of this section as managed in eight Zones defined by Maine DMR. The Zones are bounded northeast by the U.S./Canada EEZ International Boundary Line, offshore by the Lobster Management Area (LMA) boundary where LMA 1 meets the border of LMA 3 (LMA 1/LMA 3 boundary), and to the west by a boundary proceeding offshore from the Maine/New Hampshire state line. Individual Zone boundaries are defined as follows:

Table 3 to paragraph (a)(2)(v)

Maine Lobster Management Zone	Description
A - East	The eastern and offshore boundary of Zone A East follows the International Boundary Line between Canada and the United States (Maine) extending to and following the Exclusive Economic Zone boundary to approximately 44°8' N. lat., 67°18.00' W. long. The western boundary runs from that point due north along the 67°18.00' W. long. Line to Cross Island, Maine.
A- West	The eastern boundary of Zone A West is the western boundary of Zone A East. The western boundary of Zone A West follows: a line running from the Southern tip of Schoodic Point at 44°19.90' N. lat., and 68°03.61' W.long. and running south southeast to the LMA1/LMA3 border at 43°45.43' N. lat. and 67°50.12' W. long. The offshore boundary is the LMA1/LMA3 boundary.
B	The eastern boundary of Zone B is the western boundary of Zone A West. The western boundary follows a line that starts at the southernmost end of Newbury Neck following a straight line connecting the points as follows: 44°13.7' N. lat, 68°27.8 W long. (a point ¼ mile due east of Pond Island), then to the easternmost point of Black Island then to the navigation buoy R "8" at the western entrance of York Narrows then south to Swans Island Head then continuing along the southwestern shore of Swans Island to West Point then following the western boundary of the Swans Island

	Lobster Conservation Area southerly to a point at 44° 01.9' N. lat, 68°28.6' W. long, then SSE to 43°32.66' N. lat., 68°17.28' W. long. where it intersects the LMA1/LMA3 boundary. The offshore boundary is the LMA1/LMA3 boundary.
C	The eastern boundary of Zone C is the western boundary of Zone B. The western boundary runs along a line connecting the points as follows: 44°18.72' N. lat., 68°49.61' W. long. (Head of the Cape, Cape Rosier), SSW to 44°10.49' N. lat., 68°55.57' W. long., SW to 44°06.14' N. lat., 69°00.00' W. long., S to 44°04.51' N. lat., 69°00.01' W. long., SSE to 44° 00.79' N. lat., 68°59.48' W. long., SSE to 43°58.01' N. lat., 68°58.02' W. long., WSW to 43°57.82' N. lat., 68° 58.69' W. long., SSW to 43°56.86' N. lat., 68°58.85' W. long., SE to 43°55.30' N. lat., 68°55.00' W. long., WSW to 43°54.27' N. lat., 68°58.33' W. long., S to 43°51.00' N. lat., 68°58.31' W. long., W to 43°51.00' N. lat., 69°00.11' W. long., SSE to 43°46.57' N. lat., 68°59.30' W. long., SW to 43°44.88' N. lat., 69°01.97' W. long., SE to 43°35.08' N. lat., 68° 50.08' W. long., S to 43°19.63' N. lat., 68° 44.255' W. long. where it intersects the LMA1/LMA3 boundary. The offshore boundary is the LMA1/LMA3 boundary.
D	The eastern boundary of Zone D runs along the points as follows: 44° 18.72' N, 068° 49.61' W (Head of the Cape, Cape Rosier), SSW to 44° 10.492' N, 068° 55.574' W, SW to 44° 06.136' N, 069° 00.000' W, S to 44° 04.506' N, 069° 00.014' W, SSE to 44° 00.788' N, 068° 59.475' W, SSE to 43° 58.011' N, 068° 58.023' W, ENE to 43° 58.194' N, 068° 57.381' W, SSE to

	43° 57.309' N, 068° 57.226' W, SE to 43° 55.688' N, 068° 53.662' W, WSW to 43° 55.285' N, 068° 55.000' W, WSW to 43° 54.265' N, 068° 58.330' W, S to 43° 50.997' N, 068° 58.313' W, W to 43° 51.001' N, 069° 00.107' W, SSE to 43° 46.565' N, 068° 59.298' W, NE to 43° 47.452' N, 068° 57.853' W, SE to 43° 44.669' N, 068° 54.350' W, S to 43°19.63' N. lat., 68° 44.255' W. long. where it intersects the LMA1/LMA3 boundary. The western boundary of Zone D starts at the southern tip of Pemaquid Point, SSW and follows a line connecting the points as follows: 43°48.1' N. lat, 69°30'W. long., S to 43°39.0' N. lat, 69°30.0' W. long., S to 43°02.57' N. lat, 69°16.43' W. long., to where it intersects the LMA1/LMA3 boundary. The offshore boundary is the LMA1/LMA3 boundary.
E	The eastern boundary of Zone E is the western boundary of Zone C. The western boundary of Zone E begins at Newbury Point in Small Point Harbor, Phippsburg and follows a line connecting the points as follows: SSW to N"2", SSE to "2BH", S to 43°38.73' N. lat., 69°49.95' W. long., along the 3 mile line to 43°38.87' N. lat., 69°48.82' W. long, S. to 42°53.51' N.lat., 69° 32.18' W. long., where it intersects the LMA1/LMA3 boundary. The offshore boundary is the LMA1/LMA3 boundary.
F	The eastern boundary of Zone F is the western boundary of Zone E. The western boundary of Zone F runs in a straight line from the active lighthouse at Two Lights Cape Elizabeth and follows a line connecting the points as follows: 43°31.80' N. lat. 70°08.56' W. long. near the C "1" East Hue & Cry buoy, WSW to 43°29.28' N. lat, 70°11.77' W.long., S to 42°36.22' N. lat. 69°52.66' W. long, where it intersects the southeastern apex of Zone G. From this point, Zone F boundary follows a straight line southeast to 42° 29.85' N -69° 40.08' W where it meets the LMA1/LMA3 boundary.

	The offshore boundary is the LMA1/LMA3 boundary.
G	The eastern boundary of Zone G is as follows:. 43° 41.550' N, 070° 14.650' W, SSE 159° Magnetic to 43° 32.875' N, 070° 05.920' W, SSE to 42° 31.50' N, -69° 43.34' W where it meets with the southwestern boundary of Zone F The western boundary of Zone G is the seaward extension of the Maine - NH border and follows a line connecting the points as follows: 43°02.62' N. lat. 70°42.1' W. long., to 42°58.92' N. lat., 70°37.65' W. long., to 42°58.75' N. lat., 70°36.72' W. long., to where it intersects with the western Zone F boundary.

(3) *Exempted waters*--(i) *COLREGS demarcation line*. The regulations in this section do not apply to waters landward of the 72 COLREGS demarcation lines (International Regulations for Preventing Collisions at Sea, 1972), as depicted or noted on nautical charts published by the National Oceanic and Atmospheric Administration (Coast Charts 1:80,000 scale), and as described in 33 CFR Part 80 with the exception of the COLREGS lines for Casco Bay (Maine), Portsmouth Harbor (New Hampshire), Gardiners Bay and Long Island Sound (New York), and the state of Massachusetts;

(ii) *Other exempted waters*--(A) *Maine*. The regulations in this section do not apply to waters landward of a line connecting the following points (Quoddy Narrows/U.S.-Canada border to Odiornes Pt., Portsmouth, New Hampshire):

Table 4 to paragraph (a)(3)(ii)(A)

44°49.67' N. lat., 66°57.77' W. long. (R N "2", Quoddy Narrows)
44°48.64' N. lat., 66°56.43' W. long. (G "1" Whistle, West Quoddy Head)
44°47.36' N. lat., 66°59.25' W. long. (R N "2", Morton Ledge)
44°45.51' N. lat., 67°02.87' W. long. (R "28M" Whistle, Baileys Mistake)

44°37.70' N. lat., 67°09.75' W. long. (Obstruction, Southeast of Cutler)
44°27.77' N. lat., 67°32.86' W. long. (Freeman Rock, East of Great Wass Island)
44°25.74' N. lat., 67°38.39' W. long. (R "2SR" Bell, Seahorse Rock, West of Great Wass Island)
44°21.66' N. lat., 67°51.78' W. long. (R N "2", Petit Manan Island)
44°19.08' N. lat., 68°02.05' W. long. (R "2S" Bell, Schoodic Island)
44°13.55' N. lat., 68°10.71' W. long. (R "8BI" Whistle, Baker Island)
44°08.36' N. lat., 68°14.75' W. long. (Southern Point, Great Duck Island)
43°59.36' N. lat., 68°37.95' W. long. (R "2" Bell, Roaring Bull Ledge, Isle Au Haut)
43°59.83' N. lat., 68°50.06' W. long. (R "2A" Bell, Old Horse Ledge)
43°56.72' N. lat., 69°04.89' W. long. (G "5TB" Bell, Two Bush Channel)
43°50.28' N. lat., 69°18.86' W. long. (R "2 OM" Whistle, Old Man Ledge)
43°48.96' N. lat., 69°31.15' W. long. (GR C "PL", Pemaquid Ledge)
43°43.64' N. lat., 69°37.58' W. long. (R "2BR" Bell, Bantam Rock)
43°41.44' N. lat., 69°45.27' W. long. (R "20ML" Bell, Mile Ledge)
43°36.04' N. lat., 70°03.98' W. long. (RG N "BS", Bulwark Shoal)
43°31.94' N. lat., 70°08.68' W. long. (G "1", East Hue and Cry)
43°27.63' N. lat., 70°17.48' W. long. (RW "WI" Whistle, Wood Island)
43°20.23' N. lat., 70°23.64' W. long. (RW "CP" Whistle, Cape Porpoise)
43°04.06' N. lat., 70°36.70' W. long. (R N "2MR", Murray Rock)
43°02.93' N. lat., 70°41.47' W. long. (R "2KR" Whistle, Kittery Point)
43°02.55' N. lat., 70°43.33' W. long. (Odiornes Pt., Portsmouth, New Hampshire)

(B) *New Hampshire*. New Hampshire state waters are exempt from the minimum number of traps per trawl requirement in paragraph (c)(2)(iv) of this section. Harbor waters landward of the following lines are exempt from all the regulations in this section;

Table 5 to paragraph (a)(3)(ii)(B)

A line from 42°53.691' N. lat., 70°48.516' W. long. to 42°53.516' N. lat., 70°48.748' W. long.

(Hampton Harbor)
A line from 42°59.986' N. lat., 70°44.654' W. long. to 42°59.956' N., 70°44.737' W. long. (Rye Harbor)

(C) *Rhode Island*. Rhode Island state waters are exempt from the minimum number of traps per trawl requirement in paragraph (c)(2)(iv) of this section. Harbor waters landward of the following lines are exempt from all the regulations in this section;

Table 6 to paragraph (a)(3)(ii)(C)

A line from 41°22.441' N. lat., 71°30.781' W. long. to 41°22.447' N. lat., 71°30.893' W. long. (Pt. Judith Pond Inlet)
A line from 41°21.310' N. lat., 71°38.300' W. long. to 41°21.300' N. lat., 71°38.330' W. long. (Ninigret Pond Inlet)
A line from 41°19.875' N. lat., 71°43.061' W. long. to 41°19.879' N. lat., 71°43.115' W. long. (Quonochontaug Pond Inlet)
A line from 41°19.660' N. lat., 71°45.750' W. long. to 41°19.660' N. lat., 71°45.780' W. long. (Weekapaug Pond Inlet)
A line from 41°26.550' N. lat., 71°26.400' W. long. to 41°26.500' N. lat., 71°26.505' W. long. (Pettaquamscutt Inlet)

(D) *New York*. The regulations in this section do not apply to waters landward of a line that follows the territorial sea baseline through Block Island Sound (Watch Hill Point, RI, to Montauk Point, NY);

(E) *Massachusetts*. The regulations in this section do not apply to waters landward of the first bridge over any embayment, harbor, or inlet in Massachusetts. The following Massachusetts state waters are exempt from the minimum number of traps per trawl requirement in paragraph (c)(2)(iv) of this section:

(1) *Exempt waters of Massachusetts Bay and Outer Cape*. Heading From the New Hampshire border to 70° W longitude south of Cape Cod, waters in EEZ Nearshore Management Area 1 and the Outer Cape Lobster Management Area (as defined in the American Lobster

Fishery regulations under § 697.18 of this title), from the shoreline to 3 nautical miles from shore, and including waters of Cape Cod Bay southeast of a straight line connecting 41° 55.8' N lat., 70°8.4' W long. and 41°47.2' N lat., 70°19.5' W long.; and

(2) *Exempt waters of southern Massachusetts.* Heading From 70° W longitude south of Cape Cod to the Rhode Island border, all Massachusetts state waters in EEZ Nearshore Management Area 2 and the Outer Cape Lobster Management Area (as defined in the American Lobster Fishery regulations under § 697.18 of this title), including Federal waters of Nantucket Sound west of 70° W long.;

(F) *South Carolina.* The regulations in this section do not apply to waters landward of a line connecting the following points from 32°34.717' N. lat., 80°08.565' W. long. to 32°34.686' N. lat., 80°08.642' W. long. (Captain Sams Inlet);

(4) *Sinking groundline exemption.* The fisheries regulated under this section are exempt from the requirement to have groundlines composed of sinking line if their groundline is at a depth equal to or greater than 280 fathoms (1,680 feet or 512.1 m);

(5) *Net panel weak link and anchoring exemption.* The anchored gillnet fisheries regulated under this section are exempt from the requirement to install weak links in the net panel and anchor each end of the net string if the float-line is at a depth equal to or greater than 280 fathoms (1,680 feet or 512.1 m); and

(6) *Island buffer.* Those fishing in waters within 1/4 nautical miles of the following Maine islands are exempt from the minimum number of traps per trawl requirement in paragraph (c)(2)(iv) of this section: Monhegan Island, Matinicus Island Group (Metinic Island, Small Green Island, Large Green Island, Seal Island, Wooden Ball Island, Matinicus Island, Ragged Island), and Isles of Shoals Island Group (Duck Island, Appledore Island, Cedar Island,

Smuttynose Island).

(b) *Gear marking requirements*—(1) *Specified areas* Fishermen permitted by Maine, New Hampshire, Massachusetts, Rhode Island, and NMFS to fish for lobster and Jonah crab using trap/pot gear in the Northeast Region will follow the color marking requirements for Federal waters as indicated in paragraph (b)(2) of this section and, except for when fishing in LMA3, will follow the color code scheme assigned to their state, indicated in paragraph (b)(3) of this section. For all other trap/pot and gillnet gear, excluding shark gillnet, the following areas are specified for gear marking purposes: Northern Inshore State Trap/Pot Waters, Cape Cod Bay Restricted Area, Massachusetts Restricted Area, Stellwagen Bank/Jeffreys Ledge Restricted Area, Northern Nearshore Trap/Pot Waters Area, Great South Channel Restricted Trap/Pot Area, Great South Channel Restricted Gillnet Area, Great South Channel Sliver Restricted Area, Southern Nearshore Trap/Pot Waters Area, Offshore Trap/Pot Waters Area, Other Northeast Gillnet Waters Area, Mid/South Atlantic Gillnet Waters Area, Other Southeast Gillnet Waters Area, Southeast U.S. Restricted Areas, and Southeast U.S. Monitoring Area;

(i) *Jordan Basin*. The Jordan Basin Restricted Area is bounded by the following points connected by straight lines in the order listed:

Table 7 to paragraph (b)(1)(i)

Point	N. Lat.	W. Long.
JBRA1	43°15'	68°50'
JBRA2	43°35'	68°20'
JBRA3	43°25'	68°05'
JBRA4	43°05'	68°20'
JBRA5	43°05'	68°35'
JBRA1	43°15'	68°50'

(ii) *Jeffreys Ledge Restricted Area*. The Jeffreys Ledge Restricted Area is bounded by the following points connected by a straight line in the order listed:

Table 8 to paragraph (b)(1)(ii)

Point	N. Lat.	W. Long.
JLRA1	43°15'	70°25'
JLRA2	43°15'	70°00'
JLRA3	42°50'	70°00'
JLRA4	42°50'	70°25'
JLRA1	43°15'	70°25'

(2) *Markings*. All specified gear in specified areas must be marked with the color code shown in paragraph (b)(3) of this section. The color must be permanently marked on or along the rope or ropes specified under paragraphs (b)(2)(i) through (iv) of this section. Each colored mark must be clearly visible when the gear is hauled or removed from the water, including if the color of the rope is the same as or similar to the respective color code;

(i) *Northeast Region lobster and Jonah crab buoy line markings*. For all Federal and state Northeast Region lobster and Jonah crab trap/pot gear regulated under this section, the buoy lines must be marked with a solid mark at least 36 inches (91.4 cm) in length within 2 fathoms (3.7 m) of the surface buoy. When fishing in Federal waters, all Northeast Region lobster and Jonah crab trap/pot buoy lines must have an additional green mark of at least 12 inches (30.5 cm) in length no more than 6 inches (15.2 cm) from the 36-inch (91.4 cm) mark. These long marks within 2 fathoms (3.7 m) of the buoy must be solid marks that may be applied with dyed, painted, or heat-shrink tubing, insertion of a colored rope or braided sleeve, or the line may be marked as approved in writing by the Greater Atlantic Regional Administrator. When fishing in

state waters, the buoy line below the surface system must be marked by the principal port state color at least two additional times (top half, bottom half) and each mark must total 12 inches (30.5 cm) for a total of at least three marks in state waters. For dual permitted vessels, state regulations will determine whether green Federal markings in the surface system and buoy line below the surface system can remain on gear being fished in state waters. When in Federal waters, the buoy line below the surface system must be marked at least three additional times (top, middle, and bottom) with the state or LMA 3 specific color, and each mark must total at least 12 inches (30.5 cm) in length. An additional green mark of at least 12 inches (30.5 cm) in length denoting Northeast Region Federal waters must be placed within 6 inches (15.2 cm) of each area-specific colored mark for a total of at least eight marks in Federal waters. In marking or affixing the color code(s) for the 1-foot buoy line marks for gear regulated under this paragraph (b)(2)(i), the line may be: dyed; painted, marked with thin colored whipping line, thin colored plastic, or heat-shrink tubing; spliced in insertion of a colored rope or braided sleeve or other material, or a thin line may be woven into or through the line; or the line may be marked as approved in writing by the Greater Atlantic Regional Administrator. An outreach guide illustrating the techniques for marking gear is available from the Greater Atlantic Regional Administrator upon request and posted on the Atlantic Large Whale Take Reduction Plan website at *Fisheries.NOAA.gov/ALWTRP*;

(ii) *Other buoy line markings.* For all other trap/pot and gillnet gear regulated under this section, the buoy line must be marked at least three times (top, middle, bottom) and each mark must total 12 inches (30.5 cm) in length. If the mark consists of two colors, then each color mark may be 6 inches (15.2 cm) for a total mark of 12 inches (30.5 cm). In marking or affixing the color code for gear regulated under this paragraph (b)(2)(ii), the line may be: dyed, painted,

marked with thin colored whipping line, thin colored plastic, or heat-shrink tubing, spliced in insertion of a colored rope or braided sleeve or other material, or a thin line may be woven into or through the line, or the line may be marked as approved in writing by the Greater Atlantic Regional Administrator. An outreach guide illustrating the techniques for marking gear is available from the Greater Atlantic Regional Administrator upon request and posted on the Atlantic Large Whale Take Reduction Plan website at *Fisheries.NOAA.gov/ALWTRP*;

(iii) *Net panel markings.* Shark gillnet gear net panels in the Southeast U.S. Restricted Area S, Southeast U.S. Monitoring Area and Other Southeast Gillnet Waters are required to be marked. The net panel must be marked along both the floatline and the leadline at least once every 100 yards (91.4 m);

(iv) *Surface buoy markings.* Trap/pot and gillnet gear regulated under this section must mark all surface buoys to identify the vessel or fishery with one of the following: The owner's motorboat registration number, the owner's U.S. vessel documentation number, the Federal commercial fishing permit number, or whatever positive identification marking is required by the vessel's home-port state. When marking of surface buoys is not already required by state or Federal regulations, the letters and numbers used to mark the gear to identify the vessel or fishery must be at least 1 inch (2.5 cm) in height in block letters or Arabic numbers in a color that contrasts with the background color of the buoy. An outreach guide illustrating the techniques for marking gear is available from the Greater Atlantic Regional Administrator upon request and posted on the Atlantic Large Whale Take Reduction Plan website *Fisheries.NOAA.gov/ALWTRP*;

(3) *Color code.* Gear must be marked with the appropriate colors to designate gear types and areas as follows:

Table 9 to paragraph (b)(3)

Color Code Scheme	
Plan management area	Color
Northeast Region	
Lobster and Jonah Crab Trap/Pot Gear	
Trawls fished by vessels permitted by the state of Maine and with a principal port identified in Maine when fished in state waters	Purple
Trawls fished by vessels permitted by the state of Maine and NMFS, with a principal port identified in Maine when fished in Federal LMA 1 waters*	Purple, Green
Trawls fished by vessels permitted by the state of New Hampshire and with a principal port identified in New Hampshire when fished in state waters	Yellow
Trawls fished by vessels permitted by the state of New Hampshire and NMFS, with a principal port identified in New Hampshire when fished in Federal LMA 1 waters*	Yellow, Green
Trawls fished by vessels permitted by the state of Massachusetts and with a principal port identified in Massachusetts when fished in state waters	Red
Trawls fished by vessels permitted by the state of Massachusetts and NMFS with a principal port identified in Massachusetts when fished in Federal waters of LMA 1, OC, LMA 2 (including 2/3 overlap)*	Red, Green
Trawls fished by vessels permitted by the state of Rhode Island and with a principal port identified in Rhode Island when fished in state waters	Silver/Gray
Trawls fished by vessels permitted by the state of Rhode Island and NMFS, with a principal port identified in Rhode Island when in Federal waters of LMA 2	Silver/Gray Green

(including 2/3 overlap)*	
Trawls fished in the Northeast EEZ Offshore Management Area 3 (LMA3) excluding the 2/3 overlap	Black, Green
Northeast Region, Other Trap/Pot gear	
Massachusetts Restricted Area	Red
Northern Nearshore	Red
Northern Inshore State	Red
Stellwagen Bank/Jeffreys Ledge Restricted Area	Red
Great South Channel Restricted Area overlapping with LMA 2 and/or Outer Cape	Red
Exempt Rhode Island state waters (single traps)	Red and Blue
Exempt Massachusetts state waters in LMA 1 (single traps)	Red and White
Exempt Massachusetts state waters in LMA 2 (single traps)	Red and Black
Exempt Massachusetts state waters in Outer Cape (single traps)	Red and Yellow
Isles of Shoals, ME (single traps)	Red and Orange
Great South Channel Restricted Area overlapping with LMA 2/3 and/or LMA 3	Black
Jordan Basin	Black and Purple (LMA 3), Red and Purple (LMA 1)
Jeffreys Ledge	Red and Green
Trap/Pot Gear	
Southern Nearshore	Orange
Southeast Restricted Area North (state Waters)	Blue and Orange
Southeast Restricted Area North (Federal Waters)	Green and Orange
Offshore	Black
Gillnet excluding shark gillnet	

Cape Cod Bay Restricted Area	Green
Stellwagen Bank/Jeffreys Ledge Restricted Area	Green
Great South Channel Restricted Area	Green
Great South Channel Restricted Sliver Area	Green
Other Northeast Gillnet Waters	Green
Jordan Basin	Green and Yellow
Jeffreys Ledge	Green and Black
Mid/South Atlantic Gillnet Waters	Blue
Southeast US Restricted Area South	Yellow
Other Southeast Gillnet Waters	Yellow
Shark Gillnet (with webbing of 5" or greater)	
Southeast US Restricted Area South	Green and Blue
Southeast Monitoring Area	Green and Blue
Other Southeast Waters	Green and Blue

*For dual permitted vessels, state regulations will determine whether green marks can remain on gear being fished in state waters.

(c) *Restrictions applicable to trap/pot gear in regulated waters--*(1) *Universal trap/pot gear requirements.* In addition to the gear marking requirements listed in paragraph (b) of this section and the area-specific measures listed in paragraphs (c)(2) through (12) of this section, all trap/pot gear in regulated waters, including the Northern Inshore State Trap/Pot Waters Area, must comply with the universal gear requirements listed in paragraphs (c)(1)(i) through (iii) of this section;⁸

(i) *No buoy line floating at the surface.* No person or vessel may fish with trap/pot gear

⁸ Fishermen are also encouraged to maintain their buoy lines to be as knot-free as possible. Splices are considered to be less of an entanglement threat and are thus preferable to knots.

that has any portion of the buoy line floating at the surface at any time when the buoy line is directly connected to the gear at the ocean bottom. If more than one buoy is attached to a single buoy line or if a high flyer and a buoy are used together on a single buoy line, floating line may be used between these objects;

(ii) *No wet storage of gear.* Trap/pot gear must be hauled out of the water at least once every 30 days; and

(iii) *Groundlines.* All groundlines must be composed entirely of sinking line. The attachment of buoys, toggles, or other flotation devices to groundlines is prohibited.

(2) *Area specific gear requirements.* Trap/pot gear must be set according to the requirements outlined in paragraphs (c)(2)(i) through (iii) of this section and in the Table to paragraph (c)(2)(iv) of this section;

(i) *Single traps and multiple-trap trawls.* All traps must be set according to the configuration outlined in the Table to paragraph (c)(2)(iv) of this section. Trawls up to and including five traps must only have one buoy line unless specified otherwise in the Table to paragraph (c)(2)(iv) of this section;

(ii) *Buoy line weak links.* With the exception of Northeast Region lobster and Jonah crab trap/pot trawls, all buoys, flotation devices and/or weights (except traps/pots, anchors, and leadline woven into the buoy line), such as surface buoys, high flyers, radar reflectors, subsurface buoys, toggles, window weights, etc., must be attached to the buoy line with a weak link placed either as close to each individual buoy, flotation device and/or weight as operationally feasible, or at the base of the surface system where the surface system attaches to the single buoy line, and that meets the following specifications;

(A) *Weak link breaking strengths.* The breaking strength of the weak links must not

exceed the breaking strength listed in paragraph (c)(2)(iv) of this section for a specified management area;

(B) *Approved weak links.* The weak link must be chosen from the following list approved by NMFS: swivels, plastic weak links, rope of appropriate breaking strength, hog rings, rope stapled to a buoy stick, or other materials or devices approved in writing by the Greater Atlantic Regional Administrator. An outreach guide illustrating the techniques for making weak links is available from the Greater Atlantic Regional Administrator upon request and posted on the Atlantic Large Whale Take Reduction Plan website *Fisheries.NOAA.gov/ALWTRP*; and

(C) *Clean breaks.* Weak links must break cleanly leaving behind the bitter end of the line. The bitter end of the line must be free of any knots when the weak link breaks. Splices are not considered to be knots for the purposes of this paragraph (c)(2)(ii)(C);

(iii) *Weak buoy lines and weak insertion devices.* All lobster and Jonah crab trap/pot buoy lines in the management areas and configurations outlined in the Table to paragraph (c)(2)(iv) of this section must use weak line or must insert weak devices along the buoy line as described in the Table to paragraph (c)(2)(iv). The weak line and weak insert devices must meet the following specifications;

(A) *Breaking strength.* The breaking strength of the weak buoy lines and weak insertion devices must not exceed 1,700 lb (771 kgs);

(B) *Approved devices and distance between weak insertions.* Weak insertion devices must be inserted in the specified intervals from the surface system and must be devices chosen from the following list approved by NMFS: (1) any rope no thinner than 5/16 inch (8 mm) diameter that is engineered to break at 1,700 lb (771 kg) or less in a color contrasting with the primary buoy line and 3 feet (91.4 cm) or longer spliced on either end into the primary buoy line.

Splices that achieve nearly the manufactured breaking strength include but are not limited to: three or more tuck splices, an eye to loop with 3 or more tuck splices, or a butt splice, (2) a 3-foot long hollow braided sleeve such as those known as the South Shore Sleeve installed over a parted buoy line, (3) a plastic weak link engineered to break at 1700 lb (771 kg) or less in a color that contrasts with the buoy line, or other materials, devices, or configurations inserted according to specifications approved in writing by the Greater Atlantic Regional Administrator. An outreach guide illustrating the techniques for making weak insert devices is available from the Greater Atlantic Regional Administrator upon request and posted on the Atlantic Large Whale Take Reduction Plan website *Fisheries.NOAA.gov/ALWTRP*; and

(C) *Clean breaks.* Weak line and weak inserts must break cleanly leaving behind the bitter end of the line. The bitter end of the line must be free of any knots when the weak insert breaks. Splices are not considered to be knots for the purposes of this paragraph (c)(2)(iii)(D).

(iv) *Table of area specific trap/pot gear requirements.*

Table 10 to paragraph (c)(2)(iv)

Northeast Region Lobster and Jonah Crab Trap/Pot		
3		
Mgmt Area; Location	Minimum Number Traps/rawl	Minimum Number of Weak Rope or Weak Insertion Configuration
Northern Inshore State; Maine Zones A, B, F, G exempt waters to 3 miles	3 (1 buoy line)	Weak line for the top 50 percent of the buoy line or one weak insertion device at 50 percent buoy line length from top
Northern Inshore State; Maine Zones C, D, and E exempt waters to 3 miles	2 (1 buoy line) or 4 (2 buoy lines)	Weak line for the top 50 percent of the buoy line or one weak insertion device at 50 percent buoy line length from top

Northern Nearshore: Maine Zone A East 3 to 12 miles	10 (1 buoy line) or 20 (2 buoy lines)	Weak line for the top 33 percent of the buoy line or one weak insertion device at 33 percent buoy line length from top
Northern Nearshore: Maine Zone A West 3 to 6 miles	4 (1 buoy line) or 8 (2 buoy lines)	Weak line for the top 50 percent of the buoy line or two weak insertion devices, one at 25 percent and one at 50 percent buoy line length from top
Northern Nearshore: Maine Zone A West 6 to 12 miles	8 (1 buoy line) or 15 (2 buoy lines)	Weak line for the top 50 percent of the buoy line or two weak insertion devices, one at 25 percent and one at 50 percent buoy line length from top
Northern Nearshore: Maine Zone B 3 to 6 miles	5 (1 buoy line)	Weak line for the top 50 percent of the buoy line or two weak insertion devices, one at 25 percent and one at 50 percent buoy line length from top
Northern Nearshore: Maine Zone C, D, E 3 to 6 miles	5 (1 buoy line) or 10 (2 buoy lines)	Weak line for the top 50 percent of the buoy line or two weak insertion devices, one at 25 percent and one at 50 percent buoy line length from top
Northern Nearshore: Maine Zone F and G 3 to 6 miles	5 (1 buoy line) or 10 (2 buoy lines)	Weak line for the top 33 percent of the buoy line or one weak insertion device at 33 percent buoy line length from top
Northern Nearshore: Maine Zone B, D, and E 6 to 12 miles	5 (1 buoy line) or 10 (2 buoy lines)	Weak line for the top 50 percent of the buoy line or two weak insertion devices, one at 25 percent and one at 50 percent buoy line length from top
Northern Nearshore: Maine Zone C	10 (1 buoy line) or 20 (2 buoy lines)	Weak line for the top 50 percent of the buoy line or

6 to 12 miles		two weak insertion devices, one at 25 percent and one at 50 percent buoy line length from top
Northern Nearshore: Maine Zone F 6 to 12 miles	5 (1 buoy line) or 10 (2 buoy lines)	Weak line for the top 33 percent of the buoy line or one weak insertion device at 33 percent buoy line length from top
Northern Nearshore: Maine Zone G 6 to 12 miles	10 (1 buoy line) or 20 (2 buoy lines)	Weak line for the top 33 percent of the buoy line or one weak insertion device at 33 percent buoy line length from top
Northern Inshore State and Massachusetts Restricted Area; Massachusetts State Waters ²	No minimum number of traps per trawl. Trawls up to and including 3 or fewer traps must only have one buoy line	Weak inserts every 60 feet (18.3 m) in top 75 percent of line or full weak line through top 75 percent of line
Northern Inshore State and Massachusetts Restricted Area; Other Massachusetts State Waters	2 (1 buoy line) Trawls up to and including 3 or fewer traps must only have one buoy line	Weak inserts every 60 feet (18.3 m) in top 75 percent of line or full weak line through top 75 percent of line
Northern Inshore State; New Hampshire State Waters	No minimum trap/trawl	Weak line for the top 50 percent of the buoy line or one weak insertion device at 50 percent buoy line length from top
Northern Nearshore; New Hampshire and Massachusetts (3-6 miles)	10	Weak line for the top 50 percent of the buoy line or two weak insertion devices, one at 25 percent and one at 50 percent buoy line length from top
Northern Nearshore, Massachusetts Restricted Area, and Stellwagen Bank/Jeffreys Ledge Restricted Area;	15	Weak line for the top 50 percent of the buoy line or two weak insertion devices, one at 25 percent and one at 50 percent buoy line length

LMA 1 (6-12 miles)		from top
Northern Nearshore and LMA1 Restricted Area; LMA1 (12 + miles)	25	Weak line for the top 33 percent of the buoy line or one weak insertion device at 33 percent buoy line length from top
Northern Inshore State, Massachusetts Restricted Area, and Massachusetts South Island Restricted Area; OC and LMA1/OC Overlap(0-3 miles)	No minimum number of traps per trawl	Weak inserts every 60 ft (18.3 m) in top 75 percent of line or full weak line through top 75 percent of line
Northern Nearshore and Massachusetts Restricted Area; OC (3-12 miles)	15	Weak line for the top 50 percent of the buoy line or two weak insertion devices, one at 25 percent and one at 50 percent buoy line length from top
Northern Nearshore and Great South Channel Restricted Area; OC (12 + miles)	20	Weak line for the top 33 percent of the buoy line or one weak insertion device at 33 percent buoy line length from top
Northern Inshore State; RI State Waters	No minimum number of traps per trawl.	Weak inserts every 60 feet (18.3 m) in top 75 percent of line or full weak line through top 75 percent of line
Northern Nearshore; LMA 2 (3-12 miles)	10	Weak inserts every 60 feet (18.3 m) in top 75 percent of line or full weak line through top 75 percent of line
Northern Nearshore, Great South Channel Restricted Area, and Massachusetts South of Island Restricted Area; LMA 2 (12 + miles)	20	Weak inserts every 60 feet (18.3 m) in top 75 percent of line or full weak line through top 75 percent of line

Offshore, Great South Channel Restricted Area, and Massachusetts South Island Restricted Area; LMA 2/3 Overlap (12 + miles)	20	Weak inserts every 60 feet (18.3 m) in top 75 percent of line or full weak line through top 75 percent of line
Northeast Region Offshore waters including Great South Channel Restricted Area, and Massachusetts South Island Restricted Area, with the exception of the Georges Basin and South Georges 50 Fathom Restricted Areas; LMA 3 including LMA3-only vessels fishing in 2/3 overlap	45	Weak line for the top 75 percent of one buoy line
Northeast Region Offshore waters Georges Basin Restricted Area	50	Weak line for the top 75 percent of the buoy line
Northeast Region Offshore waters South Georges 50 Fathom Restricted Area	35	Weak line for the top 75 percent of the buoy line

Other Trap/Pot

Mgmt Area; Location	Minimum Number Traps/rawl	Weak Buoy Link Strength
Northern Inshore State; Maine State and Pocket Waters 1	2 (1 buoy line)	≤600 lb
Northern Nearshore; Maine Zones A-G (3-6 miles) ¹	3 (1 buoy line)	≤600 lb
Northern Nearshore; Maine Zones A-C (6-12 miles) ¹	5 (1 buoy line)	≤600 lb

Northern Nearshore; Maine Zones D-G (6-12 miles) ¹	10	≤600 lb.
Northern Nearshore, Offshore, and LMA1 Restricted Area; Maine Zones A-E (12 + miles)	15	≤600 lb (≤1500 lb in offshore, 2,000 lb if red crab trap/pot).
Northern Nearshore, Offshore, and LMA1 Restricted Area; Maine Zones F-G (12 + miles)	15 (Mar 1-Oct 31) 20 (Nov 1-Feb 28/29)	≤600 ls (≤1500 lb in offshore, 2,000 ls if red crab trap/pot).
Northern Inshore State and Massachusetts Restricted Area; Massachusetts State Waters ²	No minimum number of traps per trawl. Trawls up to and including 3 or fewer traps must only have one buoy line	≤600 lb
Northern Inshore State, Massachusetts Restricted Area, and Massachusetts South Island Restricted Area; Other Massachusetts State Waters	2 (1 buoy line) Trawls up to and including 3 or fewer traps must only have one buoy line	≤600 lb
Northern Inshore State; New Hampshire State Waters	No minimum number of traps per trawl	≤600 lb
Northern Nearshore and Massachusetts Restricted Area and Stellwagen Bank/Jeffreys Ledge Restricted Area; LMA 1 (3-12 miles)	10	≤600 lb
Northern Nearshore and LMA1 Restricted Area;	20	≤600 lb

LMA 1 (12+ miles)		
Northern Inshore State and Massachusetts Restricted Area; LMA1/OC Overlap (0-3 miles)	No minimum number of traps per trawl	≤ 600 lb
Northern Inshore State and Massachusetts Restricted Area; OC (0-3 miles)	No minimum number of traps per trawl	≤ 600 lb
Northern Nearshore and Massachusetts Restricted Area; OC (3-12 miles)	10	≤ 600 lb
Northern Nearshore and Great South Channel Restricted Area; OC (12 + miles)	20	≤ 600 lb
Northern Inshore State; Rhode Island State Waters	No minimum number of traps per trawl.	≤ 600 lb
Northern Nearshore, and Massachusetts South Island Restricted Area; LMA 2 (3-12 miles)	10	≤ 600 lb
Northern Nearshore, Great South Channel Restricted Area; LMA 2 (12 + miles)	20	≤ 600 lb
Northeast Offshore and Great South Channel Restricted Area, and Massachusetts South Island Restricted Area;	20	≤ 1500 lb (2,000 lb if red crab trap/pot).

LMA 2/3 Overlap (12 + miles)		
Northeast Offshore waters, Great South Channel Restricted Area, and Massachusetts South Island Restricted Area; LMA 3 (12 + miles)	20	≤1500 lb (2,000 lb if red crab trap/pot).
Southern Nearshore; LMA 4,5,6	No minimum number of traps per trawl.	≤600 lb
Southeast US Restricted Area North ³ Florida State Waters	1	≤200 lb
Southeast US Restricted Area North; ³ Georgia State Waters	1	≤600 lb
Southeast US Restricted Area North; ³ South Carolina State Waters	1	≤600 lb
Southeast US Restricted Area North; ³ Federal Waters off Florida, Georgia, South Carolina	1	≤600 lb

¹The 6-mile line, pocket waters, and Maine Zones are defined in paragraphs (a)(2)(iii), (a)(2)(iv) and (a)(2)(v) of this section.

²Massachusetts State waters as defined as paragraph (a)(3)(ii)(E) of this section.

³See paragraph (f)(1) of this section for description of area.

(3) *Massachusetts Restricted Area--(i) Area.* The Massachusetts Restricted Area is bounded landward by the Massachusetts shoreline, from points MRA1 through MRA3 bounded seaward by the designated Massachusetts state waters boundary, and then bounded by a rhumb line connecting points MRA3 through MRA11 in order as detailed below;

Table 11 to paragraph (c)(3)(i)

Point	N. lat.	W. long.
MRA1	42° 52.32'	70° 48.98'
MRA2	42° 52.58'	70° 43.94'
MRA3	42° 12'	70° 38.69'
MRA4	42°12'	70°30'
MRA5	42°30'	70°30'
MRA6	42°30'	69°45'
MRA7	41°56.5'	69°45'
MRA8	41°21.5'	69°16'
MRA9	41°15.3'	69°57.9'
MRA10	41°20.3'	70°00'
MRA11	41°40.2'	70°00'

(ii) *Closure to fishing with buoy lines.* From February 1 to April 30, it is prohibited to fish with, set, or possess trap/pot gear in the area in this paragraph (c)(3)(i) unless it is fished without buoy lines or with buoy lines that are stored on the bottom until it can be remotely released for hauling, or it is stowed in accordance with § 229.2 of this chapter. Authorizations for fishing without buoy lines must be obtained if such fishing would not be in accordance with surface marking requirements of §§ 697.21 and 648.84 of this title or other applicable fishery management regulations.

(iii) *Area-specific gear or vessel requirements.* From May 1 through January 31, no person or vessel may fish with or possess trap/pot gear in the Massachusetts Restricted Area unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, and the area-specific requirements listed in paragraph (c)(2) of this section, or unless the gear is

stowed as specified in § 229.2 of this chapter.

(4) *South Island Restricted Area--(i) Area.* The South Island Restricted Area is bounded by the following points connected by rhumb lines in the order listed, and bounded on the north by the shoreline of Nantucket, Massachusetts.

Table 12 to paragraph (c)(4)(i)

Point	N. lat.	W. long.
SIRA1	41° 20.00' N	71° 19.00' W
SIRA2	41° 20.00' N	69° 30.00' W
SIRA3	40° 30.00' N	69° 30.00' W
SIRA4	40° 30.00' N	71° 19.00' W
SIRA	41° 20.00' N	71° 19.00' W

(ii) *Closure to fishing with buoy lines.* From February 1 to April 30, it is prohibited to fish with, set, or possess trap/pot gear in the area in paragraph (c)(4)(i) unless it is fished without buoy lines or with buoy lines that are stored on the bottom until they can be remotely released for hauling, or the trap/pot gear is stowed in accordance with § 229.2 of this chapter. Authorizations for fishing without buoy lines must be obtained if such fishing would not be in accordance with surface marking requirements of §§ 697.21 and 648.84 of this title.

(iii) *Area-specific gear or vessel requirements.* From May 1 through January 31, no person or vessel may fish with or possess trap/pot gear in the Massachusetts South Island Restricted Area unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, and the area-specific requirements listed in paragraph (c)(2) of this section, or unless the gear is stowed as specified in § 229.2 of this chapter.

(5) *Great South Channel Restricted Trap/Pot Area--(i) Area.* The Great South Channel Restricted Trap/Pot Area consists of the area bounded by the following points.

Table 13 to paragraph (c)(5)(i)

Point	N. Lat.	W. Long.
GSC1	41°40'	69°45'
GSC2	41°0'	69°05'
GSC3	41°38'	68°13'
GSC4	42°10'	68°31'
GSC1	41°40'	69°45'

(ii) *Closure to fishing with buoy lines.* From April 1 through June 30, it is prohibited to fish with, set, or possess trap/pot gear in the area in paragraph (c)(5)(i) unless it is fished without buoy lines or with buoy lines that are stored on the bottom until they can be remotely released for hauling, or the trap/pot gear is stowed in accordance with § 229.2 of this chapter. Authorizations for fishing without buoy lines must be obtained if such fishing would not be in accordance with surface marking requirements of §§ 697.21 and 648.84 of this title.

(iii) *Area-specific gear or vessel requirements.* From July 1 through March 31, no person or vessel may fish with or possess trap/pot gear in the Great South Channel Restricted Trap/Pot Area unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, and the area-specific requirements listed in paragraph (c)(2) of this section, or unless the gear is stowed as specified in § 229.2 of this title.

(6) *Lobster Management Area One Restricted Area--(i) Area.* The Lobster Management Area One Restricted Area (LMRA1) is bounded by the following points connected by rhumb lines in the order listed.

Table 14 to paragraph (c)(6)(i)

Point	N. lat.	W. long.
LMA1RA 1	43°06'	69°36.77'
LMA1RA 2	43°44'	68°21.6'
LMA1RA 3	43°32.68'	68°17.27'
LMA1RA 4	42°53.52'	69°32.16'
LMA1RA 1	43°06'	69°36.77'

(ii) *Restrictions to fishing with buoy lines.* From October 1 to January 31, it is prohibited to fish with, set, or possess trap/pot gear in the area in paragraph (c)(6)(i) unless it is fished without buoy lines or with buoy lines that are stored on the bottom until they can be remotely released for hauling, or the trap/pot gear is stowed in accordance with § 229.2 of this chapter. Authorizations for fishing without buoy lines must be obtained if such fishing would not be in accordance with surface marking requirements of §§ 697.21 and 648.84 of this title.

(iii) *Area-specific gear or vessel requirements.* From February 1 through September 30, no person or vessel may fish with or possess trap/pot gear in the LMA 1 Restricted Area unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, and the area-specific requirements listed in paragraph (c)(2) of this section, or unless the gear is stowed as specified in § 229.2 of this chapter.

(7) *Stellwagen Bank/Jeffreys Ledge Restricted Area--(i) Area.* The Stellwagen Bank/Jeffreys Ledge Restricted Area includes all Federal waters of the Gulf of Maine, except those designated as the Massachusetts Restricted Area in paragraph (c)(3) of this section, that lie south of 43°15' N. lat. and west of 70°00' W. long.

(ii) *Year round area-specific gear or vessel requirements.* No person or vessel may fish with or possess trap/pot gear in the Stellwagen Bank/Jeffreys Ledge Restricted Area unless that

gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, and the area-specific requirements listed in paragraph (c)(2) of this section, or unless the gear is stowed as specified in § 229.2 of this chapter.

(8) *Georges Basin Restricted Area (i) Area.* The Georges Basin Restricted Area (GBRA) referred to in paragraph (c)(2)(iv) of this section is bounded by rhumb lines connecting the following points in the order listed below.

Table 15 to paragraph (c)(8)(i)

Point	N. lat.	W. long.
GBRA 1	42°03.00'	67°40.02'
GBRA 2	42°30.00'	67°40.02'
GBRA 3	42°30.00'	67°27.00'
GBRA 4	42°09.30'	67°08.70'
GBRA 1	42°03.00'	67°40.02'

(iii) *Area-specific gear or vessel requirements.* No person or vessel may fish with or possess trap/pot gear in the Georges Basin Restricted Area unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, and the area-specific requirements listed in paragraph (c)(2) of this section, or unless the gear is stowed as specified in § 229.2.

(9) *South Georges 50 Fathom Restricted Area.* The South Georges 50 Fathom Restricted Area curve line referred to in paragraph (c)(2)(iv) of this section is an area bounded in the south by the 40 degree southern border of the Northeast Region, bounded seaward by the EEZ, and bounded in the north by rhumb lines connecting the following points in the order listed below.

Table 16 to paragraph (c)(9)

Point	N. lat.	W. long.

SGRA 1	40° 00.00'	71° 49.86'
SGRA 2	40° 06.47'	71° 24.69'
SGRA 3	40° 06.49'	71° 24.62'
SGRA 4	40° 20.82'	71° 03.52'
SGRA 5	40° 20.89'	71° 03.42'
SGRA 6	40° 21.16'	70° 35.17'
SGRA 7	40° 21.16'	70° 35.02'
SGRA 8	40° 16.84'	70° 07.34'
SGRA 9	40° 16.81'	70° 07.17'
SGRA 10	40° 09.92'	69° 40.43'
SGRA 11	40° 09.87'	69° 40.25'
SGRA 12	40° 14.72'	69° 12.77'
SGRA 13	40° 14.74'	69° 12.63'
SGRA 14	40° 19.83'	68° 45.19'
SGRA 15	40° 19.86'	68° 45.05'
SGRA 16	40° 31.55'	68° 21.25'
SGRA 17	40° 31.63'	68° 21.10'
SGRA 18	40° 34.09'	67° 52.94'
SGRA 19	40° 34.11'	67° 52.76'
SGRA 20	40° 38.45'	67° 24.98'
SGRA 21	40° 38.46'	67° 24.90'
SGRA 22	40° 50.05'	67° 00.91'
SGRA 23	40° 50.14'	67° 00.73'
SGRA 24	41° 00.10'	66° 35.45'
SGRA 25	41° 00.21'	66° 35.18'
SGRA 26	41° 14.84'	66° 21.82'

(10) *Offshore Trap/Pot⁹ Waters Area—(i) Area.* The Offshore Trap/Pot Waters Area includes all Federal waters of the EEZ Offshore Management Area known as Lobster Management Area 3, including the area known as the Area 2/3 Overlap and Area 3/5 Overlap as defined in the American Lobster Fishery regulations at § 697.18 of this title, with the exception of the Great South Channel Restricted Trap/Pot Area, Southeast Restricted Area, Georges Basin

⁹ Fishermen using red crab trap/pot gear should refer to paragraph (c)(12) of this section for the restrictions applicable to the red crab trap/pot fishery.

Restricted Area, South Georges 50 Fathom Restricted Area, and extending south along the 100-fathom (600-ft or 182.9-m) depth contour from 35°14' N. lat. South to 27°51' N. lat., and east to the eastern edge of the EEZ.

(ii) *Year-round area-specific gear or vessel requirements.* No person or vessel may fish with or possess trap/pot gear in the Northeast Region portion of Offshore Trap/Pot Waters Area that overlaps an area from the U.S./Canada border south to a straight line from 41°18.2' N. lat., 71°51.5' W. long. (Watch Hill Point, RI) south to 40°00' N. lat., and then east to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, and the area-specific requirements listed in paragraph (c)(2) of this section, or unless the gear is stowed as specified in § 229.2 of this chapter.

(iii) *Seasonal area-specific gear or vessel requirements.* From September 1 to May 31, no person or vessel may fish with or possess trap/pot gear in the Offshore Trap/Pot Waters Area that overlaps an area bounded on the north by a straight line from 41°18.2' N. lat., 71°51.5' W. long. (Watch Hill Point, RI) south to 40°00' N. lat. and then east to the eastern edge of the EEZ, and bounded on the south by a line at 32°00' N. lat., and east to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, and area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(iv) *Seasonal area-specific gear or vessel requirements.* From November 15 to April 15, no person or vessel may fish with or possess trap/pot gear in the Offshore Trap/Pot Waters Area that overlaps an area from 32°00' N. lat. south to 29°00' N. lat. and east to the eastern edge of the

EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(v) *Seasonal area-specific gear or vessel requirements.* From December 1 to March 31, no person or vessel may fish with or possess trap/pot gear in the Offshore Trap/Pot Waters Area that overlaps an area from 29°00' N. lat. south to 27°51' N. lat. and east to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) in this section, or unless the gear is stowed as specified in § 229.2 of this chapter.

(11) *Northern Inshore State Trap/Pot Waters Area--(i) Area.* The Northern Inshore State Trap/Pot Waters Area includes the state waters of Rhode Island, Massachusetts, New Hampshire, and Maine, with the exception of Massachusetts Restricted Area and those waters exempted under paragraph (a)(3) of this section. Federal waters west of 70°00' N. lat. in Nantucket Sound are also included in the Northern Inshore State Trap/Pot Waters Area.

(ii) *Year-round area-specific gear or vessel requirements.* No person or vessel may fish with or possess trap/pot gear in the Northern Inshore State Trap/Pot Waters Area unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(12) *Northern Nearshore Trap/Pot Waters Area--(i) Area.* The Northern Nearshore

Trap/Pot Waters Area includes all Federal waters of EEZ Nearshore Management Area 1, Area 2, and the Outer Cape Lobster Management Area (as defined in the American Lobster Fishery regulations at § 697.18 of this title), with the exception of the Great South Channel Restricted Trap/Pot Area, Massachusetts Restricted Area, Stellwagen Bank/Jeffreys Ledge Restricted Area, and Federal waters west of 70°00' N. lat. in Nantucket Sound (included in the Northern Inshore State Trap/Pot Waters Area) and those waters exempted under paragraph (a)(3) of this section.

(ii) *Year-round area-specific gear or vessel requirements.* No person or vessel may fish with or possess trap/pot gear in the Northern Nearshore Trap/Pot Waters Area unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section, or unless the gear is stowed as specified in § 229.2 of this chapter.

(13) *Southern Nearshore¹⁰ Trap/Pot Waters Area--(i) Area.* The Southern Nearshore Trap/Pot Waters Area includes all state and Federal waters that fall within EEZ Nearshore Management Area 4, EEZ Nearshore Management Area 5, and EEZ Nearshore Management Area 6 (as defined in the American Lobster Fishery regulations in § 697.18 of this title, and excluding the Area 3/5 Overlap), and inside the 100-fathom (600-ft or 182.9-m) depth contour line from 35°30' N. lat. south to 27°51' N. lat. and extending inshore to the shoreline or exemption line, with the exception of those waters exempted under paragraph (a)(3) of this section and those waters in the Southeast Restricted Area defined in paragraph (f)(1) of this section.

¹⁰ Fishermen using red crab trap/pot gear should refer to paragraph (c)(14) of this section for the restrictions applicable to the red crab trap/pot fishery.

(ii) *Year-round area-specific gear or vessel requirements.* No person or vessel may fish with or possess trap/pot gear in the Southern Nearshore Trap/Pot Waters Area that is east of a straight line from 41°18.2' N. lat., 71°51.5' W. long. (Watch Hill Point, RI) south to 40°00' N. lat., unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(iii) *Seasonal area-specific gear or vessel requirements.* From September 1 to May 31, no person or vessel may fish with or possess trap/pot gear in the Southern Nearshore Trap/Pot Waters Area that overlaps an area bounded on the north by a straight line from 41°18.2' N. lat., 71°51.5' W. long. (Watch Hill Point, RI) south to 40°00' N. lat. and then east to the eastern edge of the EEZ, and bounded on the south by 32°00' N. lat., and east to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(iv) *Seasonal area-specific gear or vessel requirements.* From November 15 to April 15, no person or vessel may fish with or possess trap/pot gear in the Southern Nearshore Trap/Pot Waters Area that overlaps an area from 32°00' N. lat. south to 29°00' N. lat. and east to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(v) *Seasonal area-specific gear or vessel requirements.* From December 1 to March 31, no person or vessel may fish with or possess trap/pot gear in the Southern Nearshore Trap/Pot Waters Area that overlaps an area from 29°00' N. lat. south to 27°51' N. lat. and east to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(14) *Restrictions applicable to the red crab trap/pot fishery--*(i) *Area.* The red crab trap/pot fishery is regulated in the waters identified in paragraphs (c)(10)(i) and (c)(14)(i) of this section.

(ii) *Year-round area-specific gear or vessel requirements.* No person or vessel may fish with or possess red crab trap/pot gear in the area identified in paragraph (c)(14)(i) of this section that overlaps an area from the U.S./Canada border south to a straight line from 41° 18.2' N. lat., 71°51.5' W. long. (Watch Hill Point, RI) south to 40°00' N. lat., and then east to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(iii) *Seasonal area-specific gear or vessel requirements.* From September 1 to May 31, no person or vessel may fish with or possess red crab trap/pot gear in the area identified in paragraph (c)(14)(i) of this section that overlaps an area bounded on the north by a straight line from 41°18.2' N. lat., 71°51.5' W. long. (Watch Hill Point, RI) south to 40°00' N. lat. and then east to the eastern edge of the EEZ, and bounded on the south by a line at 32°00' N. lat., and east

to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(iv) *Seasonal area-specific gear or vessel requirements.* From November 15 to April 15, no person or vessel may fish with or possess red crab trap/pot gear in the area identified in paragraph (c)(14)(i) of this section that overlaps an area from 32°00' N. lat. south to 29°00' N. lat. and east to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

(v) *Seasonal area-specific gear or vessel requirements.* From December 1 to March 31, no person or vessel may fish with or possess red crab trap/pot gear in the area identified in paragraph (c)(14)(i) of this section that overlaps an area from 29°00' N. lat. south to 27°51' N. lat. and east to the eastern edge of the EEZ, unless that gear complies with the gear marking requirements specified in paragraph (b) of this section, the universal trap/pot gear requirements specified in paragraph (c)(1) of this section, the area-specific requirements in paragraph (c)(2) of this section or unless the gear is stowed as specified in § 229.2 of this chapter.

PART 697 ATLANTIC COASTAL FISHERIES COOPERATIVE MANAGEMENT

4. The authority citation for 50 CFR part 697 continues to read as follows:

Authority: 16 U.S.C. 5101 *et seq.*

5. In § 697.21, revise paragraph (b)(2) and (3) to read as follows:

§ 697.21 Gear identification and marking, escape vent, maximum trap size, and ghost panel

requirements.

* * * * *

(b) * * *

(2) With the exception of Maine permitted vessels fishing in Maine Lobster Management Zones that can fish up to ten lobster traps on a trawl with one buoy line, lobster trap trawls consisting of more than three traps must have a radar reflector and a single flag or pennant on the westernmost end (marking the half compass circle from magnetic south through west, to and including north), while the easternmost end (meaning the half compass circle from magnetic north through east, to and including south) of an American lobster trap trawl must be configured with a radar reflector only. Standard tetrahedral corner radar reflectors of at least 8 inches (20.32 cm) (both in height and width, and made from metal) must be employed. (A copy of a diagram showing a standard tetrahedral corner radar reflector is available upon request to the Office of the Greater Atlantic Regional Administrator.)

(3) No American lobster trap trawl shall exceed 1.5 nautical miles (2.78 km) in length, as measured from radar reflector to radar reflector, except in the EEZ Offshore Management Area 3 where the maximum length of a lobster trap trawl shall not exceed 1.75 nautical miles (3.24 km).

* * * * *

EXHIBIT 6

EXHIBIT A

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION BIOLOGICAL OPINION

Action Agency: National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, through its Sustainable Fisheries Division

Activity: Endangered Species Act Section 7 Consultation on the:
(a) Authorization of the American Lobster, Atlantic Bluefish, Atlantic Deep-Sea Red Crab, Mackerel/Squid/Butterfish, Monkfish, Northeast Multispecies, Northeast Skate Complex, Spiny Dogfish, Summer Flounder/Scup/Black Sea Bass, and Jonah Crab Fisheries and
(b) Implementation of the New England Fishery Management Council's Omnibus Essential Fish Habitat Amendment 2
[Consultation No. GARFO-2017-00031]

Consulting Agency: National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office, through its Protected Resources Division

Date Issued: May 27, 2021

Approved by: 
Michael Pentony
Regional Administrator

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List of Abbreviations and Acronyms

ACA	Atlantic Coastal Fisheries Cooperative Management Act
ACL	annual catch limit
ACOE	Army Corps of Engineers
ACT	annual catch target
ALWDN	Atlantic Large Whale Disentanglement Network
ALWTRP	Atlantic Large Whale Take Reduction Plan
ALWTRT	Atlantic Large Whale Take Reduction Team
AM	accountability measure
AMAPPS	Atlantic Marine Assessment Program for Protected Species
AOC	area of occurrence
ARA	Assistant Regional Administrator
ASM	at-sea monitor
ASMFC	Atlantic States Marine Fisheries Commission
ASSRT	Atlantic Sturgeon Status Review Team
ATBA	area to be avoided
AUV	autonomous underwater vehicle
BDTRP	Bottlenose Dolphin Take Reduction Plan
BOEM	Bureau of Ocean Energy Management
CA	closed area
CB	Chesapeake Bay
CCB	Cape Cod Bay
CCL	curved carapace length
CCS	Center for Coastal Studies
CFR	Code of Federal Regulations
CGOM	central Gulf of Maine
CI	confidence interval
CLF	Conservation Law Foundation
CMP	coastal migratory pelagics
COASTSPAN	Cooperative Atlantic States Shark Pupping and Nursery
COLREG	International Regulations for Preventing Collisions at Sea
COP	construction and operation plan
CPH	confirmation of permit history
CPUE	catch per unit effort
CSE	conservation spawning escapement
CV	coefficient of variation
DAM	dynamic area management
DAS	days-at-sea
DFO	Department of Fisheries and Oceans, Canada
DHRA	dedicated habitat research area
DMA	dynamic management area
DMIS	data matching and imputation system
DPS	distinct population segment
DST	decision support tool
DWH	Deep Water Horizon
EEAA	exempted educational activity authorization

EEZ	exclusive economic zone
EFH	essential fish habitat
EFP	exempted fishing permit
EGI	East Greenland and West Iceland
EGOM	eastern Gulf of Maine
EOO	extent of occurrence
EPA	Environmental Protection Agency
EPAct	Energy Policy Act of 2005
EPR	eggs per recruit
EPU	ecological production unit
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FKNMS	Florida Keys National Marine Sanctuary
FLUPSY	floating upweller system
FMP	fishery management plan
FR	Federal Register
FWRI	Fish and Wildlife Research
GAM	generalized additive model
GAR	Greater Atlantic Region
GARFO	Greater Atlantic Regional Fisheries Office
GB	Georges Bank
GCRU	Greater Caribbean Recovery Unit
GLM	generalized linear model
GOM	Gulf of Maine
GPS	global positioning system
GSC	Great South Channel
HAPC	habitat areas of particular concern
HMA	habitat management area
HPTRP	Harbor Porpoise Take Reduction Plan
IEc	Industrial Economics, Inc.
IHA	incidental harassment authorization
IMO	International Maritime Organization
INBS	index nesting beach survey
IPCC	Intergovernmental Panel on Climate Change
ISFMP	interstate fishery management plan
ITS	incidental take statement
IUCN	International Union for the Conservation of Nature
km	kilometer
kN	kilonewton
lb	pound
lbf	pounds-force
LMA	lobster management area
LOA	letter of authorization
LOF	List of Fisheries
m	meter
M/SI	mortality and serious injury

MAFMC	Mid-Atlantic Fishery Management Council
MARAD	Maritime Administration
MDDMR	Maryland Department of Marine Resources
MDMR	Maine Department of Marine Resources
MMAP	Marine Mammal Authorization Program
MMEP	Marine Mammal Exemption Program
MMHSRP	Marine Mammal Health and Stranding Response Program
MMPA	Marine Mammal Protection Act
MRIP	Marine Recreational Information Program
MSA	Magnuson-Stevens Fishery Conservation and Management Act
msb	Atlantic mackerel/squid/butterfish
MSR	mandatory ship reporting
mt	metric tons
N.J.S.A.	New Jersey Statutes Annotated
NA	North Atlantic
NADW	North Atlantic Deep Water
NAO	North Atlantic Oscillation
NASA	National Aeronautics and Space Administration
NASCO	North Atlantic Salmon Conservation Organization
NAST	National Assessment Synthesis Team
NE	northeast
NEAMAP	Northeast Area Monitoring and Assessment Program
NED	Northeast Distant
NEFMC	New England Fishery Management Council
NEFOP	Northeast Fisheries Observer Program
NEFSC	Northeast Fisheries Science Center
NEIT	Northeast Implementation Team
NFMA	Northern Fishery Management Area
NGO	non-governmental organization
NGOM	Northern Gulf of Mexico recovery unit
NLS	Nantucket Lightship
NMFS	National Marine Fisheries Service
nmi	nautical miles
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NRDA	national resource damage assessment
NRU	Northern recovery unit
NWA	Northwest Atlantic
NYB	New York Bight
OBIS-SEAMAP	Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations,
OCS	outer continental shelf
PAIS	Padre Island National Seashore
PBF	physical and biological features
PCB	polychlorinated biphenyls
PCE	primary constituent elements

PFRU	Peninsula Florida recovery unit
PIT	passive integrated transponder
PRD	Protected Resources Division
PVA	population viability analysis
RA	Regional Administrator
READ	Resource Evaluation and Assessment Division
REEF	Reef Environmental Education Foundation
RGA	restricted gear area
RMU	regional management unit
ROV	remotely operated vehicle
RPA	reasonable and prudent alternative
RPM	reasonable and prudent measure
RSA	research-set-aside
RV	reproductive value
RWSAS	Right Whale Sighting Advisory System
SA	South Atlantic
SAM	seasonal area management
SAP	special access program
SAR	stock assessment report
SARA	Species at Risk Act
SARBO	South Atlantic Regional Biological Opinion
SBRM	standardized bycatch reporting methodology
SCL	straight carapace length
SCUTES	Students Collaborating to Undertake Tracking Efforts for Sturgeon
SEIT	Southeast Implementation Team
SERO	Southeast Regional Office
SFMA	Southern Fishery Management Area
SHRU	Salmon habitat recovery unit
SMS	small mesh multispecies
SMA	seasonal management area
SNBS	statewide nesting beach survey
SNE	Southern New England
SRP	scientific research permit
SSB/R _{max}	stock biomass per recruit
SSC	Scientific and Statistical Committee
SSSRT	Shortnose Sturgeon Status Review Team
SST	sea surface temperature
STDN	Sea Turtle Disentanglement Network
STSSN	Sea Turtle Stranding and Salvage Network
T&C	terms and conditions
TAL	total allowable landings
TDD	turtle deflector dredge
TED	turtle excluder device
TRP	take reduction plan
TSS	traffic separation scheme
U.S.C.	United States Code

UME	unusual mortality event
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USN	United States Navy
UXO	unexploded ordinance
VIMS	Virginia Institute of Marine Science
VMS	vessel monitoring system
VSP	viable salmonid populations
VTR	vessel trip report
WGOM	western Gulf of Maine
YOY	young-of-the-year

1. INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq.*) requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a federal agency may affect species listed as threatened or endangered, that agency is required to consult with either NOAA's National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the species that may be affected. In instances where NMFS or USFWS are themselves proposing an action that may affect listed species, the agency must conduct intra-service consultation. Since the actions described in this document are authorized by the NMFS Greater Atlantic Regional Fisheries Office (GARFO), this office has requested formal intra-service section 7 consultation.

Per an October 17, 2017, memorandum (memorandum from Kimberly Damon-Randall, ARA for Protected Resources, to Michael Pentony, ARA for Sustainable Fisheries), NMFS GARFO has reinitiated formal intra-service consultation¹ on the authorization of fisheries managed by NMFS under their respective fishery management plans (FMP) issued under the authority of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and, for the American lobster and Jonah crab fisheries, permitted and operated through implementing regulations compatible with the interstate fishery management plans (ISFMP) issued under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (ACA). Fisheries included in the reinitiation are the following: (1) American lobster, (2) Atlantic bluefish, (3) Atlantic deep-sea red crab, (4) mackerel/squid/butterfish, (5) monkfish, (6) Northeast multispecies, (7) Northeast skate complex, (8) spiny dogfish, and (9) summer flounder/scup/black sea bass fisheries. In addition, we have initiated consultation on the Jonah crab fishery (see section 2.3), which has not previously undergone section 7 consultation. These fisheries are collectively referred to as "the fisheries," hereinafter.

The Atlantic herring (primarily purse seine and mid-water trawl gear), surfclam/ocean quahog (primarily hydraulic clam dredge gear), and tilefish (primarily bottom longline and rod/reel gear) FMPs are not included in this biological opinion because interactions with ESA-listed species in these fisheries have not been documented, are extremely unlikely, or the gear is not known to interact with protected species. Given this information, reinitiation was not triggered for these fisheries. In addition, the Atlantic Sea Scallop FMP was considered in a biological opinion dated July 12, 2012 and most recently amended on November 27, 2018. On February 14, 2020, NMFS reinitiated consultation on the Atlantic Sea Scallop FMP (memorandum from Jennifer Anderson, ARA for Protected Resources, to Sarah Bland, ARA for Sustainable Fisheries, February 19, 2020).

As described in the October 2017 Memorandum, reinitiation of the consultations was necessary given new information on the status of the North Atlantic right whale (Pace et al. 2017). In addition, the North Atlantic right whale reinitiation trigger for the biological opinion on the Northeast multispecies, monkfish, spiny dogfish, Atlantic bluefish, Northeast skate complex, mackerel/squid/butterfish, and summer flounder/scup/black sea bass fisheries ("Batched Opinion")

¹ Consultation No. GARFO-2017-00031

was exceeded, and preliminary information in the draft 2017 Marine Mammal Stock Assessment Report (SAR) (Hayes 2018) indicated the right whale reinitiation trigger for the biological opinion for the American lobster fishery would also be exceeded (memorandum from Kimberly Damon-Randall, ARA for Protected Resources, to Michael Pentony, ARA for Sustainable Fisheries, October 17, 2017). The red crab fishery biological opinion does not contain reinitiation triggers for large whales; however, it uses trap/pot gear equipped with vertical lines similar to that used in the lobster fishery. In accordance with section 7 of the ESA, as amended, this document represents NMFS' biological opinion (Opinion) on the authorization of these fisheries and their effects on ESA-listed species under NMFS jurisdiction.

2. CONSULTATION HISTORY

2.1. Overview of Past Fishery Consultations

All fisheries, with the exception of Jonah crab, included in the action have previously undergone formal consultation (Table 1). A formal consultation is conducted when an action may affect and is likely to adversely affect an ESA-listed species or critical habitat. The product of a formal consultation is a biological opinion that determines if the action is likely to jeopardize the continued existence of any ESA-listed species or result in the destruction of adverse modification of critical habitat. The table below lists the formal consultations previously completed on these fisheries. If an opinion determines that the proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat, it must include a "reasonable and prudent alternative (RPA)" that avoids the likelihood of jeopardy or adverse modification or otherwise indicate that to the best of the agency's knowledge, there are no RPAs. If the analysis concludes with a determination that the proposed action is not likely to jeopardize a listed species or destroy or adversely critical habitat and incidental take of listed species is reasonably certain to occur, then the biological opinion includes an incidental take statement (ITS) with the anticipated level of take of the listed species and "reasonable and prudent measures (RPM)" to avoid and minimize the take. Additional information on the conclusions is included in the individual opinions. In addition to the formal consultations outlined below, the effects of FMP Amendments or Framework Adjustments (Frameworks), as well as other management measures (e.g., marine mammal take reduction plans (TRP)) were evaluated to determine if reinitiation was triggered with any of these actions. If these actions did not trigger reinitiation of ESA consultation, they are not included in the list of completed consultations (Table 1) below.

Table 1: History of formal consultations completed on FMPs or marine mammal TRPs and the jeopardy determinations of those consultations
When jeopardy was found, the species that was jeopardized is indicated in parentheses.

FMPS/ISFMP	Formal Consultation Actions	Year	Jeopardy?
American Lobster	Initial consultation on implementation of Marine Mammal Exemption Program (MMEP)	1989	No
	Reinitiation to consider measures designed to prevent overfishing	1994	No
	Reinitiation on lobster fishery due to right whale deaths off FL/GA	1996	Yes (for right whale)
	Supplemented 1996 RPA	1997	No
	Consultation on ISFMP (management authority transferred Jan 2000)	1998	No
	Reinitiation to consider new information on right whale status and changes to the ALWTRP.	2001	Yes (for right whale)
	Reinitiation due to fishery management actions	2002	No
	Reinitiation due to changes to the ALWTRP	2010	No
	Reinitiation due to listing of Atlantic sturgeon distinct population segments	2012	No
	Reinitiation due to new marine mammal stock assessment and modifications to the ALWTRP	2014	No
ALWTRP	Consultation on ALWTRP	1997	No
Multispecies ¹	Initial consultation	1986	No
	Reinitiation due to effort reduction programs in the fishery	1993	No
	Reinitiation due to fishery management actions	1996 (Feb)	No
	Reinitiation due to fishery management actions	1996 (Dec)	Yes (for right whale)
	Reinitiation due action implementing a gillnet prohibition	1997	No
	Reinitiation concurrent with the initial formal consultation on the ALWTRP	1997	No
	Reinitiation due to multiple entanglements of right whales	2001	Yes (for right whale)
	Reinitiation due to changes to the ALWTRP and sea turtle bycatch estimates	2010	No
Monkfish ¹	Initial consultation, including gillnet modifications under the ALWTRP	1998	No
	Reinitiation due to new information on the status of right whales and exceedance of the ITS for sea turtles	2001	Yes (for right whale)

FMPs/ISFMP	Formal Consultation Actions	Year	Jeopardy?
	Reinitiation due to specifications deferring measures that would have effectively eliminated the directed monkfish fishery	2002	No
	Reinitiation due to new fishery management measures	2003	No
	Reinitiation due to the elimination of the SAM and DAM programs and new information on effects to sea turtles	2010	No
Spiny Dogfish ¹	Initial consultation	1999	No
	Reinitiation due to new information on entanglement of right whales	2001	Yes (for right whale)
	Reinitiation due to changes in the ALWTRP, including replacing the SAM and DAM programs	2010	No
Bluefish ¹	Initial formal consultation	1999	No
	Reinitiation due to new information on whale interactions and sea turtle bycatch	2010	No
Skate Complex ¹	Initial consultation	2003	No
	Reinitiation due to new information on whale and turtle interactions and sea turtle bycatch	2010	No
Atlantic Mackerel/Squid/Butterfish ¹	Initial consultation for implementation of MMEP	1990	No
	Formal consultation due to information on possible sea turtle interactions	1999	No
	Reinitiation due to new information on sea turtle bycatch	2010	No
Summer Flounder/Scup/Black Sea Bass ¹	Initiation of consultation on the summer flounder FMP	1988	No
	Reinitiated due to new information on sea turtle takes	1991	Yes (for Kemp's ridley)
	Reinitiation due to proposal to include scup and black sea bass in FMP	1996	No
	Reinitiation due to proposed increased landing limits in each fishery	2001	No
	Reinitiation due to loggerhead bycatch estimates and new information on the ALWTRP/List of Fisheries on scup/black sea bass trap/pot fishery	2010	No
Red crab	Initial formal consultation on FMP	2002	No
Batched Fisheries	Reinitiation due to listing of Atlantic sturgeon distinct population segments	2013	No

¹ The bluefish, Atlantic mackerel/squid/butterfish, monkfish, Northeast multispecies, Northeast skate complex, spiny dogfish, and summer flounder/scup/black sea bass fisheries were combined into a "batched fisheries" opinion in 2013.

2.2. Cause for Reinitiating

Reinitiation of formal consultation is required where discretionary control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action (50 CFR 402.16). On September 18, 2017, new information indicated North Atlantic right whale abundance has been in decline since 2010 (Pace et al. 2017). This differs from the information analyzed in the previous biological opinions listed above and may reveal effects from the fisheries analyzed in the Batched Fisheries, Lobster, and Red Crab Biological Opinions that may not have been previously considered.

In addition, the Lobster and Batched Fisheries Opinions contain different numerical mortality and serious injury (M/SI) reinitiation triggers for large whales. Based on information in the 2016 SAR (Hayes et al. 2017a), the reinitiation trigger for Batched Fisheries Biological Opinion was exceeded. At the time of reinitiation, preliminary information in the Draft 2017 SAR (Hayes 2018) indicated that the reinitiation trigger for the American Lobster Biological Opinion would also be exceeded. The Red Crab Biological Opinion does not contain reinitiation triggers for large whales; however, the red crab fishery uses trap/pot gear with vertical lines similar to that used in the lobster fishery. Therefore, we are including it in this analysis to more comprehensively evaluate impacts from trap/pot gear. Taking into consideration the above information, we reinitiated formal section 7 consultation on the fisheries due to the availability of new information that may reveal effects of the action that may not have been previously considered.

2.3. Initiation of Consultation

Jonah crab was not managed under a coast-wide management plan until 2015, and therefore, NMFS has not conducted an ESA section 7 consultation on this fishery. In 2015, the Atlantic States Marine Fisheries Commission (Commission) approved the ISFMP for Jonah crab. Since that time, the Commission has made slight modifications to the management measures (see: <http://www.asmfc.org/species/jonah-crab>). There is a high degree of overlap between the Jonah crab and American lobster fisheries with approximately 95 percent of Jonah crab landings caught in lobster traps (ASMFC 2015a, b). Based on this, the Jonah crab ISFMP restricts the targeted harvest of Jonah crab to lobster trap harvesters and relies on trap regulations in place for the lobster fishery to regulate the targeted Jonah crab trap fishery. Under the umbrella of the Commission, states and federal government collaboratively manage the Jonah crab fishery through the ISFMP for Jonah crab. Federal regulations that complement the Commission's Plan were proposed on March 22, 2019 (84 FR 10756). NMFS has implemented regulations to limit directed Jonah crab fishing access and harvest to those harvesters who have an existing limited-access American lobster permit. Other gears may land an incidental amount of Jonah crabs (84 FR 61571, November 13, 2019). As the regulations represent a federal action and because the gear type used in the fishery is the same as gear known to interact with ESA-listed species, we are including the federal Jonah crab fishery in this consultation.

The proposed action also includes management measures (see section 3.3) recently implemented in multiple New England Fishery Management Council FMPs (Atlantic deep sea red crab Atlantic herring, Atlantic salmon, Atlantic sea scallop, monkfish, Northeast multispecies, and skate) under the Council's Omnibus Essential Fish Habitat Amendment 2 (Habitat Amendment) (68 FR 15240, April 9, 2018). NMFS has consulted under the ESA on these FMPs. In addition to the formal consultations listed in Table 1, NMFS has formally consulted on the Atlantic sea scallop FMP (NMFS 2012b, amended 2018) and informally on the Atlantic herring (NMFS 2010b). Conservation Law Foundation challenged the rule implementing approved measures of the Omnibus Essential Fish Habitat Amendment 2 (68 FR 15240, April 9, 2018) and, on October 28, 2019, the court enjoined NMFS from allowing gillnet fishing within the former boundaries of the Nantucket Lightship and Closed Area 1 Groundfish Closure Areas (CLF v. Ross, Civil Action No. 18-1087 (JEB)) until NMFS fully complied with the ESA and MSA. Per this Order, NMFS is including the implementation of the Habitat Amendment so that we can comprehensively analyze impacts to ESA-listed species resulting from implementation of this Amendment.

3. DESCRIPTION OF THE PROPOSED ACTION

3.1. Authorization of the Fisheries

The proposed action is the authorization of the following fisheries, two managed under ISFMPs and eight managed under MSA FMPs: (1) American lobster, (2) Atlantic bluefish, (3) Atlantic deep-sea red crab, (4) Jonah crab, (5) mackerel/squid/butterfish, (6) monkfish, (7) Northeast multispecies, (8) Northeast skate complex (9) spiny dogfish, and (10) summer flounder/scup/black sea bass fisheries. Analysis of these fisheries will include all vessels with one or more federal permits for species included under these FMPs and ISFMPs. Through these permits, NMFS would authorize fishing in federal waters (> 3 nmi from shore) in the action area.

Previous biological opinions completed on the fisheries have assessed the effects of the fisheries on ESA-listed species and designated critical habitat (NMFS 2002a, 2013b, 2014b). As the data available at the time the biological opinions were written did not allow us to separate out the effects from federally-permitted vessels fishing in state waters from those fishing in federal waters, these past opinions considered the operation of the fisheries to include all federally-permitted vessels fishing in state and federal waters in the action area. With new tools and data available, we are able to refine our effects analysis to evaluate fishing operations in federal waters. As NMFS does not authorize, fund, or carry out fishing activities in state waters, these activities are not considered part of the proposed action in this Opinion. Dually permitted vessels (i.e., possessing both a state and federal permit) can still operate in state waters without federal authorization. Consequently, this Opinion is evaluating effects from fishing activities (i.e., entanglement/bycatch) by vessels with federal permits in federal waters only. The effects analysis will consider the effects to ESA-listed species of transits through state and federal waters to the fishing grounds in federal waters.

In assessing the authorization of these fisheries, we consider how they operate under current requirements of the MSA, ACA, ESA, and the Marine Mammal Protection Act (MMPA). In addition, NMFS is proposing regulations as part of the Atlantic Large Whale Take Reduction Plan (ALWTRP) that will modify the American lobster and Jonah crab trap/pot fisheries. Changes in the operation of these fisheries resulting from the proposed ALWTRP measures are included in our analysis in this Opinion.

We batched the ten fisheries into one comprehensive consultation to evaluate effects across the federally-permitted fisheries by gear type. This allows us to more accurately describe and evaluate interactions between NMFS-authorized fishing activities and ESA-listed species and to more holistically focus our efforts on reducing interactions and minimizing impacts resulting from interactions that do occur. Furthermore, we are implementing the recommendation of NMFS' Northeast Fisheries Science Center (NEFSC) to evaluate protected species impacts by fishing fleets in which multiple fisheries are prosecuted, rather than on a fishery-by-fishery basis (memorandum from Michael Simpkins, NEFSC READ Chief, to Jennifer Anderson, Acting ARA for Protected Resources, November 6, 2018).

3.2. North Atlantic Right Whale Conservation Framework for Federal Fisheries in the Greater Atlantic Region

NMFS has developed a North Atlantic Right Whale Conservation Framework for Fisheries in the Greater Atlantic Region (Framework) to further reduce M/SI in the federal fisheries (Appendix 1). Serious injury includes any injury that will likely result in mortality (50 CFR 229.2). This Framework outlines NMFS' commitment to use its authorities to implement measures that are necessary for the recovery of right whales, while providing a phased approach and flexibility to the fishing industry. It should be noted that while the MMPA and ESA have different objectives, they work together to protect and recover North Atlantic right whales, restoring stocks to sustainable levels. As the MMPA measures may also contribute to progress towards the ESA goals described below, they will be considered in implementing the Framework. The Framework will further modify how the federal fixed gear fisheries operate and, as such, these changes are considered as part of the proposed action.

The Framework reduces M/SI in federal fisheries over a 10-year period to an average of 0.136 M/SIs annually. The Framework identifies the level of reductions in M/SI that NMFS is committed to achieve in order to meet its mandates (Table 2). At this time, the Framework does not specify particular measures. If gear and operational measures cannot reach the targets of the Conservation Framework, NMFS has the authority to implement closures (partial/complete or seasonal) to reduce risk, if needed. The Framework is predicated on maximizing the likelihood of North Atlantic right whale recovery success. It recognizes that efforts to reduce M/SI from other sources are underway, that there is uncertainty associated with available data, and that environmental conditions are changing. To maintain the maximum likelihood of recovery success over time, the Framework utilizes an adaptive framework and allows for revisions as additional information becomes available or should any of the assumptions require revisions. To achieve this, a comprehensive evaluation will be completed in 2025/2026. If M/SI from sources other than the federal fisheries (e.g., U.S. vessel strikes, U.S. state fisheries, and/or Canadian vessel strikes and fisheries) are reduced, new information on the apportionment of M/SIs to source becomes available, or there are improvements in the species' status, NMFS will determine whether the Framework needs to be fully implemented to achieve its conservation goals. If specific criteria identified in the Framework are met, then measures required in the federal fisheries will be reduced (see Table 2). Any changes to the Framework as a result of this evaluation will still ensure that reductions in North Atlantic right whale M/SIs in the federal fisheries achieve the level needed to ensure that the fisheries are not impacting the survival and recovery of the species.

The Framework actions include the current ALWTRP rulemaking and three additional rulemakings over the next ten years. As described below, NMFS will evaluate population metrics and threats during the Framework implementation.

Table 2: Actions to be taken under the Framework

Phase	Year	Framework Action Description
	Annually	Provide updates, as appropriate, on the implementation of the Framework to the New England and Mid-Atlantic Fishery Management Councils, Atlantic States Marine Fisheries Commission, and ALWTRT.
1	2021	NMFS implements the MMPA ALWTRP rulemaking focused on 60 percent reduction in right whale M/SI incidental to American lobster and Jonah crab trap/pot fisheries. In federal waters, this action reduces M/SIs, on average annually, to 2.69. Implementation for certain measures will begin in 2021; others will be phased over time.
2	2023	NMFS implements rulemaking to reduce M/SI in federal gillnet and other pot trap (i.e., other than lobster and Jonah crab fisheries included in Phase 1) fisheries by 60 percent, reducing M/SI, on average annually, to 2.61. The ALWTRT will convene in 2021 to recommend modifications to the ALWTRP to address risk in the remaining fixed gear fisheries. This phase will consider how any changes to the ALWTRP contribute to achieving the target reduction under this Framework.
Evaluation	2023-2024	NMFS evaluates any updated or new data on right whale population and threats to assess progress towards achieving the conservation goals of this Framework. At this time, we will also assess measures taken by Canada to address M/SI in Canadian waters.
3	2025	NMFS implements rulemaking to further reduce M/SI by 60 percent in all federal fixed gear fisheries, reducing M/I, on average annually, to 1.04.
Evaluation	2025-2026	NMFS evaluates measures implemented in 2025 action as well as new data on right whale population and threats to assess progress towards achieving the conservation goals of this Framework. Based on the results of this evaluation, NMFS will determine the degree to which additional measures are needed to ensure the fisheries are not appreciably reducing the likelihood of survival and recovery. As described above, if actions outside the federal fisheries reduce risk to right whales by 0.5 M/SI on average annually (1 whale every two years), the M/SI reduction requirement in Phase 4 will be reduced from 87 percent to 39 percent. If M/SI from other sources is reduced by greater than one M/SI on average annually, we will evaluate whether further action in the federal fisheries is needed.
4	2030	In accordance with the goals identified in the 2025-2026 evaluation, NMFS implements regulations to further reduce M/SI (up to 87 percent) in fixed gear fisheries.

3.2.1. *Proposed measures under the Atlantic Large Whale Take Reduction Plan*

The ALWTRP, last amended in 2015, includes fishing gear modifications and seasonal area closures to reduce the risk that large whales will die or be seriously injured as a result of entanglement in U.S. commercial fishing gear. The ALWTRP also includes requirements for marking gear to improve our understanding of where entanglement incidents occur. The nature and extent of the gear modification and seasonal closure requirements varies by jurisdiction (i.e. state waters, geographic regions, and within federal waters) such that risk reduction is distributed throughout the U.S. range (see section 5.4.5 for more information on the current requirements). NMFS is proposing to modify the requirements of the ALWTRP. Because these modifications will change the operations of the lobster and Jonah crab fisheries described above, we are considering how the proposed measures will alter the fisheries in this Opinion.

The Framework includes the current proposed ALWTRP measures (Table 3). These measures aim to reduce right whale entanglement risk posed by Northeast U.S. lobster and Jonah crab trap/pot gear by at least 60 percent². Measures include operational requirements, seasonal closures, and gear modifications. “Trawling up” requirements increase the number of traps per trawl according to distance from shore (Table 3) to reduce the number of vertical lines fished. In Area 3, the proposed measures would increase the length of the trawl from 1.5 nmi (2.78 km) to 1.75 nmi (3.24 km) to accommodate the proposed trawling up requirements. If some vessels cannot accommodate 45 trap/trawls, the proposed measures allow consideration of permit conditions to vary trap/trawl requirements across the Area 3 fleet to achieve an average of 45 traps/trawl.

The proposed ALWTRP measures would establish two new seasonal restricted areas, the Lobster Management Area One Restricted Area Offshore of Maine and the Massachusetts South Island Restricted Area (Table 3, Figure 1). Fishing for lobster or crab with gear that uses persistent buoy lines would be prohibited during the restricted season. Seasonal restrictions in the existing Massachusetts Bay and Great South Channel restricted areas would also be modified to prohibit fishing with persistent buoy lines rather than a complete closure that prohibits the harvest of lobster and Jonah crab. While fishermen would still be required to get exemptions from the requirements for surface gear marking under the lobster ISFMP, with those exemptions commercial fishing using “ropeless fishing” technology would be permitted in these areas. In addition, state waters of the Massachusetts Bay Restricted Area would be closed an extra month, through May, with the potential to open earlier in May when surveys indicate whales have left the area. The Cape Cod Bay and Outer Cape State Water areas represent soft openings of the Massachusetts Bay Restricted Area as the closure would be continued until no more than three whales are left as confirmed by surveys.

The gear modifications proposed include weak inserts or weak rope. The depth at which the insert must be placed is based on distance from shore. Alternatively, full weak rope would be required to the same depth on the line (Table 3). Ropes retrieved from right whale entanglements from 1994 to 2010 had breaking strengths that were 1,700 pound-force (lbf) (7.56 kiloNewtons) (kN)) or higher; adult right whales were found in rope strengths of 4,496 lbf (20 kN) and higher

² The ALWTRP proposed rule has a risk reduction greater than 60 percent as it accounts for risk reduction previously achieved in Massachusetts state waters. In this Opinion, we analyze only the future risk reduction measures which will achieve a 58.1 percent reduction in risk to right whales.

(Knowlton et al. 2016). This suggests right whales may be able to break free of rope that is weaker than 1700 lbf. This is consistent with estimates of the force that large whales are capable of applying, based on an axial locomotor muscle morphology study (Arthur et al. 2015). The authors suggested that the maximum force output for a large right whale is likely sufficient to break line at that breaking strength (Arthur et al. 2015). That study and others recognized that success breaking free is also somewhat dependent on the complexity of the entanglement (van der Hoop et al. 2017b). The proposed measures would also include additional gear marking requirements. Measures proposed by the states of Maine and Massachusetts are described in the *Cumulative Effects* section.

Table 3: Proposed measures under the ALWTRP proposed rule

Component	Area	Proposed Measures
Trawl up/Line Reduction	ME exempt area – 3 nmi	3 traps/rawl
	ME 3 – 6 nmi	8 traps/rawl
	Outside of ME 3-6 nmi	No change (10 traps/rawl maintained)
	Area 1 6 – 12 nmi	15 traps/rawl
	Area 2, Outer Cape Cod 3 – 12 nmi	15 traps/rawl
	Area 1, 2 over 12 nmi	25 traps/rawl
	MA state waters, all zones	No singles on vessels longer than 29' permits after 1/1/2020
	Area 3	45 traps/rawl, increase maximum trawl length to 1.75 nmi
Closures	Existing closures become buoy lineless	Allow EFPs for ropeless fishing, with conditions that might restrict areas and would include vessels speed and observer requirements, monitoring, and reporting requirements
	Lobster Management Area One Restricted Area	Fishing for lobster or Jonah crab with persistent buoy lines would be prohibited from Oct through Jan offshore of Maine at the Area 1/3 border and across Maine Zones C/D/E
	Massachusetts South Islands Restricted Area	South of Nantucket, Feb through Apr
	State waters of Massachusetts Bay Restricted Area	State water closed through May until no more than 3 whales remain as confirmed by surveys
Weak Link Modification	Northeast Region Trap/Trawl Management Area	Retain current weak link/line requirement at surface system but allow it to be at base of surface system or, as currently required, at buoy

Component	Area	Proposed Measures
Weak Line	ME exempt area – 3 nmi	2 weak insertions, at 25 percent and 50 percent down line
	NH/MA/RI Coast – 3 nmi	1 weak insertion 50 percent down the line
	All areas 3 – 12 nmi	2 weak insertions, at 25 percent and 50 percent down line
	Area 1, 2, Outer Cape Cod over 12 nmi	1 weak insertion 35 percent down the line
	Area 2	Same weak insertions as above based on distance from shore
	Area 3	One endline weak within the top 75 percent year round

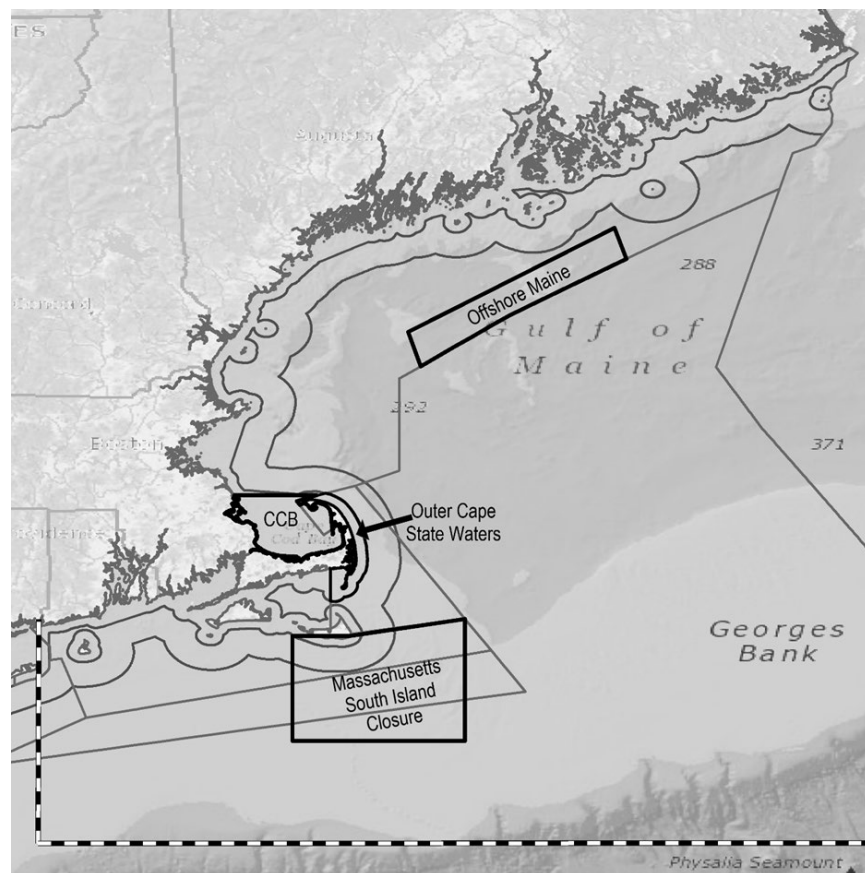


Figure 1: Proposed closures under the ALWTRP

3.3. NEFMC Omnibus Essential Fish Habitat Amendment 2

The proposed action also includes management measures recently implemented in multiple New England Fishery Management Council FMPs (Atlantic Deep-Sea Red Crab, Atlantic Herring, Atlantic Salmon, Atlantic Sea Scallop, Monkfish, Northeast Multispecies, and Skate) under the Council's Omnibus Essential Fish Habitat Amendment 2 (Habitat Amendment) (83 FR 15240, April 9, 2018). The Habitat Amendment updated the essential fish habitat (EFH) designations, designated habitat area of particular concern (HAPC), and updated prey species lists and non-

fishing habitat impacts. It also revised the system of year-round closed areas that restrict some fishing gears in order to protect vulnerable habitat, and it established a system of Dedicated Habitat Research Areas (DHRA). Lastly, it implemented administrative measures for ongoing review of these areas.

NMFS approved the majority of the Council's Habitat Amendment recommendations (Letter from John Bullard, RA GARFO to Dr. Quinn, Chairman NEFMC, January 3, 2018). NMFS approved all the updated EFH designations, all the recommended HAPC designations, the majority of the habitat management area (HMA) recommendations, all the DHRA recommendations, all the seasonal spawning recommendations, and both of the framework and administrative recommendations. Because the EFH and HAPC designations are not codified, those updates became effective upon the Amendment decision. On April 9, 2018, NMFS published a final rule (83 FR 15240) implementing the approved management measures in the Omnibus Essential Fish Habitat Amendment 2.

In addition to the EFH designation updates, this action approved all of the Council's recommendations for HAPC, including the current Atlantic Salmon HAPC and the Northern Edge Juvenile Cod. In addition, the action approves the following new HAPCs: Inshore Juvenile Cod HAPC; Great South Channel Juvenile Cod HAPC; Cashes Ledge HAPC; Jeffreys Ledge/Stellwagen Bank HAPC; Bear and Retriever Seamount HAPC; and 11 canyon or canyon complexes.

Approved measures (see Figure 2 for areas) included:

- Establish the (Small) Eastern Maine HMA, closed to mobile bottom-tending gear;
- Maintain Cashes Ledge (Groundfish) Closure Area, with current restrictions and exemptions;
- Modify the Cashes Ledge Habitat Closure Area, closed to mobile bottom-tending gear;
- Modify the Jeffreys Ledge Habitat Closure Area, closed to mobile bottom-tending gear;
- Establish the Ammen Rock HMA, closed to all fishing, except lobster traps;
- Establish the Fippennies Ledge HMA, closed to mobile bottom-tending gear;
- Maintain the Western Gulf of Maine Habitat Closure Area, closed to mobile bottom-tending gear;
- Modify the Western Gulf of Maine Groundfish Closure Area to align with the Western Gulf of Maine Habitat Closure Area, with current restrictions and exemptions;
- Exempt shrimp trawling from the designated portion of the northwest corner of the Western Gulf of Maine Closure Areas;
- Add the Gulf of Maine Roller Gear restriction as a habitat protection measure;
- Remove the Closed Area I Habitat and Groundfish Closure Area designations;
- Remove the Nantucket Lightship Habitat and Groundfish Closure Area designations;
- Establish the Great South Channel HMA, closed to mobile bottom-tending gear throughout and clam dredge gear in the defined northeast section. Clam dredge gear would be permitted throughout the rest of the HMA for 1 year while the Council considers restrictions that are more refined;
- Establish the Stellwagen and Georges Bank DHRAs, with a 3-year review requirement, with the measures recommended;
- Establish the Winter Massachusetts Bay Spawning Closure, closed to gears capable of catching groundfish from November 1-January 31 of each year;

- Establish the Spring Massachusetts Bay Spawning Closure, in Block 125, closed to commercial and recreational gears capable of catching groundfish from April 15-30 of each year;
- Establish Closed Area I North and Closed Area II seasonal closures, closed to commercial gears capable of catching groundfish, except scallop dredges, from January 1-April 15 of each year;
- Remove the May Georges Bank spawning closure;
- Consider adjustments to the habitat management areas in framework adjustments; and
- Establish a system to review habitat management measures at least every 10 years.

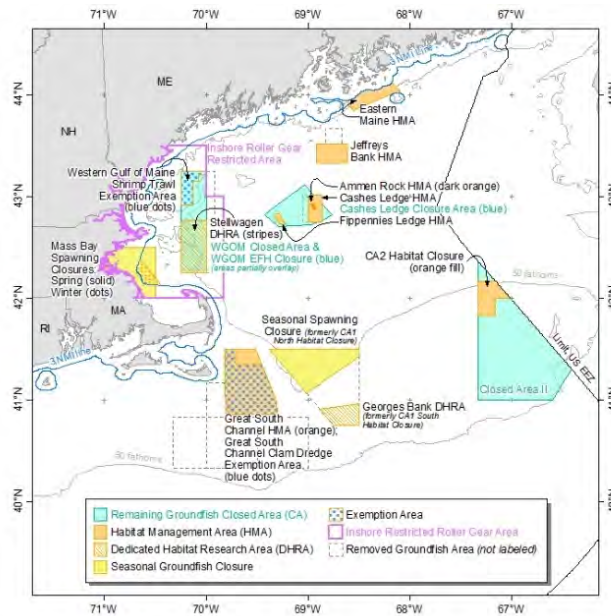


Figure 2: Omnibus Habitat Amendment 2 closures

As described above, the Conservation Law Foundation challenged the rule implementing approved measures of the Omnibus Essential Fish Habitat Amendment 2 (68 FR 15240, April 9, 2018) and, on October 28, 2019, the court enjoined NMFS from allowing gillnet fishing within the former boundaries of the Nantucket Lightship and Closed Area 1 Groundfish Closure Areas. The Amendment had resulted in the opening of these areas. Currently, some measures approved under this action remain in place, while others (i.e., the opening of the Nantucket Lightship and Closed Area 1 Habitat and Groundfish closure areas to gillnet gear) have been suspended and prior regulations that prohibited gillnet gear from fishing in these areas were restored (84 FR 68798, December 17, 2019). In order to fully evaluate the measures, this analysis will compare the impacts resulting from implementation of all approved measures to impacts occurring before the measures were approved and implemented.

3.4. Description of the Gear Used in the Fisheries Managed Under the FMPs

The level of data available on the fisheries considered in this Opinion varies depending on their characteristics and operation; therefore, the data presented below vary. In each case, this information is the best available for each FMP. For example, the following three fisheries provide a contrast in available information:

1. The Northeast Multispecies fishery requires most permit holders to use a vessel monitoring system (a GPS-type system) to track vessels and requires all permit holders to complete vessel trip reports (VTR). Thus, a high degree of information is available on the participation in and effort by this fishery.
2. The summer flounder fishery requires permit holders to complete VTRs. Thus, a moderate degree of information is available on the participation in and effort by this fishery.
3. The American lobster fishery does not have any reporting requirements for federal permit holders, though federal lobster permit holders may have reporting requirements if issued permits for other fisheries. As of 2018, approximately half of all lobster permit holders are not required to submit VTRs, the vast majority of whom fish in the Gulf of Maine which is responsible for the majority of landings. Thus, we must rely on other available information (e.g., number of permits, trap tag orders) as a proxy for participation in and effort by this fishery.

Specifics for each fishery are included in the following sections.

Sink gillnets, hook and line (i.e., handlines, bottom longline, and rod and reel), pots/traps, and bottom trawls are the predominant gears used in the fisheries included in this Opinion. The use of other gears (e.g., pound nets, pelagic longline, mid-water and paired trawls, haul and purse seines, and troll) occurs very infrequently or not at all. GARFO analysis of 2019 landings in the 10 FMPs indicated that mid-water and pair trawls in the mackerel, squid, butterfish fishery accounted for approximately 4 percent of landings under the FMP. All other gears accounted for no more than 0.1 percent of landings under the 10 FMPs. Therefore, we do not believe the limited use of these gears in the fisheries will have any effects on the ESA-listed species, and we will not discuss them further in this Opinion.

Sink gillnets are panels of net with a top rope, referred to as the head rope or floating line, and a bottom rope, referred to as the lead line. Floats are attached to floating line and the lead line is weighted to help maintain the vertical profile of the net in the water column. Multiple net panels are typically attached together to form a net string. Buoy lines attached to each end of a net string rise to the surface to mark the location of the gear. When fished in this configuration, these gillnets are referred to as ‘stand-up’ gillnets. In some areas, “tie-downs” (wire used between the floatline and the lead line as a way to create a pocket or bag of netting to trap fish) are used to reduce the vertical profile of gillnets. Fishermen may use tie-downs in order to better entangle bottom species (e.g., monkfish, flounder) in the gillnet. The minimum mesh size varies, depending on the species targeted. Vessels are also limited, as described below, in the number of gillnets that they can deploy, based on fishery. Based on where and when gillnet gear is set, gillnets must also comply with gear regulations in the ALWTRP (50 CFR 229.32), the Harbor Porpoise Take Reduction Plan (50 CFR 229.33, 50 CFR 229.34), the Bottlenose Dolphin Take Reduction Plan (50 CFR 229.35), and sea turtle regulations (50 CFR 223.206). Described more fully in section 5.4.5, 5.4.8, and 5.4.9, the take reduction plans include gear marking, pinger, buoy and groundline, storage, weak link requirements, and closures. Sea turtle requirements are described in section 5.4.4.

Hook and Line encompasses a variety of gears, but the defining characteristic of these gears is the use of artificial or natural bait placed on a hook, which is fixed to the end of a length of fishing line. The most basic hook and line gear types are handline and rod and reel, which use a

single line with few or single baited hooks, brought to the appropriate depth by lead or other weights. Handline is spooled by hand, while line set out by a rod and reel is spooled mechanically. Both of these gears utilize a technique referred to as jigging, wherein a specialized lure is jerked vertically in order to attract and hook fish. Jigging can be conducted by hand or by automatic jigging equipment. Bottom longline have a mainline weighted to the seafloor with buoy lines marked by flags on either end, called high flyers. Leaders, called gangions or snoods, with baited hooks are attached to the mainline. Vessels are also limited in the number, shape, and size of hooks that can be set.

Trap/pot gear consists of the trap, buoy/surface line, groundline, buoys, and/or highflyers. The traps rest on the bottom and may or may not be baited. Buoy line(s) connect to the trap and rise vertically to the surface. Traps/pots may be set singly with each trap having its own surface line and buoy or fished in trawls consisting of two or more traps per trawl. A trawl consists of two or more traps attached to a single groundline, with at least one, but most often two, surface lines and buoys. The surface lines are typically at an end of a series of traps to mark the location of the gear. Trap gear configuration regulations differ based on jurisdiction. Offshore gear includes additional line at or near the surface to connect a radar reflector highflyer to one of the buoys to aid in the relocation and "visibility" of the gear. Traps/pots must also comply with the gear regulations in the ALWTRP (50 CFR 229.32), including buoy and groundline, storage, weak link, and traps per trawl requirements.

Bottom trawls are typically cone-shaped nets towed on the bottom. Large, rectangular doors attached to the two cables keep the net open while deployed. At the bottom of the trawl mouth is the footrope or ground rope that can bear many heavy steel weights (bobbins) to keep the trawl on the seabed. In addition, bottom trawls may have large rubber discs or steel bobbins (rockhoppers) that ride over structures such as boulders and coral heads that might otherwise snag the net. The constricted posterior netting of a bottom trawl that retains the catch is the codend. Nets are towed at a speed of 3 to 5 knots on average. Duration of tows varies, but averages 3 to 5 hours. The minimum mesh size for bottom trawls varies, depending on the target species. The summer flounder trawl fishery must also comply with gear requirements in the sea turtle regulations (50 CFR 223.206).

3.4.1. *Description of the Current American Lobster and Jonah Crab Fisheries*

The states and federal government manage American lobster through the Atlantic States Marine Fisheries Commission under Amendment 3 to the ISFMP and its Addenda (I - XXIV). The Plan identifies seven Lobster Management Areas (Areas 1, 2, 3, 4, 5, 6, and the Outer Cape) and two stocks (Gulf of Maine/Georges Bank (GOM/GB) and Southern New England (SNE)), as depicted in Figure 3. Each management area has different effort control restrictions, such as trap limits, minimum/maximum sizes, gear requirements, and closed seasons (Table 4).

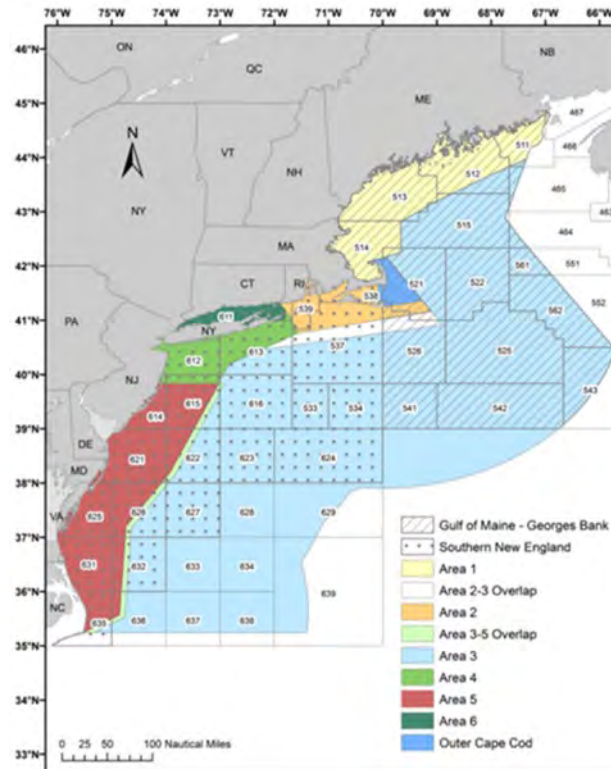


Figure 3: Lobster management and stock areas

Table 4: Summary of lobster trap limits in management areas

Management Measure	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Outer Cape
Trap Limits	800	Permit-specific, not to exceed 800	Permit-specific, not to exceed 1,945	Permit-specific, not to exceed 1,440	Permit-specific, not to exceed 1,440	State waters only	Permit-specific, not to exceed 800

Lobsters occur in coastal waters from Maine south through North Carolina and are caught at depths of 15-1,000 ft (4.6-304.8 m). The lobster fishery is active year round, with greater effort inshore during the spring/summer and offshore in the fall/winter. Landings typically follow a seasonal pattern that is associated with the biological cycle of the American lobster, much of which is temperature-dependent. There are four restricted gear areas (RGAs) that are alternatively closed to either trap or mobile gear on a seasonal basis. Mobile gear vessels and trap harvesters agreed upon these closures to reduce gear conflicts (Table 5, Figure 4). These areas run west to east along the 50-fathom contour, south of Rhode Island.

Table 5: Summary of restricted gear areas

Restricted Gear Area	Area Closed to Mobile Gear	Area Closed to Lobster Fixed Gear
1	October 1 st – June 15 th	June 16 th – September 30 th
2	November 27 th – June 15 th	June 16 th – November 26 th
3	June 16 th – November 26 th	January 1 st – April 30 th
4	June 16 th – September 30 th	N/A

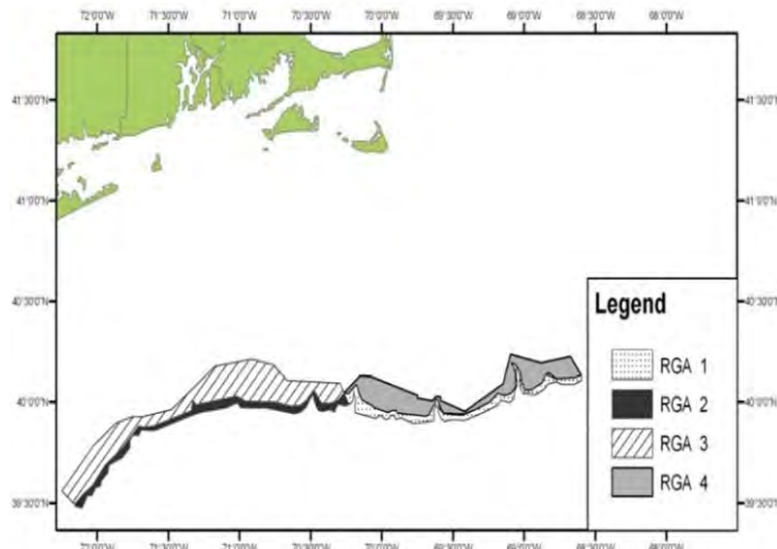


Figure 4: Restricted gear areas

The 2020 American Lobster Benchmark Stock Assessment and Peer Review Report outlined the status of lobster stocks. The Gulf of Maine/Georges Bank stock is at near record high abundance, above the abundance threshold, and overfishing is not occurring. The Southern New England stock is severely depleted and below the abundance threshold, but overfishing is not occurring. The poor stock condition in Southern New England is thought to be attributed to rising ocean temperatures (ASMFC 2015a, 2020a).

The states and federal government manage Jonah crab through the Commission's Jonah Crab ISFMP. This plan recognizes the interdependence of the American lobster and Jonah crab fisheries because available landings data indicate that Cancer crabs (Jonah crab and rock crab) were incidentally caught in lobster traps prior to becoming a targeted species (ASMFC 2015b). Jonah crabs are found in waters of the Atlantic Ocean from Newfoundland, Canada to Florida, United States (Haefner 1977). Very little is known about the life history and stock status of Jonah crabs, and, to date, no stock assessment has been completed.

Federal regulations, under the ACA in 50 CFR 697, were approved and became effective on December 12, 2019 complement the Commission's ISFMP. Measures include a minimum size, a prohibition on retaining egg-bearing females, incidental catch restrictions, requiring vessels to have a lobster permit to land Jonah crabs, and dealer permitting and report. By requiring a vessel landing Jonah crabs to have a lobster permit, the Jonah crab fishery is managed through effort controls, including permits, trap-limit, and area requirements from the American lobster fishery. The fishery takes place year-round. At present, the Jonah Crab Plan contains no closures.

However, due to the linkage with the lobster fishery, harvesters must abide by closures in the ISFMP for American Lobster, including restricted gear areas and ALWTRP closures.

The ALWTRP also regulates the American lobster and Jonah crab fisheries distinctly from the fishery management measures of the ISFMPs. Changes to the operation of these fisheries from the proposed ALWTRP regulations are considered as part of the proposed action in this Opinion.

Description of Gear Usage

Lobster fishing is conducted primarily using lobster pots/traps. A lobster trap, as regulated in 50 CFR 697.2, is a structure or device other than a net that is fished on the ocean bottom by a lobster permit holder and is designed for or capable of catching lobsters. Traps must be marked with a trap tag and identified by either the federal or state permit number. Trap trawls (multiple traps linked together by sinking groundline) cannot exceed a length of 1.5 nmi. The Interstate Lobster Plan does not regulate the number of traps per trawl, however, the ALWTRP includes minimum traps per trawl requirements.

Lobsters and Jonah crabs are also harvested by non-trap permit holders using methods other than trap gear such as trawls and gillnets. The 2020 lobster stock assessment estimated that these gear types accounted for approximately 2 percent of all landings between 1981 and 2018 (ASMFC 2020a). Non-trap landings in the Jonah crab fishery are also a minimal component of the fishery. These non-trap gears are authorized and regulated in other fishery management plans.

Fishing Effort

Due to the lack of mandatory harvester reporting requirements in the lobster fishery, effort is difficult to quantify. Furthermore, fishing effort is difficult to define in the American lobster fishery, because there is not a linear relationship between the number of traps fished and fishing effort. Many factors affect the catch rates of lobsters in traps including location, bait, trap design, soak time, temperature, and the presence of other animals (Cobb 1995 as cited in ASMFC 2020). This complicates the relationships between catches or catch per unit effort and abundance and/or densities, as well as between effort and mortality (ASMFC 2020a). Effort in the federally-permitted lobster fishery is controlled by limiting the number of eligible participating vessels or permits. States and the federal government have since further qualified and authorized harvesters using trap gear to fish in particular management areas using a specific number of traps. NMFS issued 3,068 trap permits for the 2018-fishing year (Table 6). This includes active permits and permits in confirmation of permit history (CPH), an inactive status. CPH status retains a permit's eligibility in the event the vessel has sunk or is sold. The permit in CPH may then be placed on a vessel at a later date.

Table 6: Fishing Year 2018 federal trap fishery permits and traps by state and area

State*	Area 1 Permits	Area 1 Traps	Area 2 Permits	Area 2 Traps	Area 3 Permits	Area 3 Traps	Area 4 Permits	Area 4 Traps	Area 5 Permits	Area 5 Traps	OCC Permits	OCC Traps
ME	1,305	1,044,000	2	741	10	4,681	1	1,200	0	0	1	645
NH	49	39,200	3	319	18	21,462	2	2,540	1	1,440	0	0
MA	276	220,000	72	24,397	49	47,543	2	1,580	1	500	17	9,034
RI	14	11,200	100	48,473	32	34,399	5	2,784	0	0	0	0
CT	1	800	6	3,020	1	589	3	2,725	1	875	0	0
NY	0	0	2	1,031	3	2,066	21	19,423	1	600	0	0
NJ	3	2,400	2	742	12	11,058	40	46,050	21	13,959	0	0

State*	Area 1 Permits	Area 1 Traps	Area 2 Permits	Area 2 Traps	Area 3 Permits	Area 3 Traps	Area 4 Permits	Area 4 Traps	Area 5 Permits	Area 5 Traps	OCC Permits	OCC Traps
DE	0	0	0	0	0	0	0	0	6	6,730	0	0
MD	1	800	0	0	0	0	0	0	6	4,700	0	0
VA	1	800	1	1	1	6	1	400	2	2,000	0	0
NC	0	0	0	0	0	0	1	800	0	0	0	0
FL	1	800	0	0	0	0	1	900	0	0	0	0
Total	1,651	1,320,000	188	78,724	126	121,804	77	78,402	39	30,804	18	9,679

*State is identified based on the permit holder's mailing address

Similarly, vessels using non-trap gear must have qualified into the fishery to be authorized to fish in any management area. Non-trap gear is not regulated by the lobster regulations, but could include trawl, gillnet, and dredge gear, as regulated by other FMPs. NMFS issued 1,041 non-trap permits for the 2018 fishing year. This includes active permits and permits in CPH status (see above). Table 7 summarizes both active and inactive non-trap permits.

Table 7: Federal non-trap fishery permits by state

State*	Total Non- Trap Permits
ME	111
NH	50
MA	464
RI	99
CT	28
NY	68
NJ	140
DE	2
MD	1
VA	42
NC	32
FL	4
Total	1041

*State is identified based on the permit holder's mailing address

Landings of lobster have increased over the past 35 years from 30 million lb in 1975 to peaking at 159 million lb in 2016. With a total ex-vessel value of approximately \$667 million in 2016, the lobster fishery is one of the most valuable fisheries on the Atlantic coast. The greatest percentage of landings (97.7 percent) comes from the Gulf of Maine/Georges Bank stock. Landings from Southern New England have declined due to changing conditions making this region less productive. Figure 5 summarizes landings by area. There are no landing limits for harvesters using trap gear; harvesters using other gears (e.g., gillnets, trawls) are subject to a limit of 100 lobsters per 24-hour period, not to exceed 500 lobsters for a trip five days or longer.

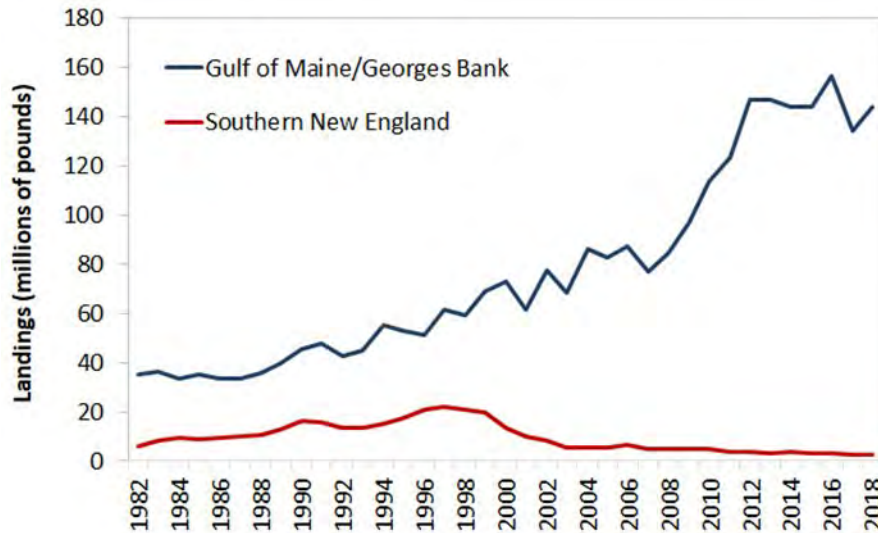


Figure 5: American lobster landings by area, 1981-2018 (see <http://www.asmfc.org/species/american-lobster>) (ASMFC 2015a)

Despite an increase in landings, the 2020 stock assessment (ASMFC 2020a) notes a historic increase in traps fished³ followed by a more recent decrease, with variation by stock area. In the Gulf of Maine, the number of traps fished in the 1980s and early 1990s was fairly stable, averaging approximately 2.3 million traps. From 1993 until 2005, the number of traps reported fished steadily increased to over 3.5 million traps and remained there until 2008. Between 2009 and 2013, the number of traps fished has decreased slightly to 3.3 million traps and has since dropped to approximately 3.2 million traps in 2018. Available information suggests that traps have continued to decrease across the fishery since 2018. The number of traps fished on Georges Bank is not as well characterized. Using Massachusetts data to characterize a trend, the number of traps fished on Georges Bank increased by roughly 30 percent from 1982 to 1992. From 1993 to 2009, the number of traps varied, without trend, around a mean of 43,000 traps. Since 2010, the number of traps increased and fluctuated 44,000 traps and 50,000 traps. In Southern New England, the number of traps fished increased six-fold between 1981 and 1998, reaching a high of approximately 600,000 traps. Between 1999 and 2018, the number of traps fished declined by 75 percent, reaching a low of 147,860 traps in 2018 (ASMFC 2020a).

In addition to these trends, other actions adopted by the Commission's Lobster Plan and implemented by the states and federal government have and will continue to affect the number of traps authorized in the fishery. To address the declining abundance of the Southern New England lobster stock, NMFS implemented trap reductions to all permit holders in Areas 2 and 3, following the reduction schedule outlined in Table 8. These trap reductions are ongoing.

³ The 2020 stock assessment estimates the total number of traps reported fished by state (or trap tags issued for Maine) within each stock are presented. Data from some states was not included as it was either confidential or not available. Thus, trap data should be considered an estimate.

Table 8: Area 2 and 3 trap reduction schedule

Effective Year (fishing year)	Area 2 Reductions (%)	Area 3 Reductions (%)
2016	25	5
2017	5	5
2018	5	5
2019	5	5
2020	5	5
2021	5	NA

Upcoming actions approved by the Commission and slated for federal implementation in 2020 include a reduction in the Area 3 trap limit, as described in Table 8. The Commission has recommended a gradual reduction schedule over a number of years, to a maximum of 1,548 traps (ASMFC 2013).

Federal regulations recently restricted Jonah crab harvest to lobster permit holders because 95 percent of historic cancer crab, including Jonah crab, landings were from lobster traps fished by lobster permit holders. As a result of this requirement, no additional traps are authorized in the fishery beyond what is authorized in the lobster fishery. Table 9 summarizes the number of Jonah crab harvesters by state from 2010-2015, prior to full state implementation of the Commission's Plan (NMFS 2018d).

Table 9: Jonah crab harvesters by state, 2010-2015

State	2010	2011	2012	2013	2014	2015
ME/NH	514	427	318	221	186	225
MA	103	86	94	122	126	124
RI	83	62	69	80	63	62
CT/NY	70	31	26	33	32	15
NJ	21	34	25	20	26	25
DE/MD/VA/NC	9	7	3		5	9
Total*	786	639	531	471	431	452

Jonah crab landings have increased dramatically since 1990 (Figure 6). The trend of increasing Jonah crab landings in the late 1990s coincides with the collapse of the Southern New England lobster stock and a decrease in lobster landings, suggesting harvesters turned to Jonah crab to supplement their income. While landings have increased overall, the majority of this increase was observed in federal waters, as reported by NMFS' Fisheries of the United States, 2010-2017 (NMFS 2018d).

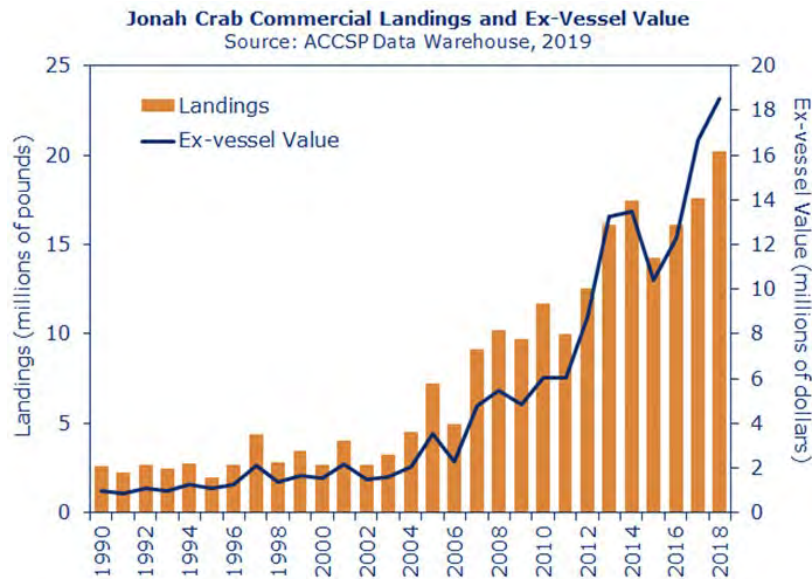


Figure 6: Jonah crab landings 1990-2018 (see <http://www.asmfc.org/species/jonah-crab>)

3.4.2. *Description of the Current Northeast Multispecies Fishery*

The New England Council manages the Northeast (NE) multispecies fishery through the NE Multispecies FMP. Sixteen species of groundfish are managed under the NE Multispecies FMP. Groundfish are found throughout New England waters, from the Gulf of Maine to southern New England. The NE multispecies fishery operates year-round. For management purposes, the fishing year runs from May 1 through April 30.

Large Mesh Multispecies: Thirteen species (20 stocks) are managed as part of the large-mesh complex, based on fish size and the type of gear used to harvest the fish. These species are fished both as target species (Atlantic cod, haddock, pollock, yellowtail flounder, witch flounder, winter flounder, American plaice, Atlantic halibut, redfish, and white hake) and as non-target species (windowpane flounder, ocean pout, and Atlantic wolffish).

The commercial NE multispecies fishery is divided between the sector program and the common pool. Vessels voluntarily choose to enter into the sector program as part of a groundfish sector, each of which are allocated a quota of Northeast multispecies stocks based on the collective fishing history of the sector's members. Each sector may determine how participating vessels fish that quota, also known as an Annual Catch Entitlement. Vessels that do not choose to participate in the sectors program are placed in the common pool fishery. Common pool vessels are subject to possession limits and days-at-sea (DAS – the number of days that can be fished per year), as well as quotas managed in four-month trimesters.

Vessels participating in the commercial fishery must have a permit; either a limited access permit that qualified into the fishery or an open access permit that typically allows only a small amount of NE multispecies to be harvested. All NE multispecies vessels must also comply with seasonal and year-round closed and habitat management areas (Figure 7 and Figure 8), gear size and modification restrictions, and minimum fish sizes. There is a large recreational fishery comprised of private vessels and for-hire (charter and party) vessels, which predominately fish for cod, haddock, pollock, redfish, and winter flounder with hook and line gear.

For all participants in the fishery, a system of annual catch limits (ACL) and accountability measures is in place to ensure that catches remain below desired targets for each stock in the complex. Accountability measures (AMs) are management controls to prevent ACLs from being exceeded and to correct or mitigate overages of the ACL, if they occur.

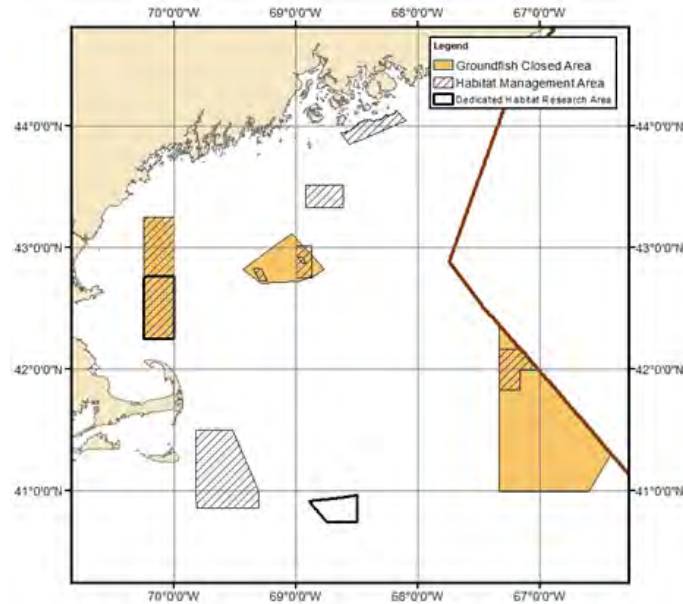


Figure 7: Overview of groundfish closure, habitat management, and dedicated habitat research areas

Large-mesh stock status is summarized below (Table 10). Overfishing is when the annual rate of catch of the stock is too high. A stock is considered overfished when the population size of the stock is too low.

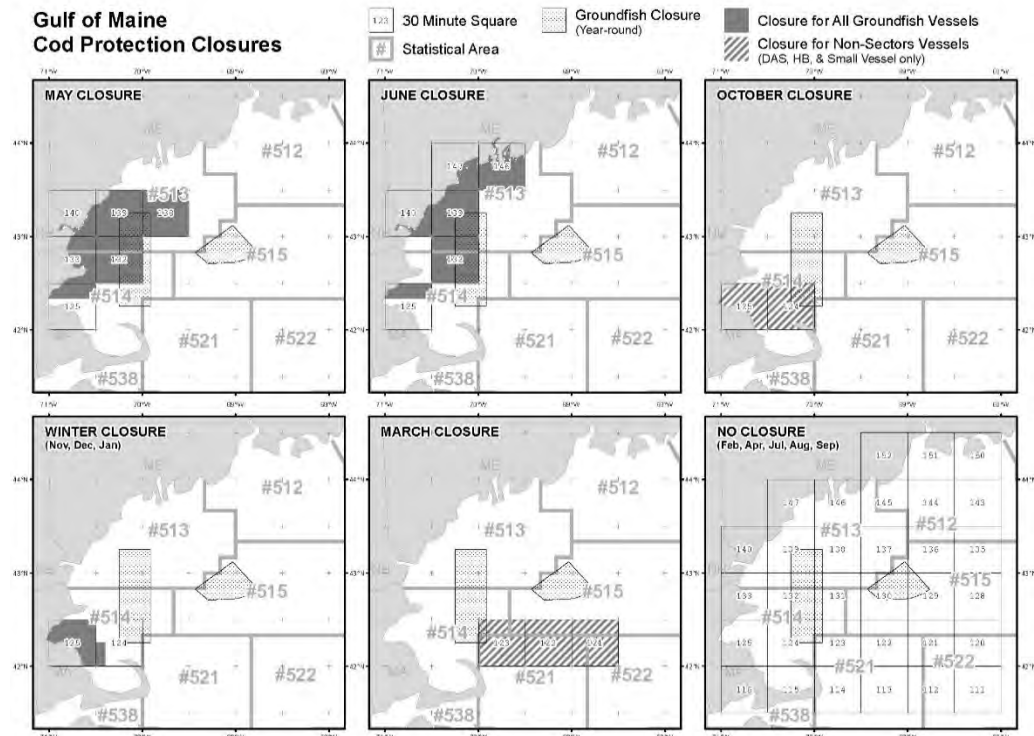


Figure 8: Seasonal Gulf of Maine cod protection closures

Table 10: Status of large-mesh Northeast multispecies stocks for fishing year 2020

Stock	Overfishing?	Overfished?
Georges Bank Cod	Yes	Yes
Gulf of Maine Cod	Yes	Yes
Georges Bank Haddock	No	No
Gulf of Maine Haddock	No	No
Georges Bank Yellowtail Flounder	Yes	Yes
Southern New England/Mid-Atlantic Yellowtail Flounder	No	Yes
Cape Cod/Gulf of Maine Yellowtail Flounder	No	No
American Plaice	No	No
Witch Flounder	Unknown	Yes
Georges Bank Winter Flounder	No	Yes
Gulf of Maine Winter Flounder	No	Unknown
Southern New England/Mid-Atlantic Winter Flounder	No	Yes
Acadian Redfish	No	No
White Hake	No	Yes
Pollock	No	No
Northern Windowpane Flounder	No	Yes
Southern Windowpane Flounder	No	No
Ocean Pout	No	Yes

Stock	Overfishing?	Overfished?
Atlantic Halibut	No	Yes
Atlantic Wolffish	No	Yes

Small-mesh multispecies: Three species (silver hake/whiting, red hake, and offshore hake) are included in the FMP as the small-mesh complex but are managed under a separate program through a series of exemptions to the NE Multispecies FMP. The small-mesh fishery operates under exemptions that allow vessels to fish for these species in designated areas, called exemption areas, using mesh sizes smaller than the minimum mesh sizes otherwise allowed under the NE Multispecies regulations (Figure 9).

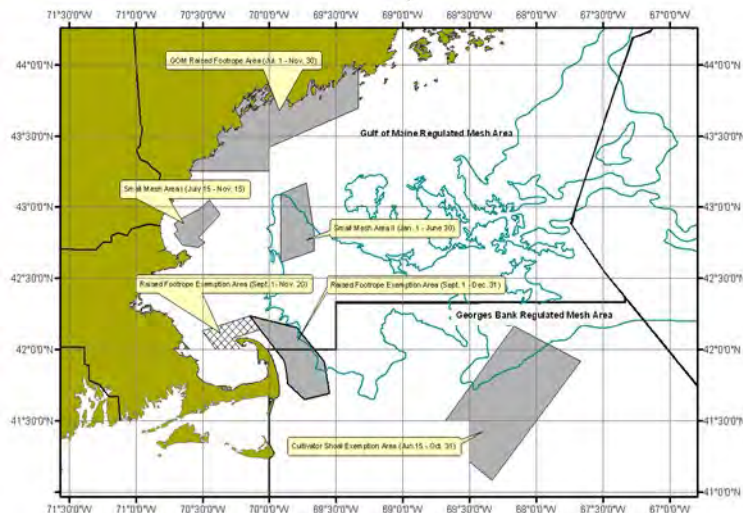


Figure 9: Whiting small mesh exemption areas

Each small-mesh exemption area has its own open season, depending on the target species and other factors considered when the exemption area was approved and implemented. Some areas can be open for several months, while others are open year round. Small-mesh stock status is summarized below (Table 11).

Table 11: Status of small-mesh Northeast multispecies stocks for fishing year 2018

Stock	Overfishing?	Overfished?
Northern Silver Hake (Whiting)	No	No
Southern Silver Hake	No	No
Offshore Hake	Unknown	Unknown
Northern Red Hake	No	No
Southern Red Hake	Yes	Yes

Description of Gear Usage

Large-mesh multispecies: A variety of gears are used in the multispecies fishery. Groundfish vessels fish for target species with trawl, gillnet, and hook and line gear (including jigs, handline, and non-automated demersal longlines). General minimum mesh sizes for trawl and gillnet are specified in Table 12, by area, though some caveats apply (see 50 CFR 648.80). In general,

gillnets may not exceed 300 ft (91.4 m) in length and NE multispecies vessels may not possess more than 150 gillnets.

Table 12: Minimum mesh size and number of net requirements in the Northeast Multispecies FMP

Area	Trawl	Gillnet
Gulf of Maine	Body: 6 in. diamond or 6.5 in. square Codend: 6.5 in. diamond or square	Size: 6.5 in. Number: 50 standup or 100 tie-down gillnets
Georges Bank	Body: 6 in. diamond or 6.5 in. square Codend: 6.5 in. diamond or square	Size: 6.5 in. Number: 50 gillnets
Southern New England	Body: 6 in. diamond or 6.5 in. square Codend: 6.5 in. diamond or square	Size: 6.5 in. Number: 75 gillnets
Mid-Atlantic	Body: 5.5 in. diamond or 6.0 in. square Codend: 6.5 in. diamond or square	Size: 6.5 in Number: 75 gillnets

The NE Multispecies FMP requires that a vessel intending to fish with gillnet gear to obtain an annual designation as either a day or trip gillnet vessel. A vessel with a day gillnet designation may set its gear and return to port leaving the gear in the water to actively fish. A day gillnet vessel must abide by the size and net limits outlined above and tagging requirements. In contrast, a trip gillnet vessel sets and actively tends its gear. Because such a vessel is limited by the number of nets it can actively tend, it has no specific net limit.

In many cases, these minimum mesh sizes also regulate gear usage in other fisheries. The NE multispecies regulations also allow for large- and small-mesh exemptions, which typically provide seasonal access to an area-specific fishery using gear that would otherwise be prohibited, including the small mesh exemption program, which uses modified bottom trawls and gillnets.

Small-Mesh Multispecies: The small-mesh multispecies fishery is managed primarily through a series of seasonal exemptions from the Northeast Multispecies FMP. The directed commercial fishery is conducted with small-mesh bottom trawl gear with a number of specific requirements to reduce bycatch of large-mesh groundfish species. For the most part, the gear requirements for the small-mesh multispecies fishery are determined by the exemption or regulated mesh area being fished.

Vessels fishing in the Raised Footrope Trawl Exempted Whiting Fishery, Gulf of Maine Grate Raised Footrope Trawl Exempted Whiting Fishery, Cape Cod Exemption Area, and Small-Mesh Areas 1 and 2 must use a raised footrope trawl with a minimum mesh size of at least 2.5 inches (6.4 cm) that must be configured in such a way that, when towed, the footrope is not in contact with the ocean bottom.

Vessels fishing in the Cultivator Shoals Small Mesh Exemption area must adhere to regulations requiring all nets to have a minimum mesh size of 3-inch (7.6-cm) square or diamond mesh applied to the first 100 meshes (200 bars in the case of square mesh) for vessels greater than 60 ft (18.3 m) in length and applied to the first 50 meshes (100 bars in the case of square mesh) for vessels less than or equal to 60 ft (18.3 m) in length.

Fishing Effort

Because the Northeast Multispecies FMP includes 25 large and small mesh stocks, fishing effort is incorporated by reference from other publically available documents.

Large-Mesh Multispecies: A summary of recent large-mesh catch specifications can be found on the Council's website (see <https://www.nefmc.org/management-plans/northeast-multispecies>). Table 13 summarizes major landings from 2010 to 2018. In general, there has been a decreasing trend in the fishery over this period. For additional information on how this data was generated, please see Framework Adjustment 59 to the [Northeast Multispecies FMP](#). While the total landed pounds have decreased somewhat, the value of the groundfish fishery has declined from nearly a \$140-million fishery in 2011 to less than \$70 million in 2017 and 2018. This is reflected in the average price for groundfish, which has declined from \$1.64 per pound in 2010 to \$1.12 per pound in 2018. Table 14 summarizes the level of effort broken down by the gear used on groundfish trips.

Table 13: Summary of major trends in the Northeast multispecies fishery

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Groundfish lb landed	57,415,923	61,372,883	47,093,911	42,072,677	42,998,382	41,440,576	33,827,147	37,237,816	44,271,347
Non-groundfish lb landed	21,683,247	27,705,817	27,458,707	19,987,155	24,916,795	22,874,953	23,678,927	24,065,322	22,515,434
Active vessels	428	414	398	342	304	277	268	252	233
Groundfish trips	12,860	15,695	14,466	10,582	9,766	8,326	7,323	7,351	7,693
Days absent from port on groundfish trips	17,943	21,233	19,881	17,364	16,709	15,038	12,620	11,646	10,904

Notes: Data includes all vessels with a valid limited access multispecies permit that made at least one groundfish trip (declared into the fishery and landed >1 pound of any stock). "Trips" refer to commercial trips in the northeast EEZ. Source: GARFO Data Matching and Imputation System (DMIS) Database. Accessed August 13, 2019.

Table 14: Number of trips and gear types used while fishing under a groundfish limited access permit. Multiple gear types may be used on a single trip (GARFO DMIS Database. accessed August 14, 2019).

Fishing Year	Trawl	Gillnet	Hook	Pot	Other Gear
2010	4,876	7,674	823	22	2
2011	6,073	9,142	1,298	24	0
2012	6,258	7,988	939	41	0
2013	5,001	5,695	289	12	0
2014	4,591	5,750	224	2	2
2015	4,744	4,186	301	19	26
2016	3,943	3,953	502	8	0
2017	4,009	3,687	522	11	0
2018	4,130	3,842	477	15	0

Small-Mesh Multispecies: A summary of recent small-mesh catch specifications can also be found on the Council’s website (<https://www.nefmc.org/management-plans/small-mesh-multispecies>) and is summarized below in Table 15. Data was generated from the 2017-2019 SAFE report (NEFMC 2020e). In general, there has been a decreasing trend in the number of permits and landings. Price per pound ranged from a low of \$0.63 2013 to a high of \$0.81 in 2018. While the number of permits and landings have decreased, there were over 8,000 trips with small-mesh multispecies landings in 2019, indicating that effort may have increased despite the decrease in active boats and landings. Revenue was at its lowest for 2019 at \$9.0 million, down \$2.3 million from 2012 where revenue totaled \$11.3 million (NEFMC 2020e).

Table 15: Summary of small mesh multispecies (SMS) trends 2012-2019 (NEFMC 2020e)

	2012	2013	2014	2015	2016	2017	2018	2019
Number of Permits*	356	357	352	321	324	334	317	304
Trips w /SMS Landings	8,726	8,098	7,903	6,589	6,299	6,912	7,722	8,426
SMS Landings mil lbs (dealer)	17.6	14.7	17.5	15.1	15.1	12.6	12.4	12.4
SMS Price/lb	\$0.64	\$0.63	\$0.69	\$0.73	\$0.74	\$0.75	\$0.81	\$0.73
SMS Revenue (mil \$)	11.3	9.2	12.0	11.0	11.2	9.4	10.0	9.0

*Number of permits represents active boats with SMS landings

3.4.3. *Description of the Current Monkfish Fishery*

The New England and Mid-Atlantic Fishery Management Councils jointly manage the monkfish fishery (NEFMC 2017). It is managed primarily with a DAS management system with corresponding trip limits per DAS. The fishery also employs a total allowable landings limit, within an ACL and AM framework. The fishery takes place year-round. Monkfish occur from Maine to North Carolina out to the continental margin and are generally found at depths from 82-656 ft (25-200 m). However, there are two separate management areas (Figure 10): the Northern (NFMA) and Southern (SFMA) Landings in the SFMA peak in the late spring/early summer months when fish are migrating from deeper water, while landings in the NFMA peak in January through March. The Fishery Management Areas are based on differing fishing activity/operations in each area. A separate offshore program area, which operates under its own regulations, spans the two management areas.

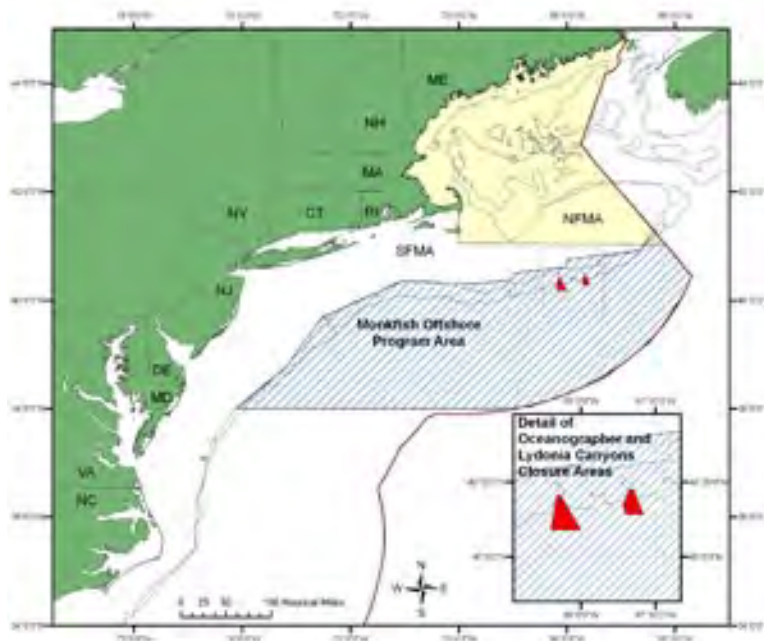


Figure 10: Monkfish fishery management areas

There are two closed areas affecting commercial monkfish vessels: Lydonia Canyon Closed Area and Oceanographer Canyon Closed Area (Figure 10). A vessel using a monkfish DAS is prohibited from fishing in these areas regardless of gear used. These areas are not closed to recreational anglers or vessels with a monkfish permit that are not fishing on a monkfish DAS.

A 2019 stock assessment updated commercial fishery statistics, fishery-independent survey indices, and fishery performance indices, among other indicators. However, because an empirical assessment was conducted based on estimates of recent catch, the 2019 assessment was only used to set catch advice, as was the case in 2016. The stock status results from the 2013 assessment, which indicated that monkfish are not overfished and no overfishing is occurring in the NFMA or the SFMA, remain valid. See Table 16 for the current monkfish specifications.

Table 16: Monkfish 2020-2022 specifications

Specification	NFMA	SFMA
Overfishing Limit	17,805 mt	23,204 mt
Acceptable Biological Catch	8,351 mt	12,316 mt
Annual Catch Limit	8,351 mt	12,316 mt
Total Allowable Landings	6,624 mt	5,882 mt

Description of Gear Usage

In the commercial fishery, bottom trawl, gillnet, longline, dredge, and trap/pot gear are authorized. In 2018, trawl gear accounted for 46 percent of landings, gillnet gear accounted for 45 percent, and dredge and other gears accounted for the remaining 9 percent. Dredge gear has accounted for a large proportion of discards in recent years (NEFMC 2020c). In the NFMA, landings are primarily by bottom trawl gear, with gillnet gear landings making up a small proportion during the winter months and a much larger proportion in the summer. In the SFMA, gillnet gear accounts for the majority of the landings. A vessel fishing with gillnet gear in the

monkfish fishery (without a NE multispecies permit) is presumed to set its gear and return to port leaving the gear in the water to actively fish. Although there is no known recreational fishery for monkfish, recreational fishing is authorized using a rod and reel or spears. Monkfish-specific gear requirements are summarized in Table 17.

Table 17: Monkfish gear requirements

Gear Type	Minimum Mesh Size	Maximum number of nets that can be set, hauled, fished, or possessed onboard	Other Requirements
Dredge	Dredge gear prohibited on a monkfish DAS		
Trawl	10 in. square or 12 in. diamond mesh throughout the codend for at least 45 continuous meshes forward of the terminus of the net. The minimum mesh size for the remainder of the trawl net is the regulated mesh size specified by the regulated mesh area fished as outlined in the multispecies regulations. Exception: Vessels fishing with trawl gear under both a monkfish and multispecies DAS, are subject to the minimum mesh size determined by the multispecies fishery.	n/a	The maximum roller size in the SFMA is 6 in. diameter.
Gillnet	10 in. diamond mesh Exception: Vessels fishing under both a monkfish and multispecies DAS or switch from a multispecies DAS to a monkfish DAS may continue to use gillnet gear with less than 10-inch diamond mesh. However, the vessel must go by the more restrictive mesh sizes as outlined in the multispecies regulations	150-160 gillnets at any time, depending on permit category Note: If vessel is also fishing on a multispecies DAS, it must go by the more restrictive net limits of the multispecies regulated mesh areas.	Each gillnet must be tagged and cannot be longer than 300 ft.

Fishing Effort

The monkfish fishery differs regionally. The NFMA has significant overlap with the NE multispecies fishery, as evidenced by the gear requirements in Table 17 and the permit categories listed below in Table 18. The fishery in the SFMA operates more independent of other fisheries.

Table 18: Monkfish permits (NMFS Permit Data, <https://www.fisheries.noaa.gov/permit/monkfish>)

Permit Category	Description	Permits Issued in 2017	Number of Permits in CPH
Category A	Commercial limited access DAS permit that does not also have a Northeast Multispecies or scallop limited access permit	20	173
Category B		38	
Category C	Commercial limited access DAS permit that has either a Northeast Multispecies or scallop limited access permit	260	
Category D		220	
Category F (offshore)	Commercial limited access offshore fishery	18	
Category H	Commercial limited access DAS for use in the Southern Fishery Management Area.	7	

Permit Category	Description	Permits Issued in 2017	Number of Permits in CPH
Category E	Commercial open-access incidental permit	1,470	Not Applicable

Landings in both areas combined peaked in 2003 but then declined to reach a relatively stable level between 2011 and 2014 (Table 19). Landings in 2015 showed a slight increase in the NFMA and a slight decrease in the SFMA (NEFMC 2017, NMFS 2012a). Since that time, landings in the SFMA have remained relatively stable in the SFMA. Landings in the NFMA between 2016-2018 increased due to management actions that allowed increased trip limits.

Table 19: NFMA and SFMA landings, 1999-2018 (NEFMC 2020c)

Year	NFMA (mt)	SFMA (mt)
1999	9,720	14,311
2000	11,859	7,960
2001	14,853	11,069
2002	14,491	7,478
2003	14,155	12,198
2004	11,750	6,193
2005	9,533	9,656
2006	6,677	5,909
2007	5,050	7,180
2008	3,528	6,751
2009	3,344	4,800
2010	2,834	4,484
2011	3,699	5,801
2012	3,920	5,184
2013	3,596	5,088
2014	3,403	5,415
2015	4,080	4,733
2016	5,443	4,280
2017	6,850	3,723
2018	5,961	4,581

3.4.4. *Description of the Current Spiny Dogfish Fishery*

The New England and Mid-Atlantic Councils jointly manage the Atlantic spiny dogfish fishery under the federal Spiny Dogfish FMP. The FMP was implemented in 2000, when spiny dogfish were determined to be overfished. However, the spiny dogfish stock was declared successfully rebuilt in a 2010 assessment and continues to remain above its threshold biomass with no overfishing occurring. The Atlantic States Marine Fisheries Commission also manages the spiny dogfish fishery in state waters from Maine to North Carolina through its Interstate Fishery Management Plan for Spiny Dogfish. This Opinion considers the federal component of the fishery managed by the Councils.

The spiny dogfish fishery is managed using a coastwide annual quota and possession limits. There is very limited directed recreational fishing for spiny dogfish and no federal recreational

permit or quota. An annual catch limit and commercial quota are established through the specifications process for up to three years at a time, and AMs are used should overages occur. Each year, in addition to U.S. discards, deductions are made from the acceptable biological catch to account for Canadian landings, as a small portion of the spiny dogfish fishery takes place in Canadian waters during the summer. Up to 3 percent of the annual quota can be set aside for research purposes, but this program has not been utilized in recent years. The current federal possession limit for spiny dogfish is 6,000 lb per trip, and only one trip may be landed each calendar day. The current spiny dogfish fishery specifications are shown below in Table 20.

Table 20: Spiny dogfish 2019-2021 specifications, in metric tons

	2019	2020	2021
Overfishing Limit	21,549	N/A	N/A
Acceptable Biological Catch	12,914	14,126	16,043
Annual Catch Limit	12,865	14,077	15,994
Commercial Quota	9,309	10,521	12,438

Both Councils and the Commission reviewed and approved Scientific and Statistical Committee (SSC) and Monitoring Committee recommendations at their respective meetings in October and December 2020, and all recommended revised and projected 2021 and 2022 spiny dogfish specifications to reflect the Mid-Atlantic Council's updated risk policy. On May 4, 2021, NMFS finalized the spiny recommendations (88 FR 23633). The revisions increased the commercial quota 8 percent from what was originally projected. Table 21 shows the specifications.

Table 21: Comparison of original and revised spiny dogfish specifications for 2021 and 2022, in metric tons (mt)

	Original 2021	Revised 2021 and 2022	Percent Change
Overfishing Limit	16,043	17,498	9
Acceptable Biological Catch	15,994	17,453	9
Annual Catch Limit	12,519	13,461	8
Commercial Quota	12,438	13,408	8

Spiny dogfish are a migratory species in the North Atlantic and are most abundant from Nova Scotia to Cape Hatteras, North Carolina. They move northward in the spring and summer and southward in the fall and winter, with a preferred temperature range from 7.2 °C to 12.8 °C. This places peak abundance in mid-Atlantic waters during winter and spring months, with the bulk of the stock migrating as far north as Canada by mid-summer. Spiny dogfish also tend to congregate further offshore (near the shelf break) in the winter and move inshore (sometimes up into bays and estuaries) in the summer. The highest concentrations of spiny dogfish migrate to Southern New England, Georges Bank, and the Gulf of Maine in the fall.

The spiny dogfish fishery is active year-round, although, there is some seasonality in the distribution of landings due to the migratory nature of the species. In general, fishing effort follows the north-south seasonal migratory pattern. Spiny dogfish fishing is concentrated in the north Atlantic around Georges Bank, the Gulf of Maine, and Massachusetts state waters from

May through October. Effort shifts further south (e.g., Virginia and North Carolina) in late fall and early winter. Overall, the highest landings of spiny dogfish typically occur between June and October in Massachusetts. There are no closed areas specifically under the spiny dogfish FMP. However, permit holders are subject to the regulations and restrictions of the other permits they may be fishing under in conjunction with spiny dogfish (i.e. NE Multispecies).

Description of Gear Usage

In the commercial spiny dogfish fishery, gillnet, trawl, hook and line, rod and reel, spear, and dredge are all authorized gear; though gillnets, hook gear (longline, handline), and bottom trawls are most commonly used. Gillnets are the primary gear in the directed spiny dogfish commercial fishery, responsible for approximately 66 percent of landings annually. The other most prevalent gears in the spiny dogfish fishery are bottom longline (25 percent of catch) and bottom trawl (4 percent). The remaining spiny dogfish (about 4 percent annually) are caught with other or unknown gear. There is a small spiny dogfish recreational fishery (less than 1.5 percent of total catch annually) where handline, rod and reel, and spear are all authorized recreational gears (MAFMC 2019c).

Vessels participating in the spiny dogfish fishery must abide by the minimum mesh sizes and gear limits for gillnet and trawl gear required by the NE multispecies regulations in the four RMAs shown in Figure 11. There are also nine exempted fishing areas from the Gulf of Maine through the mid-Atlantic where spiny dogfish may be caught; some of which allow the use of smaller mesh sizes. Incidental harvesters may land spiny dogfish with gear authorized and regulated through these fishery exemption areas and programs. These exemption areas and the type of gear used are outlined below in Table 22. For a map of these exemptions areas, see: <https://www.fisheries.noaa.gov/species/atlantic-spiny-dogfish>.



Figure 11: Regulated Mesh Areas (RMAs) in the North Atlantic

Table 22: Exemption areas in the spiny dogfish fishery

Exemption Area	Gear Allowed	Season	Letter of Authorization Required
Nantucket Shoals Dogfish Fishery	Trawl, Gillnet	June 1 – Oct 15	Yes
Cultivator Shoals Whiting Fishery	Trawl	June 15 – Oct 31	Yes
Small Mesh Areas 1 and 2	Trawl	1: July 15 – Nov 15, 2: Jan 1 – June 30	No
Raised Footrope Trawl Whiting Fishery	Trawl	Sept 1 – Dec 31	Yes
GOM/GB Dogfish Gillnet	Gillnet	July 1 – Aug 31	No
Cape Cod Spiny Dogfish	Gillnet, Longline, Handgear	June 1 – Dec 31	No
Southern New England	Trawl	Year round	No
SNE Dogfish Gillnet	Gillnet	May 1 – Oct 31	No
Mid-Atlantic	Trawl, Gillnet	Year round	No

Fishing Effort

As previously stated, no significant directed recreational fishery exists for spiny dogfish. All federal permits for the spiny dogfish fishery are open access commercial permits, so the number of active permits and vessels participating in the fishery can fluctuate on an annual basis. The best available data shows that NMFS issued 2,305 commercial spiny dogfish permits in 2019. However, of the 2,259 vessels with open access permits in 2017, only 244 actively contributed to overall landings that year.

While there is some seasonality in effort within the spiny dogfish fishery due to the migration of the stock as described above, it is still active in the United States year round. The vast majority (60-70 percent) of commercial landings each year are made in Massachusetts, with North Carolina and Virginia landing the next highest with approximately 14 and 10 percent, respectively. Most spiny dogfish are caught closer inshore, with some vessels venturing further offshore in the first half of the year to follow stock distribution. Figure 12 shows the general areas of spiny dogfish commercial fishing from 2016-2018 from dealer and VTRs. Landings from January-June are on the left and account for 67.24 percent of the total landings reported for these months. Landings from July-December are in the right panel and account for 85.78 percent of total landings for these quarters (MAFMC 2018b).

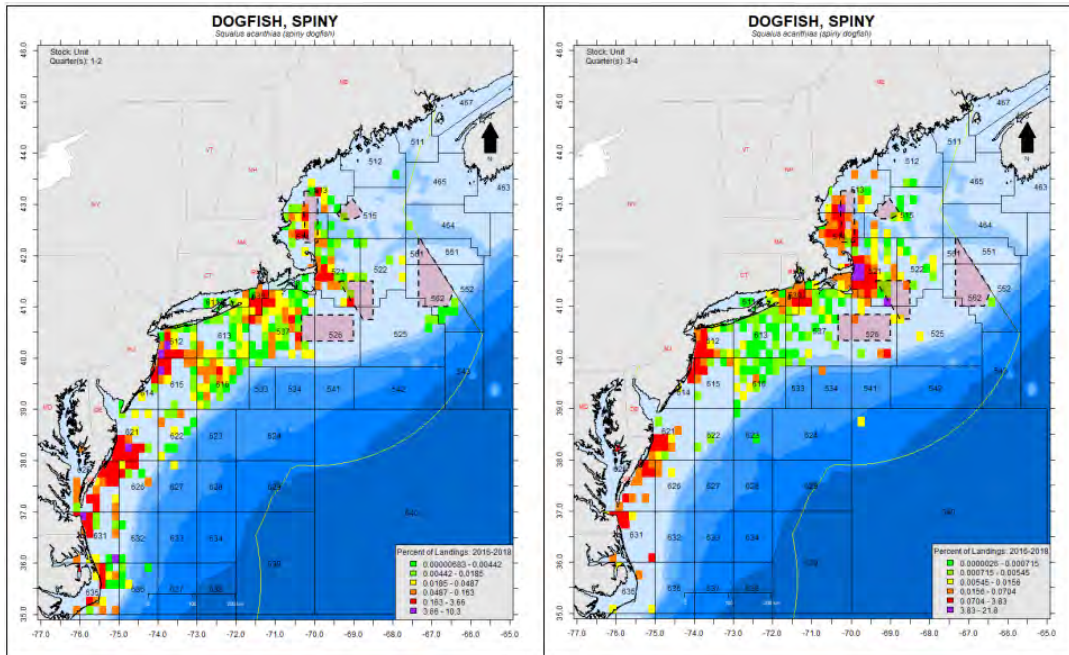


Figure 12: Spiny dogfish commercial landings 2016-2018 (data queried on July 22, 2019). Green and yellow colors represent a smaller percent of landings. Red and purple colors represent a larger percent.

3.4.5. *Description of the Current Atlantic Bluefish Fishery*

The Atlantic States Marine Fisheries Commission and the Mid-Atlantic Fishery Management Council jointly manage the Atlantic bluefish fishery in state and federal waters under the Bluefish FMP. Overall, the fishery is managed with annual catch limits, catch targets, and total allowable landings for the recreational and commercial sectors, which are then translated into quotas. The Atlantic bluefish fishery is primarily a recreational fishery, with 83 percent of the overall annual total allowable landings allocated to the recreational fishery quota and 17 percent allocated to the commercial fishery. Up to 3 percent of the total annual quota can be set aside for research purposes, but this program has not been utilized in recent years. Current fishery specifications and state commercial quota allocations for Atlantic bluefish are described in Table 23 and Table 24). The state commercial quota allocation shares were set in 2000 through Amendment 1 to the Bluefish FMP (65 FR 45844). The FMP authorizes quota to be transferred from the recreational to commercial sector as well as between states.

The recreational fishery is managed to the annual recreational harvest limit (recreational quota) using a federal bag limit and seasonal closures. In the commercial fishery, the annual coastwide commercial quota is allocated into state-specific quotas based on historic percentages specified in the FMP (Table 23). There is no federal commercial possession limit for bluefish. Each state must develop its own regulations to manage landings within its allocated commercial quotas. Though there are no closed areas under this FMP; NMFS will close the commercial fishery within a state when its commercial quota has been harvested.

Bluefish are a migratory schooling species found from Maine to Florida. They typically spend the colder winter months in the south, with larger bluefish remaining in the Mid-Atlantic Bight off North Carolina through March and smaller fish farther south, closer to Florida. Bluefish migrate north in spring as water temperatures increase. In summer, bluefish abundance centers

around the New York Bight and Southern New England, but distribution can reach as far north as Maine and Nova Scotia. Starting in late fall, they begin migrating south to warmer waters. Juveniles and adults are found primarily in waters less than 65 ft (20 m) deep.

The bluefish fishery is active year-round. There is seasonality to both the commercial and recreational fisheries due to the migratory nature of the species. In general, fishing effort follows the north-south seasonal migratory pattern. Fishing is concentrated in the south Atlantic in January and February, moves north to the mid-Atlantic in the early spring, to New England in the summer and fall, back to the mid-Atlantic in late fall, and in the south Atlantic for the winter. The majority of recreational activity occurs between March and October, with peak activity in May and June and again in September and October. Most recreational fishing for bluefish is conducted by private anglers from or near shore (>75-95 percent), although, there is a small portion of the for hire community that catch bluefish recreationally. North Carolina, Rhode Island, and New York have been the states with the highest commercial bluefish harvest for the past several years.

Based on the most recent stock assessment in August 2019, bluefish are overfished, but overfishing is not occurring (NEFSC 2020). This is a change from the 2015 assessment (NEFSC 2015). That assessment indicated the stock was not overfished and overfishing was not occurring. Both assessments used an age-structured assessment program model, and while the status determination criteria did not change between the two assessments, the 2019 assessment incorporated recently calibrated recreational catch data from the Marine Recreational Information Program (MRIP). The next rebuilding plan is scheduled for 2021, and a rebuilding plan is in development for the overfished stock. Table 23 and Table 24 include the current bluefish specifications and state commercial quota allocations.

Table 23: Atlantic bluefish 2021 specifications, in lb

Fishing Year	2021
Overfishing Limit	32.98
Acceptable Biological Catch = Annual Catch Limit	16.28
Commercial Annual Catch Target (ACT)	2.77
Recreational ACT	13.51
Commercial Total Allowable Landings (TAL)	2.77
Recreational TAL	8.3
Sector Quota Transfer	0
Commercial Quota	2.77
Recreational Harvest Limit	8.34

Table 24: Atlantic bluefish 2021 specifications by state, in lb

State	FMP Percent Share	Initial* Quota
Maine	0.67	18,503
New Hampshire	0.41	11,473
Massachusetts	6.72	185,904
Rhode Island	6.81	188,434
Connecticut	1.27	35,049
New York	10.39	287,438
New Jersey	14.82	410,082
Delaware	1.88	51,985
Maryland	3.00	83,084
Virginia	11.88	328,800
North Carolina	32.06	887,377
South Carolina	0.04	974
Georgia	0.01	263
Florida	10.06	278,432
Total	100.00	2,767,793

*Quota may be transferred between states through in-season actions. These are the initial allocations and any changes may not be reflected in this table. See the [quota monitoring page](#) for updates.

Description of Gear Usage

Gillnets are the primary gear types used in the commercial bluefish fishery, accounting for approximately 64 percent for commercial catch in 2019. Hook and line gear (i.e. longline, handline, rod and reel, etc.), pound nets, seines, pots/traps, and trawls are also authorized gears. In the past five years, gillnets have accounted for around 65 percent of the commercial directed bluefish catch, with the next most common gear used various types of trawls (bottom, beam, midwater, etc.) (23 percent), and handline (8 percent). The combination of all other gear types, including traps, seines, and cast nets, comprised the remaining 4 percent. In the recreational fishery, rod and reel, and handline are the most commonly used gear to catch bluefish. There are no gear-specific requirements identified in the Bluefish FMP; but states have the option to implement their own regulations on gear that would apply to vessels and private anglers from shore in their area.

Fishing Effort

The bluefish fishery has two available open access permits; one for the commercial fishery, and one for charter/party vessels in the recreational fishery. Because these permits are open access, the number of active permits and vessels participating in the bluefish fishery can change on an annual basis. The most recent permit data from 2020 is shown in Table 25.

Table 25: Atlantic bluefish permits in 2020

Permit Category	Type	Number of Permits Issued
1	Commercial	2,100
2	Charter/Party (Recreational)	826

Most recreational harvest in the bluefish fishery comes from inland private anglers on or near the shore. Based on 2019 recreational harvest data, approximately 60 percent of coastwide recreational landings of bluefish came from shore, followed by 36 percent private/rental and 4 percent for hire (Figure 13) (MAFMC 2020). Over the last five years (2015-2019), 60 percent of the total bluefish landings came from shore, 35 percent from private/rental boats, and 5 percent from for-hire boats. The states with the highest recreational landings in 2019 were New York, North Carolina, Florida, and New Jersey (Table 26). Over 75 percent of commercial landings in 2019 came from the six statistical areas surrounding Connecticut, New York, and Rhode Island, (Table 27, Figure 14) (MAFMC 2020).

Table 26: MRIP estimates of 2019 recreational harvest and total catch for bluefish

State	Harvest			Catch
	Pounds	Number	Average wt (lb)	Number
ME	0	0	0	0
NH	0	0	0	0
MA	719,130	265,628	2.7	736,761
RI	210,033	119,801	1.75	271,594
CT	340,666	312,022	1.09	817,150
NY	1,399,517	1,203,567	1.16	3,905,614
NJ	2,007,110	1,421,477	1.41	3,933,439
DE	315,105	75,703	4.16	611,903
MD	493,192	274,834	1.79	692,643
VA	264,534	443,112	0.6	870,958
NC	2,630,685	3,304,587	0.8	11,216,797
SC	403,141	765,113	0.53	2,295,592
GA	70,284	90,991	0.77	386,195
FL	4,525,038	2,052,080	2.21	5,212,593
Total	13,270,862	10,245,711	1.3	30,928,703

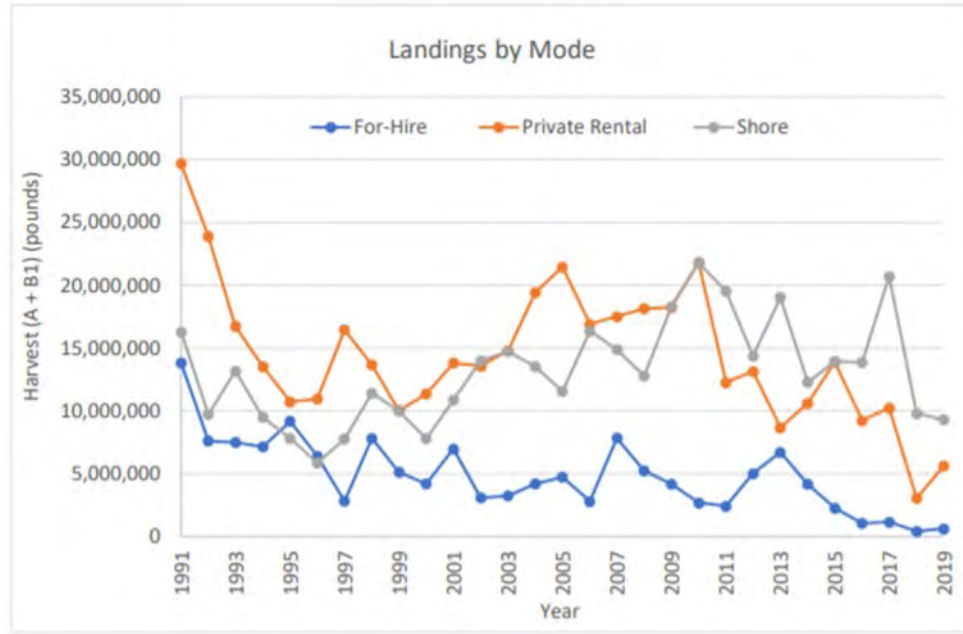


Figure 13: Bluefish recreational harvest (lb) by mode, Atlantic Coast, 1991-2019, from MRIP data (MAFMC 2020)

Table 27: Statistical areas with at least 5 percent of the total commercial bluefish landed in 2019 (MAFMC 2020)

Statistical area	Bluefish Landings (lb)	Percent of 2019 Commercial Bluefish Catch	Number of Trips	Percent of 2019 Commercial Bluefish Trips that Caught Bluefish
611	169,338	18	1,667	31
539	166,201	18	1,051	20
613	130,350	14	727	14
626	80,566	9	84	2
632	53,364	6	27	< 1
612	37,076	4	287	5

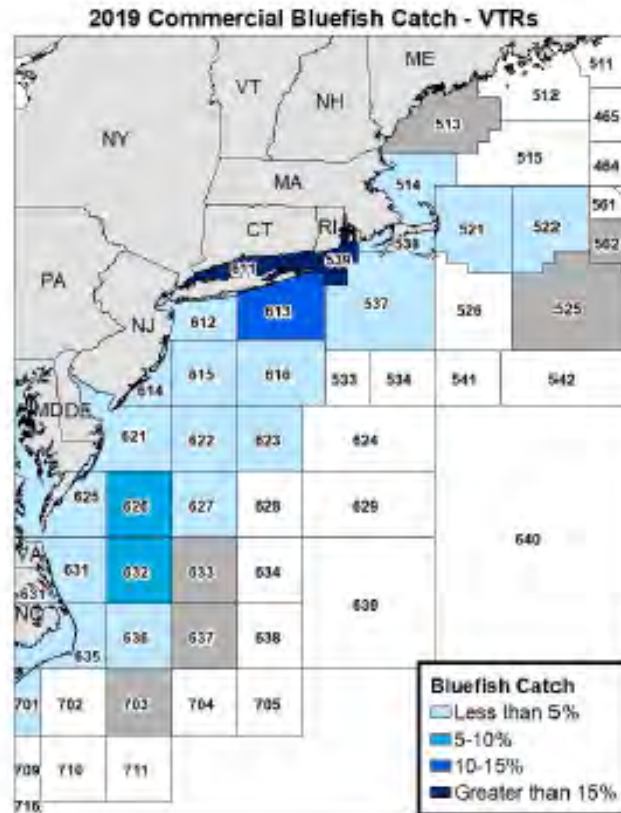


Figure 14: Commercial bluefish catch, 2019, by statistical area (MAFMC 2020)

3.4.6. *Description of the Current Northeast Skate Complex*

The New England Council manages the skate fishery under the NE Skate Complex FMP. The fishery operates from Maine to Cape Hatteras, North Carolina. Skates are mostly harvested incidentally in trawl and gillnet fisheries targeting groundfish, monkfish, and sometimes scallops. The FMP manages a complex of seven different skate species: barndoor (*Dipturus laevis*), clearnose (*Raja eglanteria*), little (*Leucoraja erinacea*), rosette (*Leucoraja garmani*), smooth (*Malacoraja senta*), thorny (*Amblyraja radiata*), and winter (*Leucoraja ocellata*) skates. Each of the seven skate stocks has overfishing and overfished status determination criteria that are based on a NMFS trawl survey index of abundance. None of the seven skate stocks are subject to overfishing. Thorny skate is overfished, and the other six skate stocks are not overfished.

The seven species in the skate complex are distributed along the coast of the northeast United States from near the tide-line to depths exceeding 2,300 ft (700 m). Within the complex, the ranges of the individual species vary. In general, barndoor skate are found along the deeper portions of the Southern New England continental shelf and the southern portion of Georges Bank, extending into Canadian waters. Clearnose skates are caught by the NMFS surveys in shallower water along the Mid-Atlantic coastline, but are known to extend into unsurveyed shallower areas and into the estuaries, particularly in Chesapeake and Delaware Bays. Little skate are found along the Mid-Atlantic, Southern New England, and Gulf of Maine coastline, in shallower waters than barndoor, rosette, smooth, thorny, and winter skates. Rosette, smooth, and thorny are typically deep-water species. NMFS' survey catches rosette skate along the shelf edge

in the Mid-Atlantic region, while smooth and thorny are found in the Gulf of Maine and along the northern edge of Georges Bank. Winter skate are found on the continental shelf of the Mid-Atlantic and Southern New England regions, as well as Georges Bank and into Canadian waters. Winter skate are typically caught in deeper waters than little skate, but partially overlap the distributions of little and barndoor skates. Skates are not known to make large-scale migrations, but they do move seasonally in response to changes in water temperature, moving offshore in summer and early fall and returning inshore during winter and spring.

Skates are harvested for two different markets – skate wings for human consumption and whole skates for use as bait in other fisheries, such as lobster and Jonah crab. Use of skate as bait is growing in importance with declines in the availability of herring. The fishery is primarily managed with fishery specific (wing vs. bait) total allowable landings, possession limits, seasons, in-season possession limit adjustments, and other AMs. Each fishing year (May 1-April 30), the skate wing fishery is allocated 66.5 percent of the federal TAL for skates, and the skate bait fishery is allocated 33.5 percent of the federal TAL. There are no closed areas identified with the Northeast Skate Complex FMP. However, area management within the Northeast Multispecies, Scallop, and Monkfish FMPs would impact the harvest of skates.

The skate wing fishery evolved in the 1990s as skates were promoted as underutilized species. Attempts to develop domestic markets were short-lived, and the bulk of the skate wing market remains overseas. Winter skate is the dominant component of the wing fishery. The Southern New England sink gillnet fishery targets winter skates (a primary component of the wing fishery) seasonally along with monkfish. Highest catch rates are in the early spring and late fall when the boats are targeting monkfish, at about a 5:1 average ratio of skates to monkfish. Little skates are also caught incidentally year-round in gillnets and sold for bait.

The skate bait fishery is more of a directed and historical fishery, compared to the wing fishery. The skate bait fishery has three seasons, with about 68 percent of total allowable landings allocated to seasons 1 and 2 (May 1st to October 31). This is designed to accommodate the amplified effort in the spring through fall lobster fishery. Small, whole skates are among the preferred baits for the lobster fishery. The skate bait fishery involves vessels from primarily Southern New England ports that target a combination of little skates (>90 percent), and to a lesser extent juvenile winter skates (<10 percent). The 2019-2021 Northeast skate complex specifications and seasonal quota allocations are described in Table 28 and Table 29.

Table 28: NE skate complex 2019-2021 specifications, in metric tons

Fishing Year	2019	2020	2021
Acceptable Biological Catch = Annual Catch Limit	31,327	32,715	32,715
Annual Catch Target	28,194	29,444	29,444
Overall Total Allowable Landings	15,788	17,864	17,864
Wing Fishery Total Allowable Landings	10,499	11,879	11,879
Bait Fishery Total Allowable Landings	5,289	5,984	5,984

Table 29: NE skate complex 2019-2021 seasonal TAL allocations

Fishing Year		2019	2020	2021
Skate Wing Fishery	Season 1 (May 1 – August 31)	5,984	6,771	6,771
	Season 2 (September 1 – April 30)	4,515	5,108	5,108
Skate Bait Fishery	Season 1 (May 1 – July 31)	1,629	1,843	1,843
	Season 2 (August 1 – October 31)	1,962	2,220	2,220
	Season 3 (November 1 – April 30)	1,698	1,921	1,921

Description of Gear Usage

Trawl, gillnet, longline, handline, dredge, and rod and reel are all authorized gears in the skate fishery. In general, skates are mostly harvested incidentally in otter trawl and gillnet fisheries targeting groundfish, monkfish, and, sometimes, scallops. In 2018, otter trawl was the primary gear used in the bait fishery (99 percent of bait-only landings), while more skates were landed in the wing fishery with gillnet gear (81 percent of wing-only landings). Overall, gillnets are responsible for approximately 66 percent of skate catch, and trawls comprise about 32 percent. Skates are also consistently caught with traps, hook gear, and scallop dredges; although landings from these gears are relatively insignificant; about 2 percent of all catch combined (NEFMC 2020d). All vessels fishing for skates using a DAS are subject to the gear regulations of whichever limited access fishery it has declared into for that DAS. Otherwise, vessels fishing for skates must abide by the gear requirements of the NE Multispecies FMP.

Fishing Effort

Total skate landings have fluctuated over the years (Table 30) (NEFMC 2020d). The fluctuations in landings is largely attributable to the wing fishery, as landings in the bait fishery have remained relatively stable.

An open access permit is required to land skates. Both a permit and a skate bait letter of authorization (LOA) is required to land whole skate for the bait fishery. Vessels fishing for skate wings must be on a New England multispecies, scallop, or monkfish DAS to land more than the incidental limit of 500 lb of skate wings. In general, vessels fishing for skate bait under a bait LOA must also be on a DAS, unless the vessel is fishing in a DAS exemption area.

The number of skate permits peaked in fishing year 2007 at 2,686 permits and has declined since; the number of skate permits in 2019 was 2,028. The number of active federally-permitted vessels (i.e., federal fishing vessels landing more than 1 lb of skate) has decreased as well, with 567 active permits in 211 to 357 active permits in 2019 (NEFMC 2020d).

Table 30: Skate landings in live weight lb (i.e., the weight of a whole skate) by fishery type. A conversion factor is applied to all wing landings in order to estimate weight of the entire skate.

Fishing Year	Bait	Wing	Total
2010	9,698,695	23,000,058	32,698,753
2011	10,837,172	30,465,414	41,302,586
2012	10,766,626	22,427,119	33,193,745
2013	11,176,451	19,720,311	30,896,762
2014	9,386,666	24,704,030	34,090,696

Fishing Year	Bait	Wing	Total
2015	10,513,990	22,943,092	33,457,082
2016	10,148,571	20,228,685	30,377,
2017	12,495,542	20,057,874	32,553,416
2018	10,625,319	21,164,021	31,789,340
2019*	8,424,659	19,019,727	27,444,386
2020*	4,468,490	10,315,403	14,783,893

*Preliminary data as of August 2020. Fishing year 2020 ends April 30, 2021 so fishing year 2020 is incomplete.

The skate bait fishery involves vessels from primarily Southern New England ports that target a combination of little skates (>90 percent), and to a lesser extent juvenile winter skates (<10 percent). The bait fishery is largely based out of Rhode Island (primary ports in Point Judith and Newport) and other secondary ports (Sea Isle City, New Jersey; New London, Connecticut; and Montauk, New York) also identified as participants in the directed bait fishery (NEFMC 2020d).

The majority of skate wings are landed in Massachusetts, Rhode Island, and New Jersey. New Bedford, Massachusetts emerged early on as the leader in production, both in landed and processed skate wing, although skate wings are landed in ports throughout the Gulf of Maine and extending down into the Mid-Atlantic. In 2016, Chatham surpassed New Bedford for the most skate wings landed, New Bedford still processes the greatest share of skate wings. As of August 2020, the three primary ports for skate wings are Chatham, Massachusetts; New Bedford, Massachusetts, and Point Judith, Rhode Island (NEFMC 2020d).

3.4.7. Description of the Current Mackerel/squid/butterfish Fishery

The Mid-Atlantic Council manages Atlantic mackerel, chub mackerel, longfin squid, *Illex* squid, and butterfish through a single FMP called the Mackerel, Squid, and Butterfish (MSB) FMP. All species use quotas and AMs. Various permitting systems, mesh requirements, time-area closures, and trip limits are used in these fisheries to help achieve optimum yield. The Atlantic mackerel and longfin squid fisheries are managed separately through incidental catch permits and a tiered limited access permit system, which includes different possession limits for the different permit categories. Atlantic mackerel catch is controlled by an annual mackerel quota and a bycatch quota for river herring and shad. The *Illex* and butterfish fisheries are managed by limited access and incidental catch permits, mesh size and area restrictions, annual quotas, and trip limits. Atlantic chub mackerel was integrated into the MSB FMP in 2020 and is managed by an annual quota and AMs (85 FR 47103, August 4, 2020).

Even though the overfishing limit is unknown, the Mid-Atlantic Council's SSC concluded that long-term average landings by the directed longfin and *Illex* squid fleet appears to be sustainable. Due to the limited fishery dependent and independent data available for Atlantic chub mackerel, there is no stock assessment for this species to specify status determination criteria. The December 2017 Atlantic mackerel stock assessment concluded that the stock is overfished and subject to overfishing. NMFS has implemented measures to establish a stock rebuilding program for Atlantic mackerel (84 FR 58053, October 30, 2019). An updated stock assessment for Atlantic mackerel is expected in 2021. The 2020 management track assessment determined the status of butterfish is not overfished with no overfishing occurring. The assessment discovered that biomass is 69 percent of its target. Given butterfish's short life history and variable recruitment substantial fluctuations in biomass are not unexpected. Fishing mortality appears to

have been low in recent years, which means recent declines are not a result of overfishing but poor recruitment. If recruitment returns to average levels, then the stock is predicted to build above the SSBmsy target quickly. The 2021 quotas for the MSB FMP is provided in Table 31.

Table 31: Squid, mackerel, and butterfish 2021 specifications

Stock	Atlantic Chub Mackerel	Atlantic Mackerel	Butterfish	<i>Illex</i>	Longfin
Overfishing Limit	3,026	N/A	22,053	Unknown	Unknown
Allowable Biological Catch	2,300	19,184	11,993	30,000	23,400
Annual Catch Limit	2,261.7	19,184	11,993	N/A	N/A
Commercial Annual Catch Target	2,171.2	17,387	11,393	N/A	N/A
Recreational ACT/Recreational Harvest Limit	N/A	1,270	N/A	N/A	N/A
Domestic Annual Harvest	N/A	17,312	6,350	28,644	22,932

The five species in the MSB FMP are available and harvested in varied distribution ranges at various times of the year along the eastern seaboard of the United States, from the coast to the continental shelf break. Atlantic mackerel are generally associated with, or related to (inversely), the distribution of herring, with some years off the Mid-Atlantic Bight, other years off Cape Cod, and others on Georges Bank. Longfin squid may aggregate from waters just south of Cape Cod to off the Mid-Atlantic, generally inshore in the summer and offshore in the winter. Butterfish are widely distributed and may aggregate in various locations throughout their range. A summary of the distribution and seasonality of the fishery is summarized in Table 32.

Table 32: Spatial distribution of mackerel, squid, and butterfish stocks

Species	Seasonality of Fishery	Spatial Distribution of Stock
Atlantic mackerel	November-April	Distributed between Labrador and North Carolina, with catch between Maine and North Carolina.
Longfin squid	Year round, peaks in the spring and fall	During the early spring and late fall, catch occurs near the shelf break, with summer and early fall catch primarily occurring nearshore.
<i>Illex</i> squid	May-October (dependent on aggregation and market)	Along the continental shelf break
Atlantic chub mackerel	May-October	Along the continental shelf break and the east coast of Florida
Butterfish	Year-round, but historically mostly in winter	Southern New England shelf break areas, in and around Long Island Sound.

Atlantic mackerel, squid, and butterfish permitted vessels cannot fish with bottom trawl gear in the Oceanographer or Lydonia Canyons or the Frank R. Lautenberg Deep-Sea Coral Protection Area. The area extends from the continental shelf/slope break off the Mid-Atlantic states (New York to North Carolina) to the border of the EEZ (Figure 15). The use of bottom-tending commercial fishing gear in the designated deep-sea coral zone is prohibited in this area. Gear

restrictions in this area do not apply to recreational fishing, commercial gear types that do not contact the sea floor, or the American lobster trap fishery. An exemption is also provided for the deep-sea red crab commercial trap fishery.



Figure 15: Frank R. Lautenberg Deep-Sea Coral Protection Area

Description of Gear Usage

Longfin squid, *Illex* squid, and butterfish are primarily harvested with bottom-tending otter trawl gear. Vessels fishing with otter trawl gear that possess 5,000 lb or more of butterfish must use nets that have a minimum codend mesh of 3 inches (7.62 cm). Vessels targeting longfin squid must comply with seasonal gear requirements described in Table 33. During closures of the longfin squid fishery resulting from the butterfish mortality cap, vessels can still fish for longfin squid using jigging gear, but this has not been common. Vessels fishing for *Illex* squid with otter trawl gear during June-September in the *Illex* squid exemption area are exempt from the longfin squid minimum mesh size requirements.

Table 33: Longfin squid seasonal mesh requirements

Trimester	Minimum Mesh Size
Trimester I (Jan-April)	2 1/8 inches (54 mm)
Trimester II (May-Aug)	1 7/8 inches (48 mm)
Trimester III (Sept-Dec)	2 1/8 inches (54 mm)
Net strengtheners must be 5 inches (12.7 cm) or greater square or diamond mesh	

The primary participants are generally larger vessels, though a wide range of vessels participate, especially in the longfin squid fishery. Larger vessels often either freeze their catch on board or keep it in refrigerated seawater and process it on shore. The squid fisheries are predominantly bottom otter trawl. Both mackerels are harvested with a variety of gears but mostly bottom otter

trawl, single midwater trawls, and paired midwater trawls. Atlantic chub mackerel is usually targeted by vessels that also target *Illex* squid when *Illex* squid is not available. Midwater otter trawls and paired midwater trawls have become increasingly important for mackerel in recent years. While there is no permit for Atlantic chub mackerel, any MSB permit is needed to possess Atlantic chub mackerel for sale.

Fishing Effort

The number of active vessels in the Atlantic mackerel, squid, and butterfish fisheries has fluctuated over the past decade, but has generally decreased for all fisheries. A more detailed breakdown of federal permit holders in 2020 is in Table 34.

Table 34: MSB permit holders in 2020

Permit Type	Permit Category	Description	Count
Moratorium Permits	SMB 1A	Longfin	230
	SMB 1B	Longfin	49
	SMB 1C	Longfin	23
Moratorium Permits	SMB 5	<i>Illex</i>	69
	SMB 6	Butterfish Moratorium	279
	SMB T1	T1 Mackerel	31
	SMB T2	T2 Mackerel	23
	SMB T3	T3 Mackerel	73
	SMB 2	SMB Charter/Party	736
Open Access	SMB 3	Squid/Butterfish Incidental	1,515
	SMB 4	Mackerel Incidental	1,643

Landings for Atlantic mackerel, longfin squid, *Illex* squid, and butterfish vary over the years due to availability of the resource and market conditions. The following descriptions are based on landings from 1996-2016. Atlantic mackerel landings ranged from a high of 124,868,012 lb in 2006 to a low of 1,169,156 lb in 2011. Longfin squid landings range from a high of 42,095,370 lb in 1999 to a low of 13,396,792 in 2004. Landings of *Illex* squid are also variable, ranging from a high of 50,965,858 lb in 1998 to a low of 589,598 lb in 2002. Butterfish landings range from a high of 9,777,854 lb in 2001 to a low of 1,032,754 lb in 2005. Atlantic chub mackerel landings in 1999-2018 range from a high of 5,250,807 in 2013 to a low of 117 in 2009.

3.4.8. Description of the Current Summer Flounder, Scup, and Black Sea Bass Fishery

The Mid-Atlantic Council and the Atlantic States Marine Fisheries Commission jointly manage summer flounder, scup, and black sea bass. These species are managed under a single FMP because these species occupy similar habitat and are often caught at the same time. All three

species are highly sought after by commercial and recreational fishermen. Although managed under one FMP, permits for summer flounder, scup, and black sea bass are issued separately based on having met that fishery's limited access eligibility requirements. Each of these three fisheries also issues open access charter/party permits.

NMFS implements ACLs and AMs for the summer flounder, scup, and black sea bass fisheries. Specific landing limits (i.e., quotas) are derived for the commercial and recreational sectors after accounting for scientific and management uncertainty. The commercial quota for summer flounder is managed on a state-by-state basis in both federal and state waters. For scup, the commercial quota is divided into three harvest periods. Federal waters are managed on a coastwide basis for each quota period. In state waters, the Commission manages the fishery with individual state quotas during the summer quota period and coastwide during the winter quota periods. The black sea bass commercial quota is managed on a coastwide basis in federal waters while the Commission manages the fishery in state waters using individual state quotas. Quota specifications for the three species regulated under the FMP are generally set on an annual basis, but may be proposed for a 3-year period.

Summer Flounder: Summer flounder are targeted in waters from Cape Cod, Massachusetts to Cape Hatteras, North Carolina. The commercial fishery is managed using a quota system along with size limits and gear requirements. The recreational fishery is managed using size, season, and bag limits. The commercial fishery for summer flounder runs year round with two major trawl fisheries concentrating offshore in the winter and inshore in the summer. The recreational fishery occurs primarily in the spring, summer, and early fall. There is a commercial closure in place in Delaware, due to an overharvest from a previous year. The 2019 stock assessment concluded that summer flounder is not overfished and no overfishing is occurring.

Scup: Scup are typically found in offshore waters in the winter from New Jersey to Cape Hatteras and in the warmer months move north to areas in southern New England and Long Island, New York. Commercial management methods include a coastwide seasonal quota, size limit, seasonal possession limits, and gear restrictions. The recreational fishery is managed using size, season, and bag limits. The commercial scup fishery occurs year round in waters from Massachusetts through North Carolina, with a significant portion of the 2018 landings coming from Rhode Island (34 percent), New York (25 percent), and New Jersey (18 percent). The recreational fishery occurs mostly during spring and fall.

Black Sea Bass: Black sea bass are distributed from the Gulf of Maine to the Gulf of Mexico, but fish north of Cape Hatteras, North Carolina are considered part of a single unit stock. Over the past decade, the distribution of sea bass has expanded into the Gulf of Maine (Bell et al. 2015) as far as eastern coastal Maine (M. McMahan, pers. comm. as cited in NEFSC 2017). Within the stock area, distribution changes on a seasonal basis and the extent of the seasonal change varies by location. In the northern end of the range (New York to Massachusetts), black sea bass move offshore crossing the continental shelf, then south along the edge of the shelf (Moser and Shepherd 2009). By late winter, northern fish may travel as far south as Virginia, but most return to the northern inshore areas by May. Black sea bass originating inshore along the Mid-Atlantic coast (New Jersey to Maryland) head offshore to the shelf edge during late autumn, travelling in a southeasterly direction. They return inshore in spring to the general area from which they originated. Black sea bass in the southern extent of the stock (Virginia and Carolina) move (Bell

et al. 2015) offshore in late autumn/early winter. Given the proximity of the shelf edge, they transit a relatively short distance, due east, to reach over-wintering areas.

The commercial fishery occurs in two seasons: the spring-fall inshore season and the winter offshore season. The commercial fishery is managed using an annual coastwide quota, size limits and gear restrictions. The recreational fishery uses size, season and bag limits. The 2019 stock assessment concluded that black sea bass is not overfished and not experiencing overfishing (NEFSC In Press). See Table 35 and Table 36 for 2020 information on ABCs, ACLs, quotas and recreational harvest limits (NMFS 2018g).

Table 35: Commercial 2020 specifications for summer flounder, scup, and black sea bass

Species	ABC (millions of lb)	ACL (millions of lb)	Quota (millions of lb)
Summer Flounder	25.03	13.52	11.53
Scup	35.77	27.90	22.23
Black Sea Bass	15.07	6.98	5.58

Table 36: Recreational 2020 specifications for summer flounder, scup, and black sea bass

Species	ABC (millions of lb)	ACL (millions of lb)	Harvest Limit (millions of lb)
Summer Flounder	25.03	6.2	5.2
Scup	35.77	7.87	6.51
Black Sea Bass	15.07	8.09	5.81

Description of Gear Usage

For the commercial fishery, trawl, longline, handline, trap/pot, gillnet, and dredge are all authorized gears. For the recreational fishery, rod and reel, handline, pot, trap, and spear are authorized gears. Otter trawls are the predominant gear type used in the commercial fisheries for all three species. Pots/traps are also used to catch black sea bass and scup in the commercial fishery. For summer flounder, VTR data indicate that 96 percent of commercial 2018 landings were caught with bottom otter trawls. All other gear types each accounted for less than 1 percent of the landings. For scup, about 97 percent of the commercial 2018 scup landings reported on VTRs were caught with bottom otter trawls. Pots and sink gillnets each accounted for about 1.7 percent of commercial landings. All other gear types each accounted for less than 1 percent of commercial landings. Although bottom otter trawl is the dominant gear type overall and in federal waters, other gear types such as pots/traps, hand lines, floating traps, and pound nets play a larger role in the summer in some state waters. For black sea bass, VTR data indicate that 72 percent of the black sea bass caught in 2018 was caught with bottom otter trawl gear. About 18 percent were caught with fish pots and traps, 4 percent in offshore lobster traps, and 3 percent with hand lines. Other gear types accounted for less than 1 percent of total commercial catch. As is the case with scup, pots/traps may play a larger role in state waters. Minimum mesh size requirements are summarized in Table 37.

Table 37: Minimum mesh size requirements for summer flounder, scup, and black sea bass

Fishery Management Plan	Minimum Trawl Mesh Size
Summer Flounder	5.5 in diamond or 6.0 in square
Scup	5.0 in diamond
Black Sea Bass	4.5 in diamond

Summer flounder trawler vessels fishing within the Summer Flounder Fishery-Sea Turtle Protection Area are required to use a turtle excluder device as detailed at 50 CFR part 223. Vessels fishing north of Oregon Inlet, NC, are exempted from this requirement from January 15 through March 15 (Figure 16).

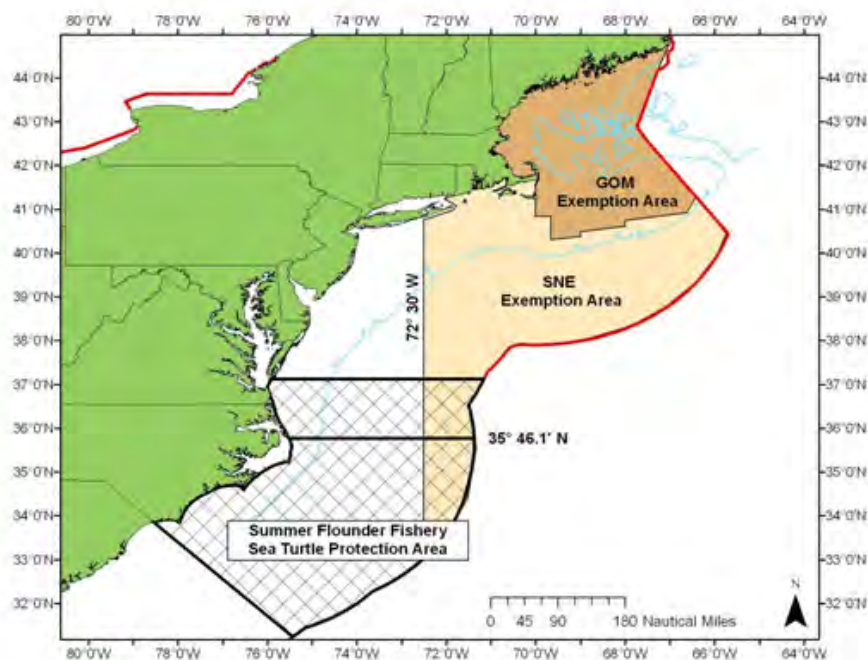


Figure 16: Summer flounder small mesh exemption and sea turtle protection areas

Regulations also restrict certain gear types in two areas off the mid-Atlantic (Figure 17) in order to minimize the mortality of juvenile scup caught as incidental bycatch. Small-mesh gear (i.e., less than 5-inch diamond mesh is prohibited for vessels fishing for longfin squid, black sea bass, or whiting (the primary small-mesh species) in the Northern Gear Restricted Areas from November 1 through December 31 and in the Southern Gear Restricted Areas from January 1 through March 15.

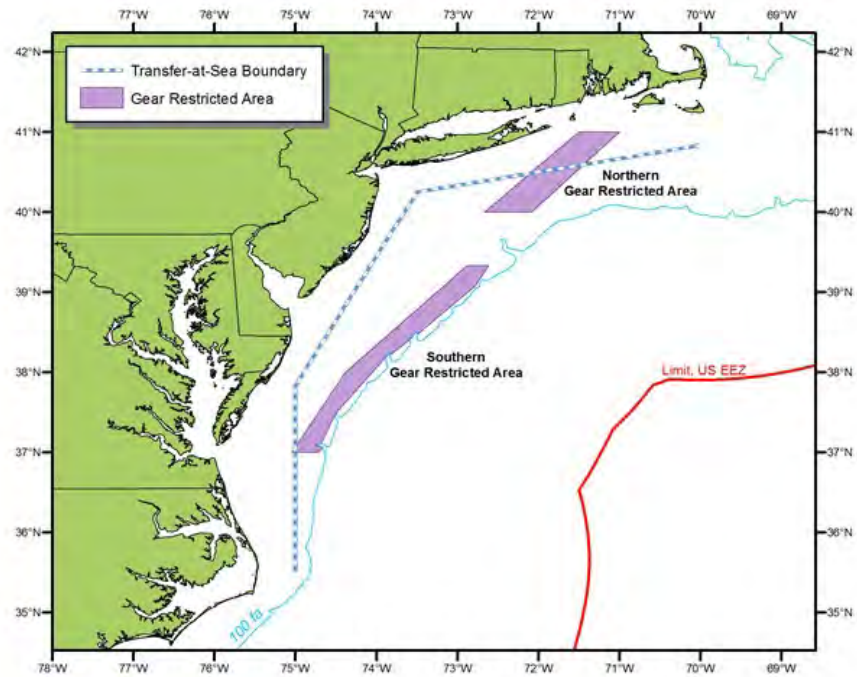


Figure 17: Scup gear restricted areas

Fishing Effort

Summer Flounder: Following the implementation of a coastwide quota in 1993, commercial summer flounder landings have fluctuated between 6 and 18 million lb. Commercial landings of summer flounder peaked in 1984 at 37.77 million pounds and reached a low of 5.83 million pounds in 2017. In 2019, commercial fishermen from Maine through North Carolina landed 9.06 million pounds of summer flounder, about 83 percent of the commercial quota (10.98 million pounds after deductions for prior year landings and discard overages). Recreational landings have varied more with catch peaking in 2010 with 59 million lb to a high of 38 million lb in 1980 to a low of three million lb in 1989. In July 2018, MRIP released revisions to their time series of recreational catch and landings estimates based on adjustments for a revised angler intercept methodology and a new effort estimation methodology (i.e., a transition from a telephone-based effort survey to a mail-based effort survey). The revised estimates of catch and landings are several times higher than the previous estimates for shore and private boat modes, substantially raising the overall summer flounder catch and harvest estimates. On average, the new landings estimates for summer flounder (in pounds) are 1.8 times higher over the time series 1981-2017, and 2.3 times higher over the past 10 years (2008-2017). In 2017, new estimates of landings in pounds were 3.16 times higher than the previous estimates.

Revised MRIP estimates indicate that recreational catch for summer flounder peaked in 2010 with 58.89 million fish caught. Recreational harvest peaked in 1983, with 25.78 million fish landed, totaling 36.74 million pounds. Recreational catch reached a low in 1989 with 5.06 million fish caught. Recreational harvest in numbers of fish reached a low in 2019 with 2.38 million fish landed (7.80 million pounds), while recreational harvest in pounds was lowest in 1989 at 5.66 million pounds. See Figure 18 for more information on commercial and recreational summer flounder landings.

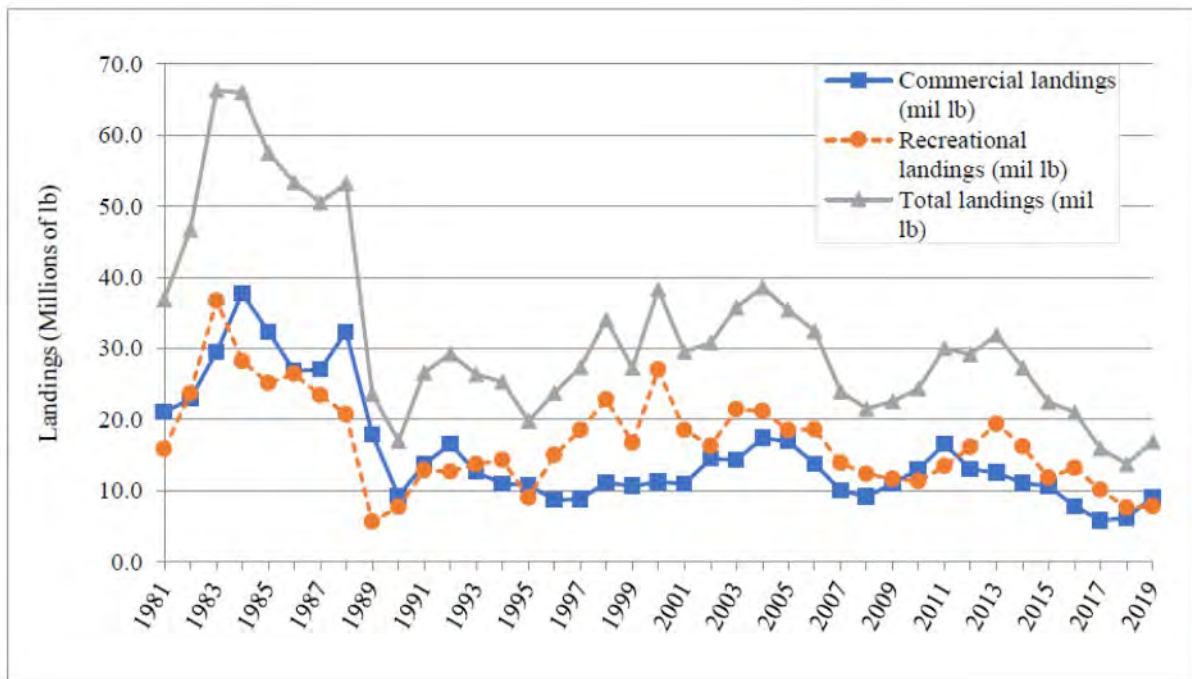


Figure 18: Commercial and recreational summer flounder landings in millions of pounds, Maine- North Carolina, 1981-2019. Recreational landings are based on revised MRIP data

Scup: Commercial scup landings peaked in 1981 at 21.73 million pounds and reached a low of 2.66 million pounds in 2000 (Figure 19). In 2019, commercial fishermen landed 13.78 million pounds of scup, about 57 percent of the commercial quota. Landings over the last decade have ranged from about 5 million lb (2008) to 17 million lb (2013). The recreational fishery accounts for a large portion of the catch of scup. From 1981-2019, recreational catch of scup peaked in 2017 at 41.20 million scup and landings peaked in 1986 with an estimated 30.43 million scup landed by recreational fishermen from Maine through North Carolina. Recreational catch was lowest in 1998 when an estimated 6.86 million scup were caught and 2.74 million scup were landed. Recreational anglers from Maine through 14 North Carolina caught an estimated 28.67 million scup and landed 14.95 million scup (about 14.12 million pounds) in 2019. See Figure 19 for more information on scup total landings (MAFMC 2019b).

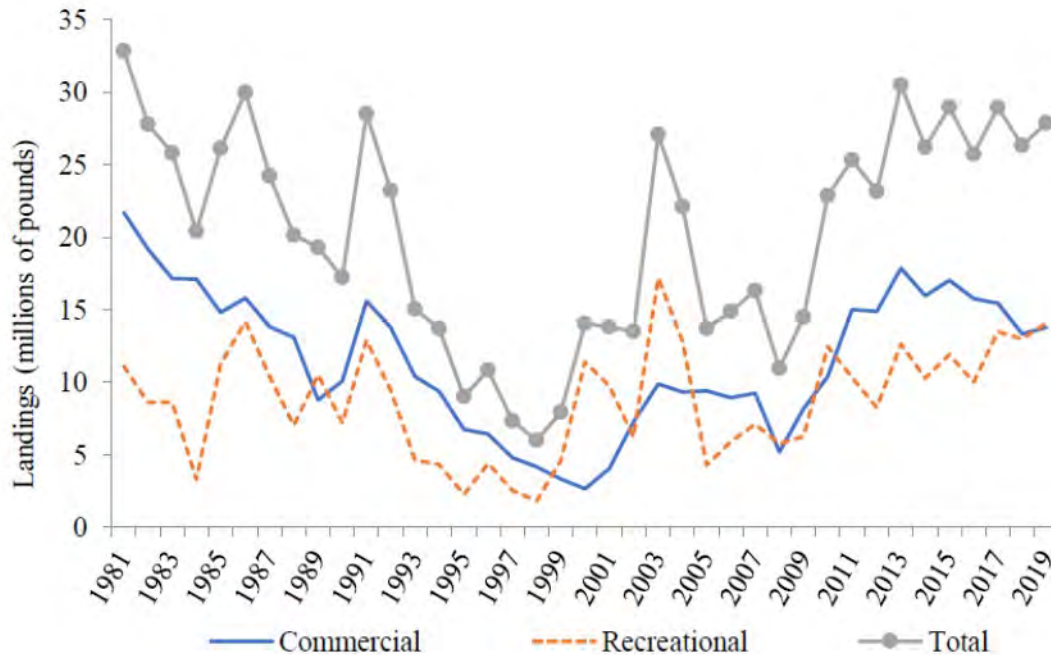


Figure 19: Commercial and recreational scup landings, Maine-North Carolina, 1981-2019. Recreational landings are based on the new MRIP numbers.

Black Sea Bass: Commercial black sea bass landings peaked at 22 million lb in 1952, following the emergence of the trap fishery. Following the implementation of quotas, average landings have ranged from 1.2 to above 3.99 million lb (in 2017). About 3.53 million pounds of black sea bass were landed by commercial fishermen in 2019, very close to the commercial quota of 3.52 million pounds. In recent years, the recreational harvest of black sea bass was highest in 2016 (12.05 million lb). In 2018, an estimated 7.92 million lb were harvested by recreational anglers. In 2019, an estimated 4.38 million black sea bass, at about 8.61 million pounds, were harvested by recreational anglers from Maine through Cape Hatteras, North Carolina (Table 38, Figure 20). Harvest prior to 2020 should not be compared against the respective recreational harvest limits as the recreational harvest limits prior to 2020 do not account for the recent changes in the MRIP estimation methodology. In 2019, 62 percent of black sea bass harvested by recreational fishermen from Maine through North Carolina (in numbers of fish) were caught in state waters and about 38 percent in federal waters. Most of the recreational harvest in 2019 was landed in New York (36 percent), followed by New Jersey (19 percent), Massachusetts, Rhode Island, and Connecticut (12 each percent). See Table 38 and Figure 20 for more information on black sea bass landings.

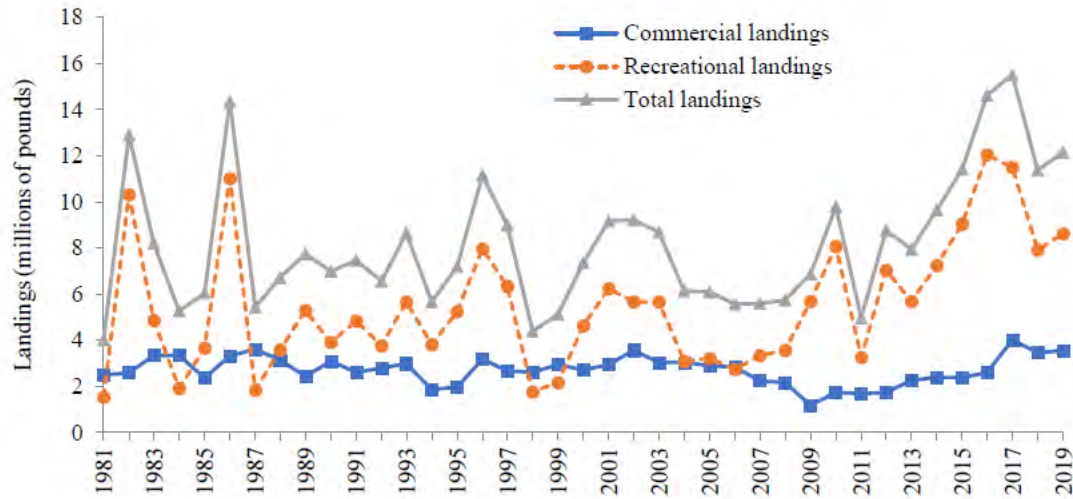


Figure 20: Commercial and recreational black sea bass landings in millions of pounds from Maine through Cape Hatteras, North Carolina, 1981-2019. Recreational landings are based on the revised MRIP estimates

Table 38: Commercial landings of summer flounder, scup, and black sea bass, 2019

Species	Landings (millions of lb)
Summer Flounder	9.06
Scup	13.4
Black Sea Bass	3.53

3.4.9. Description of the Current Atlantic Deep-Sea Red Crab Fishery

The New England Fishery Management Council manages the Atlantic deep-sea red crab fishery through the Atlantic Deep-Sea Red Crab Fishery Management Plan. This FMP uses a quota system comprised of a total allowable landings limit, within an annual catch limit and AM framework. Very little is known about the life history and stock status of deep-sea red crab, but the New England Council's SSC has indicated that the long-term average landings by the directed red crab fleet appears to be sustainable. Even though the overfishing limit is unknown, the SSC considers long-term average landings to be sufficiently below whatever that value is likely to be. Unlike most fisheries, no reliable discard estimate could be determined for red crab. Historically, the acceptable biological catch, annual catch limit, and total allowable landings are currently equal to the long-term average landings of 3.91 million lb of male crabs (NMFS 2017g). More recently, NMFS approved an increase in the acceptable biological catch for fishing years 2020-2023, as recommended by the SSC and approved by the Council, as summarized in Table 39.

Table 39: Atlantic deep-sea red crab 2011-2023 specifications

	2011-2019	2020-2023
Maximum Sustainable Yield	Undetermined	Undetermined
Overfishing Limit	Undetermined	Undetermined
Optimum Yield	Undetermined	Undetermined
Acceptable Biological Catch	1,775 mt	2,000 mt
Annual Catch Limit	1,775 mt	2,000 mt
Total Allowable Landings	1,775 mt	2,000 mt

The fishery takes place year-round. While the average landings vary seasonally and can be limited by market demand, landings are typically highest in summer and fall. Red crabs occur in a patchy distribution from Nova Scotia to Florida, primarily at depths of 400-1800 m along the continental shelf and slope. Figure 21 displays the statistical area groupings used to describe regions where Atlantic deep-sea red crabs are caught (Georges Bank/southern New England (1), New Jersey (2) and Delmarva (3) areas) (NEFMC 2020a).

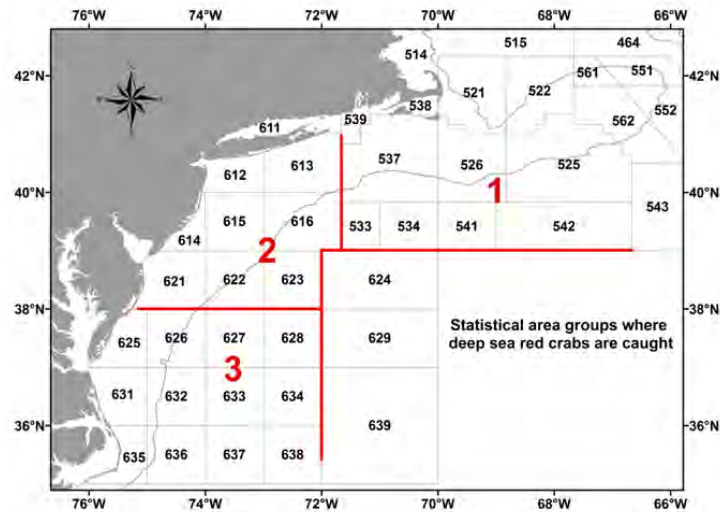


Figure 21: Atlantic deep-sea red crab harvest regions

At present, the Red Crab FMP contains no closures. However, the New England Council has submitted an omnibus FMP action to NMFS that would protect coral. This action would prohibit the use of trap gear in the Georges Bank Deep-Sea Coral Protection Area, and the red crab fishery is exempt from these restrictions. The Council has no immediate plans to revisit this exemption.

Description of Gear Usage

Red crab traps/pots (as defined in 50 CFR 648.2) are “any structure or other device, other than a net or parlor trap/pot, that is placed, or designed to be placed, on the ocean bottom and is designed for, or is capable of, catching red crabs.” Each trap may not be larger than 18 cubic feet, and they may be rectangular, trapezoidal, or conical only, unless otherwise allowed by the Regional Administrator. The most common trap used is conical in shape (NEFMC 2002). Traps are set in trawls of typically 150 traps per trawl. Red crab fishing vessels are restricted to 600 crab pots. This equates to a maximum of approximately 40 vertical lines used in the fishery if all

five limited access permitted vessels were active. More recent information suggests that the red crab fishery has deployed either 24 or 32 vertical lines annually, over the last 10 years (NEFMC 2020a). There is some amount of gear loss or damage on every trip. The reported average for pot loss or damage is just over 10 pots per trip. The average soak time of the baited traps is approximately 24 hours (NEFMC 2020a). Traps are hauled one at a time, and the catch sorted immediately (NEFMC 2002). Incidental harvesters may land red crab with gear authorized and regulated in other fishery management plans.

Fishing Effort

The majority of permits issued in for the red crab fishery are an open access, incidental permit category that allows a small amount of red crabs to be landed while participating in other fisheries. While these account for the vast majority of permits issues, these vessels account for less than 1 percent of landings (NEFMC 2016a, 2020a). The targeted red crab fishery is comprised of a small number of vessels (Table 40) with limited access permits (Category B and C permits). The majority of these vessels' revenue is generated from red crab landings. Limited access red crab vessels may fish with or carry on board up to 600 traps/pots when fishing for red crab, for 3,000 traps total authorized for use in the fishery.

Table 40: Number of permits in the Atlantic deep-sea red crab fishery in 2018

Permit Category	Description	Permits Issued
Category A	Open Access	~1,300
Category B	Limited Access	4
Category C	Limited Access	1

Updated information indicates that landings have increased since 2013, and in 2018, the landings were among the highest since implementation of the Red Crab FMP in 2002 (Figure 22). Incidental landings by vessels not targeting red crabs were nearly zero. Annual landings by region are one measure of the spatial extent of the fishery over the year. Recent data indicate that landings have increased from Region 2, compared with early years in the fishery when most of the landings were concentrated from Region 1. Landings from Region 3 have stabilized since 2013 after being highly variable in previous years (Figure 23) (NEFMC 2016a, 2020a).

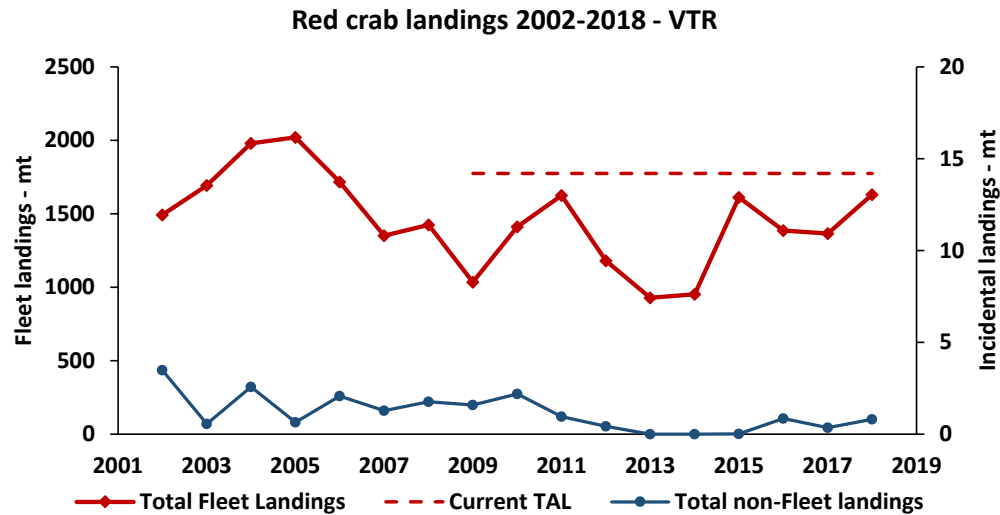


Figure 22: Atlantic deep sea red crab landings (mt), 2002-2015

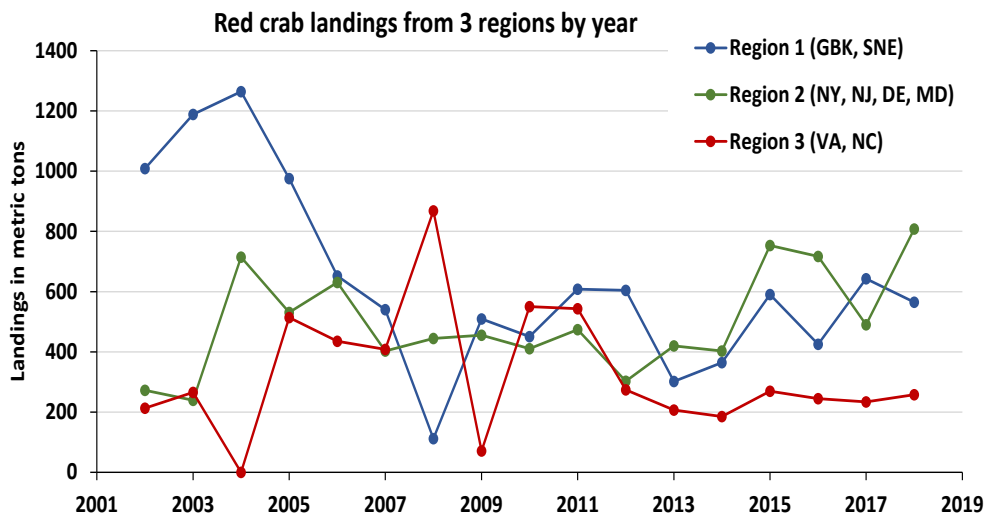


Figure 23: Atlantic deep-sea red crab landings by region, 2002-2015

3.4.10. Exempted Fishing, Education, and Research Permits

Regulations at 50 CFR 600.745 allow the Regional Administrator to authorize the targeted or incidental harvest of species managed under an FMP or fishing activities that would otherwise be prohibited for scientific research, limited testing, public display, data collection, exploration, health and safety, environmental cleanup, hazardous waste removal purposes, or for educational activities. Every year, GARFO may issue a small number of exempted fishing permits (EFP), scientific research permits (SRP), and/or exempted educational activity authorizations (EEAA) exempting the collection of a limited number of species from Northeast federal waters from regulations implementing the appropriate FMP. EFPs and EEAs involve fishing by commercial or research vessels that use similar or identical fishing methods as the fisheries that are the subject of this Opinion. The only differences with these projects are typically (a) the use of modified gear, which was not authorized under the specific FMP at the time, or (b) requests for additional DAS or trips to closed areas beyond what the annual specifications for the fishery

allowed. A SRP covers similar types of activities as an EFP in terms of authorizing minor changes to the regulations, but they are usually issued to scientific research vessels. Table 41 shows the number of EFPs, EEAs, and SRPs for each fishery issued by GARFO from 2014 to 2020.

Table 41: Number of EFPs, EEAs and SRPs issued by GARFO (2014-2020)

FMP	EFPs	EEAs	SRPs
Northeast Multispecies	52	17	18
Summer flounder/Scup/Black sea bass	16	0	3
Spiny dogfish	0	0	1
Squid/mackerel/butterfish	2	0	1
Bluefish	0	0	0
Skate	3	0	1
Monkfish	16	0	0
Lobster	26	0	0
Jonah Crab	2	0	0
Total	117	17	24

These research activities have previously been determined to be small in both scale (number of participating vessels, amount of gear, etc.) and effort (number of trips) compared to the overall fisheries. For the EFPs, EEAs, and SRPs examined between 2014 and 2020, we were able to conclude that, in all cases, the types and rates of interactions with listed species from the EFP, EEAA, and SRP activities would be similar to those analyzed in their respective biological opinions. Given our past experience with and knowledge of the usual applicants (and when and where they fish), we expect that future EFPs, EEAs, and/or SRPs would propose fishing types and associated fishing effort similar to previous EFPs/EEAs/SRPs and, therefore, not introduce a significant increase in effort levels for the ten fisheries considered in this Opinion. For example, issuance of an EFP to an active commercial vessel that is similar to the ones described above likely does not add additional effects compared to those that would otherwise accrue from the vessel's normal commercial activities. Similarly, issuance of an EFP, EEAA, or SRP to a vessel to conduct a minimal number of tows/trips with gear used in the fisheries likely would not add sufficient fishing effort to produce a detectable change in the overall amount of fishing effort in a given year. Therefore, we consider the future issuance of most SRPs, EFPs and EEAs by GARFO to be within the scope of this Opinion. If an SRP, EFP or EEAA is proposed which modifies this agency action in a manner that causes an effect to listed species or critical habitat not considered in this Opinion (i.e., is beyond the scope of the fishery activity considered), then additional section 7 consultation would be necessary.

3.5. Action Area

Action area means all areas affected directly, or indirectly, by the federal action, and not just the immediate area involved in the action (50 CFR. §402.02). For the purposes of this Opinion, the action area encompasses the area in which the ten fisheries operate, broadly defined as all U.S. EEZ waters from Maine through Key West, FL. This includes state waters (0-3 nmi) as vessels fishing in the federal fishery transit to the fishing grounds through these waters.

4. STATUS OF THE SPECIES

ESA-listed species and designated critical habitat occur in the action area of the proposed action. Table 42 summarizes those species and critical habitat that occur in the action area⁴ and that may be adversely affected (e.g., there have been observed or documented interactions in the fisheries or with gear type(s) similar to those used in the fisheries). Section 4.1 details which species and critical habitat are not likely to be adversely affected by the proposed action because the effects of the proposed action are deemed insignificant, discountable, or completely beneficial. Section 4.2 summarizes the biology and ecology of those species that may be adversely affected by the proposed action and details information on their life histories in the action area, if known.

Table 42: ESA-listed species and designated critical habitat in the action area of the proposed action

Species	Status	Potential to be adversely affected by the proposed action?
Marine Mammals: Cetaceans		
Blue whale (<i>Balaenoptera musculus</i>)	Endangered	No
North Atlantic right whale (<i>Eubalaena glacialis</i>)	Endangered	Yes
Fin whale (<i>Balaenoptera physalus</i>)	Endangered	Yes
Sei whale (<i>Balaenoptera borealis</i>)	Endangered	Yes
Sperm whale (<i>Physeter macrocephalus</i>)	Endangered	Yes
Marine Reptiles: Sea Turtles		
Green sea turtle (<i>Chelonia mydas</i>), North Atlantic DPS	Threatened	Yes
Green sea turtle (<i>Chelonia mydas</i>), South Atlantic DPS	Threatened	No
Hawksbill sea turtle (<i>Eretmochelys imbricata</i>)	Endangered	No
Kemp's ridley sea turtle (<i>Lepidochelys kempii</i>)	Endangered	Yes
Loggerhead sea turtle (<i>Caretta caretta</i>), Northwest Atlantic Ocean DPS	Threatened	Yes
Leatherback sea turtle (<i>Dermochelys coriacea</i>)	Endangered	Yes
Fish		
Atlantic salmon (<i>Salmo salar</i>)	Endangered	Yes
Atlantic sturgeon (<i>Acipenser oxyrinchus</i>)		
<i>Gulf of Maine DPS</i>	Threatened	Yes
<i>New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs</i>	Endangered	Yes

⁴ The previous biological opinion on the lobster fishery (NMFS 2014b) found that while there was a potential for lobster fishing activity to occur within the GOM DPS of Atlantic salmon critical habitat, it was not likely to adversely affect the designated critical habitat for the GOM DPS of Atlantic salmon. This fishing would have been by dually-permitted (i.e., state and federally permitted) vessels. Given that this Opinion is only considering fishing activity in federal waters, it does not overlap with the designated critical habitat. Vessels participating in the fisheries in this Opinion are also not expected to transit through the critical habitat. The GOM DPS of Atlantic salmon critical habitat is outside the action area and will not be considered here. Critical habitat for the five listed DPSs of Atlantic sturgeon, which is found in rivers, is similarly outside the action area.

Species	Status	Potential to be adversely affected by the proposed action?
Giant manta ray (<i>Manta birostris</i>)	Threatened	Yes
Nassau grouper (<i>Epinephelus striatus</i>)	Threatened	No
Oceanic whitetip shark (<i>Carcharhinus longimanus</i>)	Threatened	No
Shortnose sturgeon (<i>Acipenser brevirostrum</i>)	Endangered	No
U.S. DPS of smalltooth sawfish (<i>Pristis pectinata</i>)	Endangered	No
Seagrass		
Johnson's seagrass (<i>Halophila johnsonii</i> Eiseman)	Threatened	No
Coral		
Elkhorn coral (<i>Acropora palmata</i>)	Threatened	No
Staghorn coral (<i>Acropora cervicornis</i>)	Threatened	No
Lobed star coral (<i>Orbicella annularis</i>)	Threatened	No
Mountainous star coral (<i>Orbicella faveolata</i>)	Threatened	No
Boulder star coral (<i>Orbicella franksi</i>)	Threatened	No
Pillar coral (<i>Dendrogyra cylindrus</i>)	Threatened	No
Rough cactus coral (<i>Mycetophyllia ferox</i>)	Threatened	No
Critical Habitat		
North Atlantic right whale	Designated	No
Northwest Atlantic DPS of loggerhead sea turtle	Designated	No
U.S. DPS of smalltooth sawfish	Designated	No
Johnson's seagrass	Designated	No
Elkhorn and staghorn corals	Designated	No

4.1. Species and Critical Habitat Not Likely to be Adversely Affected by the Proposed Actions

As indicated in Table 42, we have determined that the actions considered in this Opinion are not likely to adversely affect a number of species that are listed as threatened or endangered under the ESA. Additionally, we have determined that the proposed actions are not likely to adversely affect any designated critical habitat found in the action area (Table 42). Destruction or adverse modification of critical habitat is a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species (50 CFR 402.2). Below, we present our rationale for our “not likely to adversely affect” determinations.

4.1.1. *Blue Whale*

Blue whales do not regularly occur in waters of the U.S. EEZ (Lesage et al. 2018, Waring et al. 2010). Over the last 48 years, there have only been 42 sightings of blue whales in waters of the U.S. EEZ from Maine to Key West, Florida reported in OBIS SEAMAP (<http://seamap.env.duke.edu/>). This is less than one blue whale sighting per year within the action area. In a recent study on the seasonal acoustic occurrence of whales in the New York Bight, researchers detected blue whales, using passive acoustic monitoring, on 11 percent of the survey days (Muirhead et al. 2018). The whales were detected from January to March, and detections increased with recorder distance from shore, suggesting that the individuals occurred

to the seaward, offshore end of the recording array (which extended to the shelf edge) or beyond. A single blue whale was also tracked moving south-southwest along the shelf edge (Muirhead et al. 2018). Given the limited co-occurrence between blue whales and the fisheries in this Opinion, effects to blue whales from the operation of any of the ten fisheries are extremely unlikely. This conclusion is further supported by the information on observed and documented U.S. Atlantic fishery-related interactions. In 1986, a blue whale was documented on Stellwagen Bank with gear around its flipper; the gear type was not confirmed and its origin was unknown (Waring et al. 1999). There have been other records since then and no observed or documented U.S. Atlantic fishery-related M/SIs to blue whales to date (Henry et al. 2017, Henry et al. 2015, 2016, Henry et al. 2019, Waring et al. 2010). Based on this information, effects of the fisheries on blue whales are extremely unlikely and, therefore, discountable⁵.

4.1.2. *Green Sea Turtle, South Atlantic DPS*

The green sea turtle is the largest of the hardshell marine turtles. Two DPSs occur within the action area, the North Atlantic and South Atlantic DPSs. Both DPSs are listed as threatened under the ESA (81 FR 20058, April 6, 2016). While all of the mainland U.S. nesting individuals are part of the North Atlantic DPS, the U.S. Caribbean nesting assemblages are split between the North Atlantic and South Atlantic DPS. Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992, FitzSimmons et al. 2003). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. Within U.S. waters of the Atlantic, individuals from both the North Atlantic and South Atlantic DPSs can be found on foraging grounds. There are currently no in-depth studies available to determine the percent of North Atlantic and South Atlantic DPS individuals in any given location. However, one small-scale study on the Atlantic coast of Florida (off Hutchinson Island) found that approximately 5 percent of the turtles sampled came from the Aves Island/Suriname nesting assemblage, which is part of the South Atlantic DPS (Bass and Wayne 2000). All of the individuals in both studies were benthic juveniles. Available information on green turtle migratory behavior indicates that only juvenile turtles display long distance dispersal, suggesting that larger adult-sized turtles return to forage within the region of their natal rookeries, thereby limiting the potential for gene flow across larger scales (Monzón-Argüello et al. 2010).

Of the ten fisheries in this Opinion, only the bluefish fishery operates in waters commonly used by green sea turtles from the South Atlantic DPS as it is the only fishery to extend south of North Carolina. The management unit for the Bluefish FMP extends from Maine through Key West, Florida (MAFMC and ASMFC 1998). In Georgia and South Carolina, effort in the bluefish fishery is de minimis (ASMFC 2019c). Therefore, our analysis of bluefish effort south of North Carolina is restricted to Florida. Takes of green sea turtles from the South Atlantic DPS (see section 4.2.2.1 for the North Atlantic DPS) in the bluefish fishery are considered extremely unlikely given:

⁵ When the terms “discountable” or “discountable effects” appear in this document, they refer to potential effects that are found to support a “not likely to adversely affect” conclusion because they are extremely unlikely to occur. The use of these terms should not be interpreted as having any meaning inconsistent with our regulatory definition of “effects of the action.”

- Commercial fishing effort in Florida for bluefish is limited. The majority of the commercial bluefish landings from 2012-2017 were in North Carolina, Rhode Island, New York, Massachusetts, and New Jersey (MAFMC 2013, 2014, 2015, 2016, 2017, 2018a). In 2018, North Carolina and New York continued to account for the majority of landings followed by Florida. Landings continued to be predominately in the mid-Atlantic and north, with 82 percent of landings from seven statistical areas (Figure 24). Approximately 13 percent (approximately 326,000 lb) of landings were from Florida (ASMFC 2019c, MAFMC 2019a). There was only one port in Florida where landings were greater than 100,000 lb, accounting for 6 percent of the commercial landings. At this port, the landings were from three vessels (MAFMC 2019a).

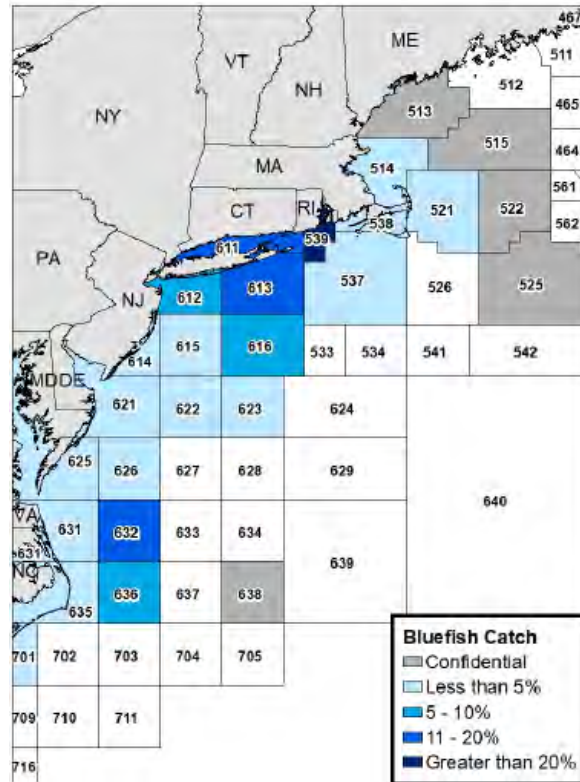


Figure 24: NMFS statistical areas accounting for a percentage of the commercial bluefish landings in 2018 (MAFMC 2019a)

- Green sea turtles on the foraging grounds are associated with seagrass habitats, which are shallow water habitats. Bluefish are a migratory pelagic species (i.e., occupying the water column not near the bottom or coast) (Shepherd and Packer 2006). Fishing effort in this Opinion occurs in federal waters. This difference in habitat preferences and the spatial extent of the fishery limits the overlap of green sea turtles and the bluefish fishery.
- Bluefish is a restricted species (Fla. Stat. §379.101(32), requiring an endorsement to harvest commercially, in Florida (68B-43.001) and subject to possession and gear restrictions (68B-43.005). Nets in federal waters adjacent to Florida state waters must be tended and soak times are limited to one hour (68B-43.005). When nets are tended, it is more likely that sea turtles at the surface will be detected.
- Recreational effort targeting bluefish in waters off Florida is also very low. In 2016 and 2017, the majority of the recreational landings have come from New Jersey, North

Carolina, and New York (MAFMC 2018a, 2019a). In 2018, the greatest overall catches occurred in North Carolina, Florida, and New Jersey (MAFMC 2019a). Bluefish were primarily caught by hook and line from shore or private boats and are often landed while targeting other species. To better understand the recreational fishery targeting bluefish in Florida, we obtained data from the Marine Recreational Information Program (MRIP). From 2014-2018, MRIP conducted 54,943 interviews in Atlantic Florida. During these interviews, bluefish were recorded on approximately 2.5 percent (1,351) of all interviews. Of the interviews where bluefish were caught, only 6 percent identified bluefish as a primary or secondary target. This indicates that approximately 0.15 percent of the recreational effort is targeting bluefish. This very low effort limits the likelihood that the recreational fishery will incidentally capture a sea turtle.

5. Bluefish are fairly active and recreational fishermen catch them by casting the lure or bait into the water and retrieving it (jigging). They may cast into schools of bluefish. While sea turtles are vulnerable to capture on hook and line gear, the techniques used in the bluefish fishery makes the effects extremely unlikely. Foraging green sea turtles are unlikely to be snagged by jigged gear as it is deployed near the surface and constantly reeled back to the boat. It is possible a sea turtle could become snagged if it comes into contact with the jigged hook, but the chances of that occurring are extremely low.
6. Interactions with vessels operating in the fishery are also unlikely to occur given the limited overlap of the fishery and South Atlantic DPS of green sea turtles.

Due to the limited distribution of the South Atlantic DPS of green sea turtles in the action area, the commercial gear requirements, and the operations of the recreational fishery, it is extremely unlikely that this species would interact with fishing gear utilized in the bluefish fishery; therefore, effects are discountable.

4.1.3. *Hawksbill Sea Turtle*

The hawksbill sea turtle is listed as endangered. This species is uncommon in the waters of the continental United States. Hawksbills prefer coral reef habitats, such as those found in the Caribbean and Central America. Within the U.S. territories, Mona Island (Puerto Rico) and Buck Island (St. Croix, U.S. Virgin Islands) contain especially important foraging and nesting habitat for hawksbills (NMFS and USFWS 1993). Within the continental United States, nesting is restricted to the southeast coast of Florida and the Florida Keys, but nesting is rare in these areas. Hawksbills have been recorded from all Gulf of Mexico states and along the U.S. east coast as far north as Massachusetts, but sightings north of Florida are rare. Many of the strandings in states north of Florida have been after hurricanes or offshore storms. Aside from Florida, Texas is the only other U.S. state where hawksbills are sighted with any regularity (NMFS and USFWS 1993). The Sea Turtle Stranding and Salvage Network (STSSN) can also provide some information on relative abundance of sea turtles as all species in a given area face similar threats. Therefore, the strandings can provide some information on the proportion of sea turtles in an area. From 2008-2017, an annual average of 14.5 hawksbill sea turtles stranded from all causes in Atlantic Florida. This represented approximately 1.3 percent of all strandings in this area (NMFS STSSN, unpublished data).

Of the ten fisheries in this Opinion, only the bluefish fishery operates in waters commonly used by hawksbill sea turtles, as it is the only fishery to extend south of North Carolina. The management unit for the Bluefish FMP extends from Maine through Key West, Florida (MAFMC and ASMFC 1998). In Georgia and South Carolina, effort is de minimis (ASMFC

2019c). Therefore, our analysis of bluefish effort south of North Carolina is restricted to Florida. Takes of hawksbill sea turtles in the bluefish fishery considered extremely unlikely given:

1. As described above, commercial fishing effort in Florida for bluefish is low, and gear restrictions apply to vessels possessing bluefish (68B-43.05), making interactions between the bluefish fishery and hawksbill sea turtles unlikely.
2. Hawksbill sea turtles are commonly associated with coral reefs. In Florida, the coral reefs are shallow water reefs that extend from the Dry Tortugas in the Florida Keys to St. Lucie Inlet on the Atlantic coast (Rohmann and Monaco 2005). Bluefish are a migratory pelagic species (i.e., occupying the water column not near the bottom or coast) (Shepherd and Packer 2006). This difference in habitat preferences limits the overlap of hawksbills and the fishery.
3. Gillnet gear is the primary gear (50 percent of 2018 landings) used to commercially land bluefish. Gears used to a lesser extent are unknown (26 percent), bottom trawl (9 percent) and other (9 percent) (MAFMC 2019a). Gillnet fishing is prohibited in Florida state waters (Florida Administrative Code 688-4.0081), and nets in federal waters adjacent to Florida state waters must be tended and soak times are limited to one hour (68B-43.005), making it more likely that sea turtles at the surface would be detected.
4. Bottom trawl would not be fished in coral reef areas. This further limits the overlap of hawksbill sea turtles and the fishery.
5. Recreational fishermen targeting bluefish in Florida represent approximately 0.15 percent of the recreational fishery (see above). This extremely low effort limits the likelihood that the recreational fishery will incidentally capture a sea turtle.
6. As described above, bluefish are fairly active and fishermen catch them by casting the lure or bait into the water and retrieving it (jigging). Sea turtles are unlikely to be snagged by jigged gear as it is deployed near the surface and constantly reeled back to the boat. It is possible a sea turtle could become snagged if it comes into contact with the jigged hook, but the chances of that occurring are extremely low.
7. Interactions with vessels operating in the fishery are also unlikely to occur given the limited overlap of the fishery and hawksbill sea turtles.

Due to the species' tropical distribution, the lack of documented interactions in the fishery, the commercial gear requirements, and the operations of the recreational fishery, it is extremely unlikely that hawksbill sea turtles would interact with fishing gear utilized in the bluefish fishery; therefore, effects are discountable.

4.1.4. *Nassau Grouper*

The Nassau grouper (*Epinephelus striatus*) is a reef fish, but it transitions through a series of habitats. As larvae, they are planktonic. As juveniles, they inhabit nearshore shallow waters in macroalgal and seagrass habitats. With increasing size and maturation, they shift primarily to reef habitat (Hill and Sadovy de Mitcheson 2013). They inhabit waters from the shoreline to about 426 feet (Hill and Sadovy de Mitcheson 2013). Nassau grouper are mostly absent from the continental United States, except Florida, where larger juveniles and adults have been recorded. In the action area, its confirmed distribution is limited to southern Florida (Figure 25). A number of surveys have collected information on Nassau group in Florida waters. A Florida Fish and Wildlife Conservation Commission survey from 1999-2007 observed 79 Nassau grouper between 35 and 70 cm in length (Letter from J. McCawley, Director, Division of Marine Fisheries Management to NMFS Southeast Regional Office as cited in Hill and Sadovy de

Mitcheson, 2013). The Reef Environmental Education Foundation (REEF) reported 1,322 Nassau grouper in 9,706 surveys over a 10-year period (2003-2013). Surveys up the east coast of Florida to Jupiter Inlet reported 83 Nassau grouper in 6763 surveys (Hill and Sadovy de Mitcheson 2013). The most serious threats to Nassau grouper are fishing at spawning aggregations and inadequate law enforcement. No spawning aggregation sites have been reported in Florida (Hill and Sadovy de Mitcheson 2013).



Figure 25: Range of Nassau grouper (Hill and Sadovy de Mitcheson 2013)

Of the ten fisheries, only the bluefish fishery may occur in waters typically used by Nassau grouper. The NEFSC Observer Program observes the fisheries in this Opinion, including the bluefish fishery, north of Cape Hatteras; given this, together with the geographical range of Nassau grouper, there is no information available on observed interactions with Nassau grouper in the bluefish fishery. Takes of Nassau grouper in the bluefish fishery are extremely unlikely for a number of reasons, including:

1. Nassau grouper and bluefish occupy and use the water column differently. As juveniles, Nassau grouper inhabit nearshore shallow waters in macroalgal and seagrass habitat. This area is outside the area where fishing activity considered in this Opinion is occurring. As adults, Nassau grouper are a relatively sedentary reef-fish species. In contrast, bluefish are a migratory pelagic species. The use of different parts of the water column and habitat by Nassau grouper and bluefish makes it unlikely that commercial or recreational fishermen targeting bluefish would capture Nassau grouper.
2. Nassau grouper occurs only in southeast Florida, which is the most southern extent of the bluefish fishery. This limits the overlap between the bluefish fishery and Nassau grouper. In the commercial fishery, the majority of landings (82 percent) in 2018 came from seven statistical areas, all of which were north of Cape Hatteras. While Florida had one port where more than 100,000 of bluefish were landed in 2018, these landings accounted for only 6 percent of the total commercial landings and were from three vessels (ASMFC 2019c, MAFMC 2019a). All of these factors limit the overlap of the commercial bluefish fishery and Nassau grouper.
3. As described above, from 2014-2018, MRIP documented bluefish on approximately 2.5 percent of the interviews conducted in Atlantic Florida. MRIP is a survey of recreational fishermen and does not include commercial vessels. Of these, only 6 percent of interviews had bluefish identified as a primary or secondary target. During this same

period, less than 0.5 percent of interviews that were positive for bluefish were also positive for Nassau grouper (includes all interviews where bluefish were documented, regardless of if they were targeted). In all cases where bluefish and Nassau grouper were recorded during the same interview, bluefish was not identified as a primary or secondary target species. Given the limited effort in the recreational bluefish fishery in this area and the limited overlap of the two species, it is unlikely bluefish recreational hook-and-line would interact with Nassau grouper.

4. Interactions with vessels transiting to the fishing grounds are also considered unlikely to occur. Nassau grouper are primarily demersal and would rarely be at risk from moving vessels which need sufficient water to navigate without encountering the bottom. When operating in areas with marginal clearance, vessels generally transit these areas slowly, allowing the species an opportunity to move out of the way. In addition, there is very limited overlap with vessels participating in the fisheries considered in this Opinion.

Given the limited overlap of the fishery and Nassau grouper; the different habitats used by bluefish and Nassau grouper, and the lack of documented interactions between this fishery and Nassau grouper, it is extremely unlikely that Nassau grouper would interact with fishing gear utilized in the bluefish fishery; therefore, effects are discountable.

4.1.5. ***Oceanic Whitetip Shark***

In the western Atlantic, oceanic whitetip sharks (*Carcharhinus longimanus*) occur from Maine to Argentina, including the Caribbean and Gulf of Mexico. It is a highly migratory species that is usually found offshore in the open ocean, on the outer continental shelf, or around oceanic islands (Bonfil et al. 2008, Young et al. 2017). The species can be found in waters temperatures between 15 °C and 28 °C, but it exhibits a strong preference for the surface mixed layer in water with temperatures above 20 °C (Bonfil et al. 2008) and is considered a surface-dwelling shark. Little is known about movements or possible migration paths (Young et al. 2017). Currently, the most significant threat to oceanic whitetip sharks is mortality in commercial fisheries, largely driven by demand of the international shark fin trade and bycatch-related mortality, as well as illegal, unreported, and unregulated fishing. Oceanic whitetip sharks are generally not targeted, but they are frequently caught as bycatch in many global fisheries, including pelagic longline fisheries targeting tuna and swordfish, purse seine, gillnet, and artisanal fisheries (Young et al. 2017).

Although some of these gear types known to interact with oceanic whitetip sharks are utilized in the fisheries considered in this Opinion, these sharks are found farther offshore in the open ocean, on the continental shelf or around oceanic islands in deep water greater than 600 ft (184 m). They have a strong preference for the surface mixed layers in waters warmer than 20 °C (Young et al. 2017). Given the more offshore distribution of oceanic whitetip sharks, little overlap between fishing gear and oceanic whitetip sharks is expected. For the fisheries that have a larger offshore component (e.g., lobster and red crab fisheries), interactions are extremely unlikely as these fisheries use trap/pot gear, a gear type not known to interact with this species. Other gear types (e.g., bottom trawls) and fisheries (e.g., squid, Northeast multispecies) may also operate in offshore waters (see <https://www.northeastoceandata.org/>). As a surface-dwelling species, oceanic whitetip sharks are unlikely interact with gears that are fished deeper in the water column. In addition, there have not been any observed interactions between the fisheries and oceanic whitetip sharks (NEFSC observer/sea sampling database, unpublished data) since the beginning of the observer program in 1989. Given their offshore distribution and the diffuse

vessel traffic, of which a limited number of vessels are fishing vessels operating in the fisheries considered in this Opinion, it is also extremely unlikely that there will be interactions between oceanic white tip sharks and the vessels in this Opinion. Given this information and the pelagic surface-dwelling nature of oceanic whitetip sharks, it is extremely unlikely and, therefore, discountable that the fisheries would interact with oceanic whitetip sharks.

4.1.6. *Shortnose Sturgeon*

Shortnose sturgeon are benthic fish that occur in large coastal rivers of eastern North America. They range from as far south as the St. Johns River, Florida (possibly extirpated from this system) to as far north as the Saint John River in New Brunswick, Canada. Shortnose sturgeon are a diadromous fish species and one of only two sturgeon species that occur in marine waters and estuaries from Canada to Florida. Tracking data indicate that shortnose sturgeon are capable of making coastal migrations, and fish have been tracked between several Maine rivers and down to the Merrimack River in Massachusetts (SSSRT 2010, Wippelhauser and Squiers 2015, Zydlewski et al. 2011). However, even in the Northeast where these coastal migrations have been documented, shortnose sturgeon do not appear to spend significant time in the marine environment and generally stay close to shore (SSSRT 2010, NMFS unpublished data).

We consider it extremely unlikely that the fisheries considered in this Opinion will interact with shortnose sturgeon given:

1. No interactions with shortnose sturgeon have been reported in the fisheries since 2005, and there have been only 12 observed (annual average of 0.4) since the inception of bycatch data collection by the Northeast Fisheries Observer Program in 1989. We reviewed these reports to determine whether Atlantic sturgeon may have been misreported as shortnose sturgeon. Three interactions occurred in 1992, and there were very little data to evaluate whether these may have been misreported. One shortnose sturgeon was captured in 2004. This sturgeon was 160 cm long, which is large for a shortnose sturgeon, but still possible. The remaining eight interactions were documented during two hauls on the same bottom trawl trip in April 2005 off New York Harbor and southwestern Long Island (the primary commercial species landed was windowpane flounder). While their estimated length puts them in the range for either shortnose or Atlantic sturgeon, the aggregation behavior where multiple sturgeon are caught in two hauls is more typical of the aggregation behavior of Atlantic sturgeons in ocean waters. In addition, recent trawl research in and around those waters where these takes have occurred has only led to captures of Atlantic sturgeon (Dunton et al. 2012, Dunton et al. 2015, Dunton et al. 2010, O'Leary et al. 2014). Therefore, we are skeptical that these identifications are correct. If the captures in the observer data were not misidentified, we consider them an anomaly and unlikely to reoccur.
2. Subsequent to these takes, additional information and training on sturgeon were provided to observers, and the observers began to collect samples for genetic analysis with the purpose of identifying the species. The fact that no shortnose sturgeon takes have been recorded since 2005 is likely a reflection of the additional information provided for sturgeon species identification. In addition, the Northeast Area Monitoring and Assessment Program (NEAMAP) surveys are conducted with bottom other trawl in nearshore waters from the Gulf of Maine to Cape Hatteras in the spring and fall. Initiated in 2006, the NEAMAP southern New England/mid-Atlantic near shore trawl fishery

collects data from Aquinnah, Massachusetts to Cape Hatteras, North Carolina. There are no records of shortnose sturgeon captured during these surveys.

3. Shortnose sturgeon only infrequently move along the coast (SSSRT 2010, NMFS unpublished data). These movements are generally limited by geographic distance between river mouths, with greater movement between geographically proximate rivers. Movement between larger groups of rivers at greater geographic distance rarely occurs. When coastal migrations have been documented, shortnose sturgeon do not appear to spend significant time in the marine environment and generally stay close to shore (SSSRT 2010). The fisheries in this Opinion do not generally operate along the shore where these migrations are taking place.
4. Vessel strikes are also considered unlikely to occur. Shortnose sturgeon are primarily demersal, occupying the bottom of the water column, and would rarely be at risk from moving vessels, which need sufficient water to navigate without encountering the bottom. Given the species distribution, there is very limited overlap with vessels participating in the fisheries considered in this Opinion.

Because the fisheries undergoing consultation occur in federal waters and generally do not overlap with the species, the lack of documented take in more than a decade in the fisheries under consultation, and the lack of documented take in nearshore trawl surveys, we have determined that it is extremely unlikely that shortnose sturgeon would interact with these fisheries; therefore, effects are discountable.

4.1.7. ***Smalltooth Sawfish and Designated Critical Habitat***

While distributed circumglobally, NMFS identified smalltooth sawfish from the southeast United States as a DPS (68 FR 15674, April 1, 2003). North of Florida, recent records of smalltooth sawfish are rare. Records in the mid-Atlantic are from the late 1800s and early 1900s. Recent records from North Carolina through Georgia are sparse. Since 1970, there was one record in North Carolina (1999) and two in Georgia (2002, 2015) (Wiley and Brame 2018). Most specimens captured along the Atlantic coast north of Florida are large adults (over 10 ft (3 m)) that likely represent seasonal migrants, wanderers, or colonizers from a historic Florida core population(s) to the south, rather than being members of a continuous, even-density population (Bigelow and Schroeder 1953a).

Current records of smalltooth sawfish from the east coast of Florida remain relatively scarce compared to the west coast, Florida Bay, and the Florida Keys (Wiley and Brame 2018). The largest numbers of smalltooth sawfish are found in south and southwest Florida from Charlotte Harbor through the Dry Tortugas (Wiley and Brame 2018). In this area, there is a resident reproducing population of smalltooth sawfish which is also the last U.S. stronghold for the species (Poulakis and Seitz 2004, Seitz and Poulakis 2002). Florida Bay and the west coast of Florida are outside the action area of this Opinion.

In Florida, smalltooth sawfish generally inhabit shallow coastal waters, estuaries, and rivers, down to a maximum depth rarely exceeding 328 ft (100 m) and are associated with mangrove, seagrass, and shoreline habitats (Wiley and Brame 2018, Wiley and Simpfendorfer 2010). When documented, the substrate associated with encounters included mud (61 percent), sand (11 percent), or seagrass (10 percent). Other habitat types reported included limestone hard bottom, rock, coral reef, and sponge bottom (Poulakis and Seitz 2004). Water temperatures (no lower than 16-18 °C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and

red mangroves) are the major environmental constraints limiting the northern movements of smalltooth sawfish in the western North Atlantic.

With the exception of the bluefish fishery, none of the fisheries considered in this Opinion overlap with smalltooth sawfish. The NEFSC Observer Program observes the fisheries in this Opinion, including the bluefish fishery, north of Cape Hatteras; given this, together with the geographical range smalltooth sawfish, there is no information available on observed interactions with smalltooth sawfish in the bluefish fishery. While the bluefish fishery uses gears known to be detrimental to smalltooth sawfish (i.e., gillnets, trawls, and hook-and-line), we believe that takes of smalltooth sawfish in the bluefish fishery are extremely unlikely given:

1. There is limited overlap between the commercial bluefish fishery and smalltooth sawfish. As described above, gillnets are the primary gear used to commercially harvest bluefish; however, the majority of the effort occurs farther north. In addition, Florida has banned gillnet fishing in state waters (Florida Administrative Code 688-4.0081). As gillnet is the primary gear type used in the bluefish fishery and smalltooth sawfish abundance is higher in state waters, this further limits the overlap.
2. Anecdotal information collected by NMFS port agents suggest smalltooth sawfish captures in commercial fisheries in the southeast are now rare (NMFS 2020c). Bluefish effort in the southeast represents only a small fraction of the overall effort in this area.
3. As described above, bluefish were only reported on 2.5 percent of MRIP interviews in Atlantic Florida. Of the 2.5 percent of interviews positive for bluefish, bluefish was the primary or secondary target species in only 6 percent of the interviews. This very low effort limits the likelihood that the recreational fishery will incidentally capture a smalltooth sawfish.
4. Vessel strikes are also considered unlikely to occur. Smalltooth sawfish are primarily demersal and would rarely be at risk from moving vessels, which need sufficient water to navigate without encountering the bottom. When operating in areas with marginal clearance, vessels generally transit these areas slowly, allowing the species an opportunity to move out of the way. Given the species distribution, there is very limited overlap with vessels participating in the fisheries considered in this Opinion.

Given the habitat preference of smalltooth sawfish for shallow coastal waters and the limited commercial and recreational bluefish effort in Florida, the likelihood of an interaction occurring between commercial bluefish fishing gear and smalltooth sawfish within the range of the DPS is extremely unlikely and discountable.

Designated critical habitat for the smalltooth sawfish DPS, which includes the Charlotte Harbor Estuary Unit and the Ten Thousand Islands/Everglades Unit (74 FR 45353, September 2, 2009), also occurs only in Florida waters west and inshore of the Florida Keys (Figure 26). The features essential to the conservation are red mangroves and shallow euryhaline habitats with depths less than 3 ft (74 FR 45353, September 2, 2009). As it is in state waters, this Opinion is considering vessel transits in this area. Critical habitat occupies a very small fraction of the action area. Given that (1) critical habitat occupies a very small fraction of the action area; (2) the number of participants in the fishery in Florida is small, as described above; and (3) that vessels transiting to the fishing grounds are unlikely to be operating in these shallow waters, any affect to the

critical habitat in the action area for the U.S. DPS of smalltooth sawfish will be insignificant and discountable.



Figure 26: Smalltooth sawfish critical habitat

4.1.8. *Johnson's Sea Grass and Designated Critical Habitat*

Johnson's seagrass occurs in a variety of habitat types, including intertidal wave-washed sandy shoals, flood deltas near inlets, and near the mouths of canals and rivers, where presumably water quality is sometimes poor and salinity fluctuates widely. It occurs in a patchy, disjunctive distribution from the intertidal zone to depths of approximately 10-13 ft (3-4 m) (NMFS 2007). Johnson's seagrass is found only in southeast Florida, ranging from Sebastian Inlet to central Biscayne Bay; within this range, 10 areas (Figure 27) are designated as critical habitat (65 FR 17786, April 5, 2000). The general physical and biological features of the critical habitat areas include adequate water quality, salinity levels, water transparency, and stable, unconsolidated sediments that are free from physical disturbance. The specific areas occupied by Johnson's seagrass are those with one or more of the following criteria: (1) locations with populations that have persisted for 10 years; (2) locations with persistent flowering populations; (3) locations at the northern and southern range limits of the species; (4) locations with unique genetic diversity; and (5) locations with a documented high abundance of Johnson's seagrass compared to other areas in the species' range.

The bluefish fishery is the only fishery considered in this Opinion operating in southeastern Florida. The critical habitat is located in state waters. Therefore, effects from vessel transits are assessed here. The number of vessels transiting these areas would be small given that the (1) species and critical habitat occupy a very small fraction of the action area, and (2) the number of

vessels participating in the fishery in Florida is small, as described above. Given this, any affect to Johnson's seagrass or critical habitat will be insignificant and discountable.



Figure 27: Johnson's seagrass distribution

4.1.9. *Corals and Designated Critical Habitat*

We evaluated the potential effects of the proposed action on seven ESA-listed corals (elkhorn, staghorn, rough cactus, pillar, lobed star, mountainous star, and boulder star corals) based on the information provided in the species status reviews, recovery plan, and the listing rules (71 FR 26852, May 9, 2006; 79 FR 53852, Sept. 10, 2014).

Coral reefs are formed on solid substrates within a narrow range of environmental conditions. These conditions include relatively narrow temperature, salinity, turbidity, pH, and light ranges (Brainard et al. 2011, Kleypas 1997). All seven species occur in waters off the east coast of Florida. Elkhorn corals commonly grow in turbulent shallow water at depths of 3-16 ft (1-5 m) in depth, but have been found to 98 ft (30 m). Staghorn corals commonly grow in more protected, deeper waters ranging from 16-49 ft (5-15 m) in depth and have been found in rare instances to 197 ft (60 m) (ABRT 2005). Rough cactus coral has been reported to occur in shallow reef environments in water depths of 16-66 ft (5-20 m) (Brainard et al. 2011, Carpenter et al. 2008). It is usually uncommon (Veron 2000 as cited in Brainard et al. 2011) or rare, occurring at densities < 0.8 colonies per 10 m² in Florida (Wagner et al. 2010). Monitoring data since 2000 from Florida and elsewhere in the Caribbean show that the rough cactus coral cover is consistently less than 1 percent, with occasional observations up to 2 percent (Brainard et al. 2011). Pillar, lobed star, mountainous star, and boulder star corals inhabit most reef environments. Pillar star coral occurs in depths from 6.5-82 ft (2-25 m) (Brainard et al. 2011, Carpenter et al. 2008). It is reported to be uncommon (Veron 2000 as cited in Brainard et al. 2011) with isolated colonies across a range of habitats. Overall colony density throughout south Florida was estimated to be ~ 0.6 colonies per 10 m² (Wagner et al. 2010). Boulder star corals are reported at depths of 16-164 ft (5-50 m) (Bongaerts et al. 2010, Brainard et al. 2011, Carpenter et al. 2008), lobed corals at depths of 1.6-66 ft (0.5-20 m) (Brainard et al. 2011, Szmant et al. 1997), and mountainous star coral are reported at depths of 1.6-131 ft (0.5-40 m) (Brainard et al. 2011, Carpenter et al. 2008, Weil and Knowton 1994). The environmental conditions of most of the U.S. Atlantic EEZ are not suitable for these seven corals. They are generally found in a small area of the southeast United States.

The bluefish fishery is the only fishery in this Opinion that occurs in southeast waters where the coral species occur. The known routes of effect from fishing on ESA-listed corals are a result of man-made abrasion and breakage resulting from vessel groundings, damaging fishing practices and fishing/marine debris (ABRT 2005). While the bluefish fishery occurs in this area, we consider it extremely unlikely that the fishery will interact with ESA-listed coral species given:

1. The effort in the commercial bluefish fishery is low in Florida. The overlap of the commercial fishery is further limited in that these species occur in only a small area off Florida. In addition, gillnets, the primary gear used in the commercial fishery, are prohibited (Florida Administrative Code 688-4.0081) in Florida state waters where these species overlap.
2. The recreational bluefish fishery does use gear that is known to impact coral reefs. Impacts to corals from hook-and-line fisheries interactions are most common to column and branching coral morphology that are more likely to become entangled by line or broken by gear. The rough cactus, lobed star, mountainous star, and boulder star coral species are characterized as boulder/mound or encrusting corals and area generally flat or round and lack the branching morphology that greatly increases the potential risk of becoming fouled by fishing lines. Pillar coral has protruding columns and the elkhorn and staghorn corals have a branching morphology. Even though these species have a morphology that is potentially susceptible to damage, interactions are extremely unlikely given the low co-occurrence of fishing effort and these corals. As described above, the number of recreational fishermen targeting bluefish is extremely low. Given this low effort, the low density of these listed corals, and the very limited overlap of the gear and species, we expect the probability of interaction to be extremely low.
3. Information in Chiappone et al. (2005) suggests that the level of lost gear from hook-and-line fishing effort needed to impact coral is very high. They report that, while lost hook-and-line fishing gear was ubiquitous in the Florida Keys, it was estimated that < 0.2 percent of the milleporid hydrocorals, stony corals, and gorgonians in the habitats studied showed injury (e.g., colony abrasions and partial mortality) as a result of lost hook-and-line gear interactions (Chiappone et al. 2005). Given that bluefish hook-and-line effort represents only a very small percentage of the overall effort, it is extremely unlikely that gear lost in this fishery would impact corals.
4. Vessel groundings are possible because of the proposed action, but we believe these events are extremely unlikely to occur given the limited effort and available technologies. Over the past 20 years, technological advancements and accessibility to depth gauges and GPS units have also increased vessel operators' ability to detect bottom features and calculate vessel position in relation to mapped coral structures. Experience and the use of technology greatly reduce the likelihood of vessels groundings.
5. Florida Keys National Marine Sanctuary regulations establish specific prohibitions against injuring corals (including *Acropora* species), anchoring on corals, grounding vessels on corals, and discharging fishing/marine debris (15 CFR 922.163).

There are four specific areas designated as critical habitat for elkhorn (*Acropora palmata*) and staghorn (*A. cervicornis*) corals (i.e., Florida, Puerto Rico, St. John/St. Thomas, and St. Croix; 73 FR 72210, November 26, 2008). Of these four areas, only the area designated in Florida occurs in the action area (Figure 28). The physical or biological features of elkhorn and staghorn corals' critical habitat that are essential to their conservation is substrate of suitable quality and availability to support successful larval settlement and recruitment, and reattachment and

recruitment of fragments. For purposes of this definition, “substrate of suitable quality and availability” means natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover. (73 FR 72210, November 26, 2008).



Figure 28: Elkhorn and staghorn coral critical habitat - Florida Unit

In designating critical habitat for these coral species, the feature essential to the conservation of the species was substrate of suitable quality and availability, in water depths to 98 ft (30 m), to support successful larval settlement, recruitment, and reattachment of fragments (73 FR 72210, November 26, 2008). The only commercial fishing activity identified that may destroy or adversely affect the essential feature involved trap fisheries (NMFS 2008b). Of the fisheries considered in the on-going consultation, only the bluefish fishery overlaps with critical habitat designated for these coral species. Pot/trap is not a gear type used in the commercial or recreational bluefish fishery. Bluefish fishing vessels transiting through critical habitat are also not expected, for reasons described above, to affect substrate of suitable quality and availability.

The low level of fishing effort, low density of ESA-listed corals occurring where fishing is likely to occur, and the measures in place to protect these species make any adverse effects on these species or the critical habitat from the proposed action extremely unlikely to occur. Based on this information, effects of the fisheries on ESA-listed corals and their designated critical habitats is extremely unlikely and, therefore, discountable.

4.1.10. *North Atlantic Right Whale Critical Habitat*

We have determined that the actions considered in this Opinion are not likely to adversely affect designated critical habitat for North Atlantic right whales (Figure 29). The two areas designated as critical habitat contain approximately 29,763 nmi² of marine habitat in the Gulf of Maine and Georges Bank region (Unit 1, Northeastern U.S. Foraging Area) and off the Southeast U.S. coast (Unit 2, Southeastern U.S. Calving Area) (81 FR 4838, January 27, 2016).

Specifically, we considered whether the actions were likely to affect the essential physical or biological features (PBFs) that afford the designated area overall value for the conservation of North Atlantic right whales.

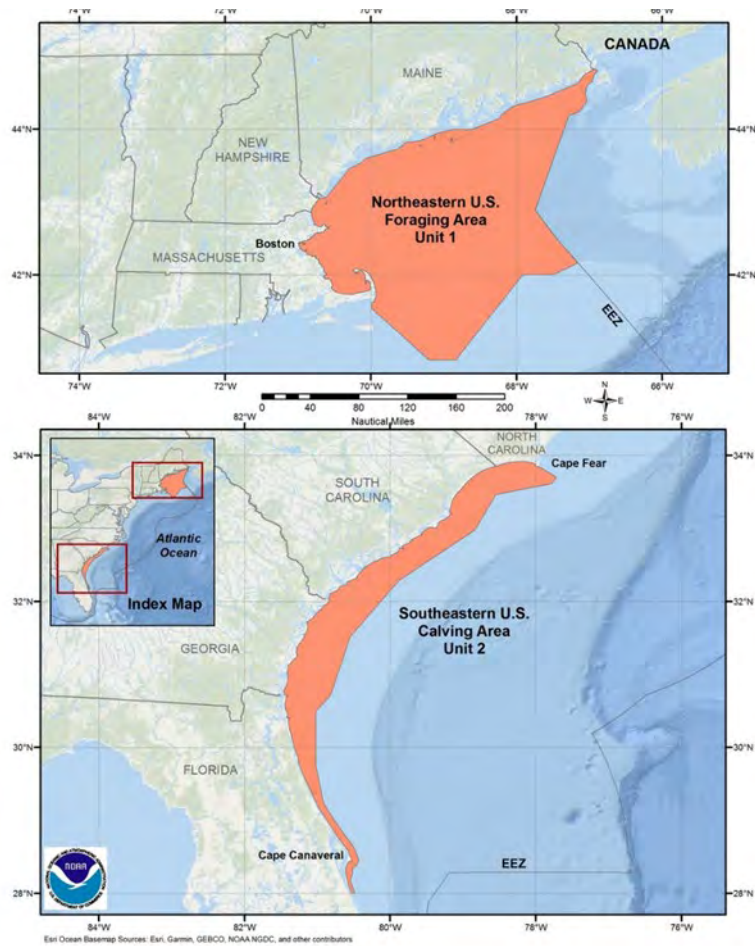


Figure 29: North Atlantic right whale critical habitat

The boundaries of both Unit 1 and Unit 2 are in the action area. The Northeastern U.S. foraging habitat (Unit 1) is defined by the distribution, aggregation and retention of *Calanus finmarchicus*, the primary and preferred prey of North Atlantic right whales (NMFS 2015c). The essential physical features identified in the final rule include prevailing currents, bathymetric features (such as basins, banks, and channels), oceanic fronts, density gradients, and flow velocities. The essential biological features include dense aggregations of copepods, specifically late stage *C. finmarchicus* in the Gulf of Maine and Georges Bank region, as well as aggregations of diapausing (overwintering) populations in the deep basins of the region (i.e., Jordan, George's, and Wilkinson basins) as these populations of *C. finmarchicus* serve as source populations for the overall Gulf of Maine population (Johnson et al. 2006, Lynch et al. 1998, Meise and O'Reilly 1996). It should also be noted that based on changes in right whale and *C. finmarchicus* distributions since 2010, the continental shelf south of New England and the Gulf of Saint Lawrence in Canada (Khan et al. 2018, Record et al. 2019), <https://fish.nefsc.noaa.gov/psb/surveys/MapperiframeWithText.html>) have become increasingly important foraging habitats for North Atlantic right whales indicating that important prey sources may also be present outside of the designated critical habitat area.

The essential features of right whale calving habitat (Unit 2) are dynamic in their distributions throughout the South Atlantic Bight, varying in time and space. The physical features of right whale calving habitat essential to the conservation of the North Atlantic right whale are calm sea surface conditions of less than or equal to Force 4 on the Beaufort Wind Scale, sea surface temperature greater than 7 °C and less than or equal to 17 °C, and water depths of 20 – 92 ft (6-28 m). These features co-occur over large contiguous areas of ocean waters during the months of November. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing. The optimal combinations of the features vary depending on factors such as weather and the age of the calves. (NMFS 2015c). No essential biological features were identified for Unit 2 (NMFS 2015c).

In designating critical habitat, NMFS evaluated and identified activities that may destroy or adversely modify the essential physical and biological features (NMFS 2015b, c). This analysis evaluated whether fishing activity will adversely affect the late-stage dense *C. finmarchicus* aggregations that trigger right whale foraging behavior, the overwintering populations of *C. finmarchicus* in deep water basins, or the physical and oceanographic features that allow these deep water populations to supply the Gulf of Maine *C. finmarchicus* population. It is extremely unlikely that fishing vessels will have any potential to affect the essential biological and physical oceanographic features (i.e., currents, temperature, bathymetry) of critical habitat. Therefore, the analysis focuses on fishing gears used in the fisheries in this Opinion.

Copepods are extremely small organisms that will pass through or around the fishing gears rather than being captured on or in them. In addition, turbidity created from fishing activities is, as described below, expected to be temporary in nature and will not impact the long-term viability of copepod aggregations. While fishing activity may temporarily disturb localized copepod concentrations, this disturbance is not expected to significantly change the quality or quantity of the aggregations to a degree that will impact the conservation of right whales. In addition, any effects from fishing gear on the environment in areas right whales are present are further limited by the requirement that gear not be set within 500 yards of the sighted right whales (50 CFR 224.103(c)), avoiding localized disturbance of copepod populations on which the whales may be feeding. Haulbacks should also not be initiated if right whales are sighted within, or close to, 500 yards from the vessel.

Bottom-tending mobile gear, such as trawls and dredges, have the potential to temporarily disturb resting copepod populations found in deep water basins as the gear moves through areas where the aggregations occur and temporarily increases turbidity. However the effect of this sediment resuspension is likely minimal for several reasons. First, while fine sediment may take up to 24 hours to resettle, the plumes created by bottom trawling are “laterally advected some distance by tidal currents before settling” (Pilskaln et al. 1998). This dispersal would result in lower concentrations of sediment spread out over a larger area, and the localized turbidity would likely be temporary. Additionally, the Gulf of Maine, particularly Wilkinson and Jordan Basin, already has a pervasive “nepheloid layer” (i.e. a layer of water containing suspended sediment) that can reach between 66-131 ft (20-40 m) in thickness (Pilskaln et al. 1998) so it is expected that any copepod aggregation in those areas is adapted to a highly turbid environment. A recent study of *Calanus* found that diapausing *Calanus* can persist across a wide range of conditions in the Northwest Atlantic, and there was little evidence that their vertical distribution was affected by the light conditions (Krumhansl et al. 2018). In addition, laboratory studies have shown that increased sediment loads may affect the feeding efficiency and production of *C. finmarchicus* in

Greenland fjords, however, the results also indicated that copepods can handle very high sediment loads for at least a short period of time (in the study, four days) (Arendt et al. 2011).

As *C. finmarchicus* enter the pre-adult stage, if they build enough lipid stores, they may enter a suspended state of development (diapause) as they retreat to depths where they remain neutrally buoyant. Emergence from diapause is synchronized to allow *C. finmarchicus* or their progeny access to favorable environmental conditions, typically phytoplankton produced during the spring bloom (Baumgartner and Tarrant 2017). The cues triggering the termination of the diapausing state are not clearly understood, however, hypotheses include light and photoperiod cues or the “existence of an endogenous long-range timer that arouses copepods from diapause after some period of time has elapsed” (Campbell et al. 2004, Hirche 1996, Miller et al. 1991). Given that diapause is triggered and maintained; it is unlikely that plumes would disturb *Calanus* when they are in this state of suspended growth. These plumes are also not expected to have an impact energy stores and temperature/light sensitivity that keep these zooplankton in their overwintering state at depth. This is considered an adaptive strategy that allows the zooplankton to suspend development until conditions are optimal for reproductive success. A portion of the pre-adult population will not retreat to depths and instead will molt into adult stages and reproduce prior to the emergence of the diapausing population if conditions allow (though there is a chance that the conditions will not be favorable) (Baumgartner and Tarrant 2017) These alternative survival strategies allow for maximum productivity and continuous replenishment of the stock with varying environmental conditions.

Bottom-tending mobile gear may also impact resting copepod eggs by increasing mortality of eggs that come into contact with the gear or decreasing the eggs’ chances of hatching if it is re-suspended by the plume (Drillet et al. 2014). On the other hand, the resuspension of the eggs into the water column may also potentially increase recruitment back into the water column (Drillet et al. 2014). This trade-off is not well understood, and it is not clear how these impacts differ from natural “bioturbation or storm events under different environmental conditions” (Drillet et al. 2014). There is also no indication of what role sitting eggs play in the overall population recruitment in the Gulf of Maine. A significant supply of the Gulf of Maine’s *C. finmarchicus* population found in Jordan and George’s Basins are supplied from the Scotian Shelf and Scotian Slope waters (Johnson et al. 2006, Miller et al. 1998) with only Wilkinson’s Basin restocking internally (Johnson et al. 2006). Given these multiple sources for *Calanus*, it is unlikely that any localized decrease in hatching success of resting or re-suspended eggs would affect the *Calanus* population at-large or to level that would have any detectable effect on North Atlantic right whale foraging,

It should be noted that, when designating critical habitat, NMFS’ assessment of activities that may destroy or adversely modify the essential physical and biological features; dredging was also considered. However, in that analysis “dredging” refers to the removal of material from the bottom of water bodies to deepen, widen or maintain navigation corridors, anchorages, or berthing areas, as well as sand mining (NMFS 2015b, c). Dredges typically used for navigational deepening or sand mining operations include hopper and cutterhead dredges. Although dredge size varies by location, hydraulic hopper dredges have draghead widths from a few feet to 12 ft (3.6 m); cutterhead diameters typically range from 16-20 inches (maximum 36 inches) (40-53 cm, maximum 91.5 cm). These dredges disturb the sediment surface (down to 12 inches (30.5 cm) or more) creating turbidity plumes that last up to a few hours. The review found that extracting sediments for navigation or beach nourishment projects would have little to no effect

on *C. finmarchicus* and that discharge of dredge material would have ephemeral effects given prevailing currents that would rapidly disperse sediment plumes at depths where essential foraging features are not present (NMFS 2015b). In addition, the ESA 5-year review for right whales concluded that habitat degradation from dredging, among other actions, is not limiting right whale recovery (NMFS 2017e). In contrast to navigational or deepening dredges, scallop dredges ride above the substrate surface, creating turbulence that stirs up the substrate and kicks scallops up and into the bag. The shoes on the dredge are in contact and ride along the surface. Dredges range in width from 5.5 ft (1.7 m) to approximately 15 ft (4.6 m). They are used in high and low energy sand environments and high energy gravel environments (Northeast Region Essential Fish Habitat Steering Committee 2002), Appendix D in NEFMC 2016b). As described above, turbidity from scallop dredges is expected to be minimal and overall effects from scallop dredges are expected to be less than those of navigational or deepening dredges. Given that fishing with dredges is localized, that the bottom disturbance is temporary, and that any turbidity created is expected to be minimal and ephemeral, we conclude that dredging will not adversely affect right whale critical habitat.

Other mobile gear, which operate in the water column, such as purse seines and midwater trawls, may temporarily disperse localized *Calanus* populations. However, given that copepods will easily pass through the mesh of these gear types, they should not interfere with the general aggregations or reproduction. These behaviors are largely dependent on oceanographic processes and currents that the gear types cannot modify.

Fixed fishing gear, such as gillnets and trap/pots, may also temporarily disturb local aggregations of copepods during the setting and hauling of gear due to turbidity caused by the sediment disturbance as the gears are set or dragged over the bottom during retrieval (Northeast Region Essential Fish Habitat Steering Committee 2002). Given the temporary nature of the disturbance, these gears are considered to have low habitat impacts, particularly in areas where sand, mud, and gravel comprise the substrate. Any movement of the gear during active fishing may also cause sediment disturbance, however, this movement would occur in higher energy environments. Local copepod populations would already be adapted to this environment, and the movement would not adversely modify the dense copepod aggregations or the oceanographic features that contribute to their aggregation behaviors. Localized disturbance to dense copepod aggregations by these gear types is further minimized by MMPA gillnet and trap/pot closure areas that exist in temporal and spatial areas where these dense concentrations are expected to trigger foraging behavior (e.g., Massachusetts Bay Restricted Area) (50 CFR 229.23).

Fixed fishing gear also does not block the entire water column or form a wall preventing access. Vertical buoy lines supporting the fixed gear may extend throughout the water column, however, the Gulf of Maine critical habitat feeding area is vast and not constricted by geological or physical barriers, therefore, whales are free to move through and around these gears to reach their feeding resources. The impact of entanglements on individual animals as they access their feeding resources is addressed in section 7.2 of this analysis, but is not considered an impact to whales accessing or moving within critical habitat.

It is extremely unlikely that the fisheries would have any effect on the essential physical oceanographic features (i.e., sea state, temperature, depth) of Unit 2. Fishing gears do not alter sea surface conditions, temperature, or depths. The only fishery considered in this Opinion that overlaps with Unit 2 is the bluefish fishery. This fishery is primarily recreational using hook-

and-line gear. There is a small amount of gillnet effort in the bluefish fishery off Florida. Gillnets are not permitted in Florida state water which reduces the overlap of the fishery and critical habitat. In addition, the limited effort that occurs in federal waters is not expected to preclude right whales from accessing these areas.

Based on the above, we have determined that the effects of the fishing gears and vessels used by the fisheries in this Opinion on the availability of copepods for foraging right whales are likely so small that they cannot be meaningfully measured, detected, or evaluated, and, therefore, insignificant. In addition, as noted above, it is extremely unlikely that the operation of fishing gears and vessels will affect the large-scale physical oceanographic conditions in the Gulf of Maine or off the southeast United States. As a result, the effects of the operation of the fisheries on those physical features are discountable. Because the effects of the fisheries on the PBFs that characterize the feeding and calving habitats for North Atlantic right whales are all insignificant and discountable, the fisheries are not likely to adversely affect this critical habitat.

4.1.11. *Northwest Atlantic DPS of Loggerhead Sea Turtle Critical Habitat*

We have determined that the actions in this Opinion are not likely to adversely modify or destroy designated critical habitat for the Northwest Atlantic DPS of loggerhead sea turtles. Critical habitat is designated for nesting beaches and 38 occupied areas within the at-sea range of the Northwest Atlantic DPS (79 FR 29755, July 10, 2014; 79 FR 39856, July 10, 2014). These marine areas in the Atlantic Ocean contain one or a combination of nearshore reproductive habitat, overwintering habitat, breeding habitat, migratory habitat, and *Sargassum* habitat (Figure 30). There is limited overlap of Northwest Atlantic DPS critical habitat and the fisheries considered in this Opinion. Setting and hauling gear and fishing vessel movements are not expected to significantly alter the physical or biological features of the critical habitat areas to levels that would affect life history patterns of individual turtles or the health of prey species found in these habitats.



Figure 30: Loggerhead sea turtle critical habitat

The nearshore reproductive habitat within the action area occurs off nesting beaches from North Carolina south through Florida. Primary constituent elements (PCEs) supporting this habitat include waters (1) with direct proximity to nesting beaches that support the highest density nesting aggregations; (2) sufficiently free of obstructions or artificial lighting; and (3) with

minimum manmade structures that could promote predators, disrupt wave patterns, and/or create excessive currents (NMFS 2013a). The reproductive habitats identified extend 0.86 nmi (1.6 km) offshore. Gillnets are prohibited in Florida state waters (Florida Administrative Code 688-4.0081). The fisheries will not result in obstructions or manmade structures that will alter the physical environment.

The winter habitat includes warm water habitat south of Cape Hatteras near the western edge of the Gulf Stream. It supports meaningful aggregations of juveniles and adults during the winter months. PCEs that support the habitat are (1) water temperatures above 10 °C from November through April; (2) continental shelf waters in proximity to the western boundary of the Gulf Stream; and (3) water depths between 65-128 ft (20 and 100 m) (NMFS 2013a). The activities considered in this Opinion will not alter water depths, water temperatures, or other physical oceanographic features.

The breeding habitat includes sites along the east coast of Florida that support meaningful aggregations of male and female adult loggerheads during breeding season. The PCEs that support this habitat are: (1) high densities of reproductive loggerheads; (2) proximity to primary Florida migratory corridor; and (3) proximity to Florida nesting grounds (NMFS 2013a). As described elsewhere, the bluefish fishery is the only fishery in this Opinion that extends south to Florida. Fishing activities that disrupt habitat use and, thus, affect concentrations of reproductive loggerheads could affect the breeding habitat. The bluefish fishery has the potential to capture protected loggerhead sea turtles as analyzed later in this Opinion, but we do not believe that this will noticeably affect the density of reproductive males and females in the breeding areas. The fishery overall has limited overlap with these areas and will not alter the physical environment or affect the distance of the breeding habitat in relation to the migratory corridor or nesting grounds. Therefore, any effects on the breeding habitat are insignificant.

The constricted migratory habitat is high use migratory corridors that are limited in width by land on one side and the edge of the continental shelf and Gulf Stream on the other. PCEs that support this habitat are (1) constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory passage and (2) passage conditions that allow for migration to/from nesting, breeding, and/or foraging areas (NMFS 2013a). Migratory habitat in the Atlantic includes areas off North Carolina and Florida. Fisheries using fixed gear (e.g., gillnets and pots/traps) are a concern if the gear is arranged closely together within the designated habitats. These gears could alter the habitat conditions needed for efficient passage of loggerheads through these areas (79 FR 39856, July 10, 2014) when gear is deployed within the critical habitat. However, the operations are wide-ranging, including areas within and outside critical habitat. Any gears deployed in migratory habitat areas fluctuates in time and space and are not permanent obstructions. We do not expect the gears used in the fisheries in this Opinion to meaningfully alter the passage conditions that allow for migration to/from nesting, breeding, and foraging habitats.

Sargassum habitat is important to various life stages, particularly post-hatchlings. Generally, the *Sargassum* habitat included in the designation and occurring in the action area is along the Atlantic coast from the western edge of the Gulf Stream eastward. PCEs that support this habitat include: (1) convergence zones, surface-water downwelling (movement of denser water downward in the water column) areas, major current margins and other locations where there are concentrated components of the *Sargassum* community in suitable water temperatures; (2)

Sargassum in concentrations to support adequate prey abundance; (3) available prey and other material associated with *Sargassum* habitat; and (4) sufficient water depth and proximity to available currents to ensure offshore transport and forage and cover requirements for post-hatchling loggerheads. In designating critical habitat, NMFS identified possible activities that may require special management considerations; commercial fishing activities were not included (79 FR 39856, July 10, 2014). While commercial fishing gear may have some interactions with *Sargassum* during deployment and retrieval, the effects are expected to be temporary and isolated in nature and, because of the fluid nature of the pelagic environment, recovery time is rapid (79 FR 39856, July 10, 2014). The fisheries do not have the capability to affect the location of water depths, currents, convergence zones, downwelling areas, major current margins or other locations with concentrated components of the *Sargassum* community. While vessels may transit the areas, any disruption of *Sargassum* habitat is not of sufficient magnitude to significantly affect the distribution of *Sargassum* mats. In addition, the fisheries will not affect the availability of loggerhead prey or other material associated with *Sargassum* because they do not target or harvest smaller prey species or *Sargassum*.

4.2. Species Likely to be Adversely Affected

This section examines the status of each species that are likely to be adversely affected (Table 42) by the proposed action. Under the ESA, species include any subspecies of any species and any distinct population segment of any species of vertebrate fish or wildlife that interbreeds when mature. This section considers the species as listed under the ESA, which may be globally or as a DPS. The status includes the current level of risk that the ESA-listed species face, based on factors considered in documents such as recovery plans, status reviews, and listing decisions. This section helps detail the species' current "reproduction, numbers, or distribution," which is considered in the jeopardy determination as described in 50 CFR. §402.02. More detailed information on the status and trends of these ESA-listed species, and their biology and ecology, is in the listing regulations and critical habitat designations published in the Federal Register, status reviews, recovery plans, and on NMFS' website: (<https://www.fisheries.noaa.gov/species-directory/threatened-endangered>), among others.

4.2.1. Large Whales

4.2.1.1. North Atlantic Right Whale (*Eubalaena glacialis*)

There are three species classified as right whales (genus *Eubalaena*): North Pacific (*E. japonica*), Southern (*E. australis*), and North Atlantic (*E. glacialis*). The North Atlantic right whale is the only species of right whale that occurs in the North Atlantic Ocean (Figure 31) and, therefore, is the only species of right whale that may occur in the action area.

Today, North Atlantic right whales occur primarily in the western North Atlantic Ocean. More recently; however, there have been acoustic detections, reports, and/or sightings of North Atlantic right whales in waters off Greenland (east/southeast), Newfoundland, northern Norway, and Iceland, as well as within Labrador Basin (Hamilton et al. 1998, Jacobsen et al. 2004, Knowlton et al. 1992, Mellinger et al. 2011). These latter sightings/detections are consistent with historic records documenting North Atlantic right whales south of Greenland, in the Denmark straits, and in eastern North Atlantic waters (Kraus et al. 2007). There is also evidence of possible historic North Atlantic right whale calving grounds being located in the Mediterranean

Sea (Rodrigues et al. 2018), an area not currently considered as part of this species historical range.

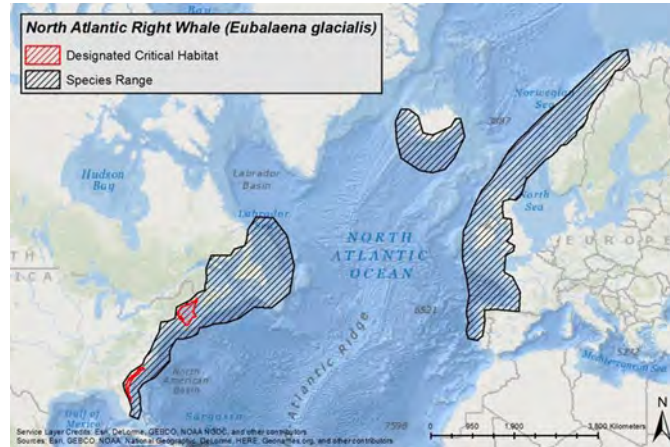


Figure 31: Approximate historic range and currently designated U.S. critical habitat of the North Atlantic right whale.

The North Atlantic right whale is distinguished by its stocky body and lack of a dorsal fin. The species was listed as endangered on December 2, 1970. We used information available in the most recent five-year review for North Atlantic right whales (NMFS 2017e), the most recent stock assessment reports (Hayes 2019, Hayes et al. 2019), and the scientific literature to summarize the species, as follows.

Life history

The maximum lifespan of North Atlantic right whales is unknown, but one individual reached at least 70 years of age (Hamilton et al. 1998, Kenney 2009). Previous modelling efforts suggest that in 1980, females had a life expectancy of approximately 51.8 years of age, which was twice that of males at the time (Fujiwara and Caswell 2001); however, by 1995, female life expectancy was estimated to have declined to approximately 14.5 years (Fujiwara and Caswell 2001). Most recent estimates indicate that North Atlantic right whale females are only living to 45 and males to age 65 (<https://www.fisheries.noaa.gov/species/north-atlantic-right-whale>). A recent study demonstrates that females, ages 5+, have reduced survival relative to males, ages 5+, resulting in a decrease in female abundance relative to male abundance (Pace et al. 2017). Specifically, state-space mark-recapture model estimates show that from 2010-2015, males declined just under 4.0 percent and females declined approximately 7 percent (Pace et al. 2017).

Gestation is estimated to be between 12 and 14 months, after which calves typically nurse for around one year (Cole et al. 2013, Kenney 2009, Kraus and Hatch 2001, Lockyer 1984). After weaning calves, females typically undergo a ‘resting’ period before becoming pregnant again, presumably because they need time to recover from the energy deficit experienced during lactation (Fortune et al. 2013, Fortune et al. 2012, Pettis et al. 2017). From 1983 to 2005, annual average calving intervals ranged from 3 to 5.8 years (overall average of 4.23 years) (Kraus et al. 2007). Between 2006 and 2015, annual average calving intervals continued to vary within this range, but in 2016 and 2017 longer calving intervals were reported (6.3 to 6.6 years in 2016 and 10.2 years in 2017) (Hayes et al. 2018a, Pettis and Hamilton 2015, Pettis and Hamilton 2016, Pettis et al. 2018a, Pettis et al. 2018b, Pettis et al. 2020). Annual average calving interval was 7 in 2019 and 7.6 in 2020 (Pettis et al. 2020, 2021). The calving index is the annual percentage of reproductive females assumed alive and available to calve that was observed to produce a calf.

This index averaged 47 percent from 2003 to 2010 but has dropped to an average of 17 percent since 2010 (Moore et al. 2021). Females have been known to give birth as young as five years old, but the mean age of a female first giving birth is 10.2 years old ($n=76$, range 5 to 23, SD 3.3) (Moore et al. 2021). Taken together, changes to inter-birth interval and age to first reproduction suggest that both parous (having given birth) and nulliparous (not having given birth) females are experiencing delays in calving. These calving delays corresponds with the recent distribution shifts. The low reproductive rate of right whales is likely the result of several factors (Moore et al. 2021).

Pregnant North Atlantic right whales migrate south, through the mid-Atlantic region of the United States, to low latitudes during late fall where they overwinter and give birth in shallow, coastal waters (Kenney 2009, Krzystan et al. 2018). During spring, these females and new calves migrate to high latitude foraging grounds where they feed on large concentrations of copepods, primarily *C. finmarchicus* (Mayo et al. 2018, NMFS 2017e). Some non-reproductive North Atlantic right whales (males, juveniles, non-reproducing females) also migrate south, although at more variable times throughout the winter. Others appear to not migrate south and remain in the northern feeding grounds year round or go elsewhere (Bort et al. 2015, Mayo et al. 2018, Morano et al. 2012, NMFS 2017e, Stone et al. 2017). Nonetheless, calving females arrive to the southern calving grounds earlier and stay in the area more than twice as long as other demographics (Krzystan et al. 2018). Little is known about North Atlantic right whale habitat use in the mid-Atlantic, but recent acoustic data indicate near year round presence of at least some whales off the coasts of New Jersey, Virginia, and North Carolina (Davis et al. 2017, Hodge et al. 2015, Salisbury et al. 2016, Whitt et al. 2013). While it is generally not known where North Atlantic right whales mate, some evidence suggests that mating may occur in the northern feeding grounds (Cole et al. 2013, Matthews et al. 2014).

Population dynamics

Today, North Atlantic right whales are primarily found in the western North Atlantic, from their calving grounds in lower latitudes off the coast of the southeastern United States to their feeding grounds in higher latitudes off the coast of New England and Nova Scotia (Hayes et al. 2018a). In recent years, the location of feeding grounds has shifted, with fewer animals being seen in the Great South Channel and the Bay of Fundy and more animals being observed in Cape Cod Bay; the Gulf of Saint Lawrence; the mid-Atlantic; and south of Nantucket, Massachusetts (Daoust et al. 2018, Davis et al. 2017, Hayes et al. 2018a, Hayes et al. 2019, Meyer-Gutbrod et al. 2018, Moore et al. 2021, Pace et al. 2017).

There are currently two recognized populations of North Atlantic right whales, an eastern and a western population. Very few individuals likely make up the population in the eastern Atlantic, which is thought to be functionally extinct (Best et al. 2001). However, in recent years, a few known individuals from the western population have been seen in the eastern Atlantic, suggesting some individuals may have wider ranges than previously thought (Kenney 2009). Specifically, there have been acoustic detections, reports, and/or sightings of North Atlantic right whales in waters off Greenland (east/southeast), Newfoundland, northern Norway, and Iceland, as well as within Labrador Basin (Jacobsen et al. 2004, Knowlton et al. 1992, Mellinger et al. 2011). It is estimated that the North Atlantic historically (i.e., pre-whaling) supported between 9,000 and 21,000 right whales (Monsarrat et al. 2016). The western population may have numbered fewer than 100 individuals by 1935, when international protection for right whales came into effect (Kenney et al. 1995).

Genetic analysis, based upon mitochondrial and nuclear DNA analyses, have consistently revealed an extremely low level of genetic diversity in the North Atlantic right whale population (Hayes et al. 2018a, Malik et al. 2000, McLeod and White 2010, Schaeff et al. 1997). Waldick et al. (2002) concluded that the principal loss of genetic diversity occurred prior to the 18th century, with more recent studies hypothesizing that the loss of genetic diversity may have occurred prior to the onset of Basque whaling during the 16th and 17th century (McLeod et al. 2008, Rastogi et al. 2004, Reeves et al. 2007, Waldick et al. 2002). The persistence of low genetic diversity in the North Atlantic right whale population might indicate inbreeding; however, based on available data, no definitive conclusions can be reached at this time (Hayes et al. 2019, Radvan 2019, Schaeff et al. 1997). By combining 25 years of field data (1980-2005) with high resolution genetic data, Frasier et al. (2013) found that North Atlantic right whale calves born between 1980 and 2005 had higher levels of microsatellite (nuclear) heterozygosity than would be expected from this species gene pool. The authors concluded that this level of heterozygosity is due to postcopulatory selection of genetically dissimilar gametes and that this mechanism is a natural means to mitigate the loss of genetic diversity, over time, in small populations (Frasier et al. 2013).

In the western North Atlantic, North Atlantic right whale abundance was estimated to be 270 animals in 1990 (Pace et al. 2017). Between 1990 to 2011, right whale abundance increased by approximately 2.8 percent per year, despite a decline in 1993 and no growth between 1997 and 2000 (Pace et al. 2017). However, since 2011, when the abundance peaked at 481 animals, the population has been in decline, with a 99.99 percent probability of a decline of just under 1 percent per year (Pace et al. 2017). Between 1990 and 2015, survival rates appeared relatively stable, but differed between the sexes, with males having higher survivorship than females (males: 0.985 ± 0.0038 ; females: 0.968 ± 0.0073) leading to a male-biased sex ratio (approximately 1.46 males per female) (Pace et al. 2017). Using the methods in Pace et al. (2017), as of January 2017, the median estimate of right whale abundance was 428 animals (95 percent credible intervals (CI) 406-447) and the minimum population estimate ($N_{\min}$) was 418 animals; this estimate did not account for the 17 confirmed mortalities observed in June 2017 (12 in Canada; 5 in the United States) that triggered the designation of a Unusual Mortality Event (UME) for North Atlantic right whales (Hayes 2019). In 2018, there were three confirmed dead stranded right whales in the United States, and, in 2019, 10 confirmed dead stranded right whales (nine in Canada and one in the United States) (<https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2019-north-atlantic-right-whale-unusual-mortality-event>). Each year, NMFS estimates the right whale population abundance and shares that estimate at the North Atlantic Right Whale Consortium's annual meeting. This estimate is considered preliminary and undergoes further review before being finalized in the North Atlantic Right Whale Stock Assessment Report.

Using the methods in Pace et al. (2017), this year's preliminary estimate is 368 (95 percent credible interval range of 356-378) individuals as of January 2019. Prior estimates considered the annual survival rate to be flat across the history of the time series. However, since 2010, annual survival rates have dropped. Therefore, the survival mechanism parameter in the model was adjusted to allow for different rates for different years. Using the original model, the population estimate is 371 (359-381) (Pace 2021). For the purposes of this Opinion, we are using the

estimate of 368 individuals.⁶ Updated photo-identification data support that the annual mortality rate changed significantly, and the new information reports a faster rate of decline than previously estimated. In these new analyses, the previous estimated of right whales alive as of January 2018 was revised down from 412 to 383. Additionally, the estimated right whale abundance for 2017 was likely lower than the estimated abundance of 428 individuals provided in the 2019 Stock Assessment Report (Hayes 2020).

In addition to finding an overall decline in the North Atlantic right whale population, Pace et al. (2017) also found that between 1990 and 2015, the survival of age 5+ females relative to 5+ males has been reduced; this has resulted in diverging trajectories for male and female abundance. Specifically, there was an estimated 142 males (95% CI=143-152) and 123 females (95% CI=116-128) in 1990; however, by 2015, model estimates show the species was comprised of 272 males (95% CI=261-282) and 186 females (95% CI=174-195; Pace et al. 2017). Calving rates also varied substantially between 1990 and 2015 (i.e., 0.3 percent to 9.5 percent), with low calving rates coinciding with three periods (1993-1995, 1998-2000, and 2012-2015) of decline or no growth (Pace et al. 2017). Using generalized linear models, Corkeron et al. (2018) found that between 1992 and 2016, North Atlantic right whale calf counts increased at a rate of 1.98 percent per year. Relative to three populations of southern right whales that increased 5.34 percent, 6.58 percent, and 7.21 percent per year, this rate of increase for North Atlantic right whales is substantially less (Corkeron et al. 2018). Using the highest annual estimates of survival recorded over the time series from Pace et al. (2017), and an assumed calving interval of approximately four years, Corkeron et al. (2018) suggests that the North Atlantic right whale population could potentially increase at a rate of at least 4 percent per year if there was no anthropogenic mortality.⁷ This rate is approximately twice that observed, and the analysis indicates that adult female mortality is the main factor influencing this rate (Corkeron et al. 2018).

Status

The North Atlantic right whale is listed under the ESA as endangered. With anthropogenic mortality limiting the recovery of North Atlantic right whales (Corkeron et al. 2018), currently, none of the species recovery goals (see below) have been met. With whaling now prohibited, the two major known human causes of mortality are vessel strikes and entanglement in fishing gear (Hayes et al. 2018a). Estimates of total annual anthropogenic mortality (i.e., ship strike and entanglement in fishing gear), as well as the number of undetected anthropogenic mortalities for North Atlantic right whales have been provided by Hayes et al. (2020) and Pace et al. (2017); these estimates show that the total annual North Atlantic right whale mortality exceed or equal

⁶ We note that the population estimate of 368 whales is preliminary and has not completed the formal review process that NMFS applies to population estimates of this type. Nevertheless, while recognizing that the number may ultimately change, it was prepared through a transparent process that applied methods that NMFS has used for a number of years to estimate the population. Given that the analysis indicates a further decline in the population and that this consultation is intended to cover fisheries actions that occur after the expected completion of the review process, NMFS is making a conservative assumption that this preliminary number will likely represent the final number and is using it as the basis for this consultation.

⁷ Based on information in the North Atlantic Right Whale Catalog, the mean calving interval is 4.69 years (P. Hamilton 2018, unpublished, in Corkeron et al. 2018). Corkeron et al. (2018) assumed a 4 year calving interval as the approximate mid-point between the North Atlantic Right Whale Catalog calving interval and observed calving intervals for southern right whales (i.e., 3.16 years for South Africa, 3.42 years for Argentina, 3.31 years for Auckland Islands, and 3.3 years for Australia).

the number of detected serious injuries and mortalities.⁸ These anthropogenic threats appear to be worsening (Hayes et al. 2018a), as evidenced by the North Atlantic right whale UME declared by NMFS on June 7, 2017, as a result of elevated right whale mortalities along the Western North Atlantic Coast. As of April 2021, the confirmed mortalities for the UME are 34 dead stranded right whales (21 in Canada; 13 in the United States) (for more information on UMEs, see <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-unusual-mortality-events>). Examinations by necropsy or photo documentation have been conducted on 23 of the 34 whales. Final results from some examinations are pending; however, preliminary findings indicate vessel strikes or rope entanglements as the cause of death. Additionally, since 2017, 15 live-free swimming non-stranded whales have been documented with serious injuries from entanglements (13) or vessel strikes (2). Therefore, the UME has been updated to 49 to include individuals to include both confirmed mortalities and seriously injured free-swimming whales.

The North Atlantic right whale population continues to decline. As provided above, between 1990 to 2011, right whale abundance increased by approximately 2.8 percent per year; however, since 2011 the population has been in decline (Pace et al. 2017). Recent modeling efforts indicate that low female survival, a male biased sex ratio, and low calving success are contributing to the population's current decline (Pace et al. 2017). For instance, five new calves were documented during the 2017 calving season, zero during the 2018 season, and seven during the 2019 season (Pettis et al. 2018a, Pettis et al. 2018b, Pettis et al. 2020), these number of births are well below the number needed to compensate for expected mortalities. More recently, there were 10 calves in the 2020 calving season and 17 calves in 2021, as of March 29. Two of the 2020 calves and one of the 2021 calves died or were seriously injured due to vessel strikes. Two additional calves were reported in the 2021 season, but were not seen as a mother/calf pair. One animal stranded dead with no evidence of human interaction and initial results suggest the calf died during birth or shortly thereafter. The second animal was an anecdotal report of a calf off the Canary Islands.

Long-term photographic identification data also indicate new calves rarely go undetected, so these years likely represent a continuation of low calving rates that began in 2012 (Kraus et al. 2007, Pace et al. 2017). While there are likely a multitude of factors involved, low calving has been linked to poor female health (Rolland et al. 2016) and reduced prey availability (Devine et al. 2017, Johnson et al. 2017, Meyer-Gutbrod and Green 2014, Meyer-Gutbrod and Greene 2018, Meyer-Gutbrod et al. 2018). A recent study comparing North Atlantic right whales to other right whale species found that juvenile, adult and lactating female North Atlantic right whales all had lower body condition scores compared to the southern right whale populations, with lactating females showing the largest difference (Christiansen et al. 2020). North Atlantic right whale calves were in good condition. While some of the difference could be the result of genetic isolation and adaptations to local environmental conditions, the authors suggest that the magnitude indicates that North Atlantic right are in poor condition, which could be suppressing their growth, survival, age of sexual maturation and calving rates. In addition, they conclude that the observed differences are most likely a result of differences in the exposure to anthropogenic factors (Christiansen et al. 2020). Furthermore, entanglement in fishing gear appears to have

⁸ Currently, 72 percent of mortalities since 2000 are estimated to have been observed (Hayes et al. 2020).

substantial health and energetic costs that affect both survival and reproduction (Hayes et al. 2018a, Hunt et al. 2016, Lysiak et al. 2018, Pettis et al. 2017, Robbins et al. 2015, Rolland et al. 2017, van der Hoop et al. 2017a).

Kenney (2018) projected that if all other known or suspected impacts (e.g., vessel strikes, calving declines, climate change, resource limitation, sublethal entanglement effects, disease, predation, and ocean noise) on the population remained the same between 1990 and 2016, and none of the observed fishery related M/SI occurred, the projected population in 2016 would be 12.2 percent higher (506 individuals). Furthermore, if the actual mortality resulting from fishing gear is double the observed rate (as estimated in Pace et al. 2017), eliminating all mortalities (observed and unobserved) could have resulted in a 2016 population increase of 24.6 percent (562 individuals) and possibly over 600 in 2018 (Kenney 2018).

Given the above information, the resilience of North Atlantic right whales to future perturbations is expected to be very low (Hayes et al. 2018a). Using a matrix population projection model, it is estimated that by 2029 the population will decline from 160 females to the 1990 estimate of 123 females if the current rate of decline is not altered (Hayes et al. 2018a). Consistent with this, recent modelling efforts indicate that the species may decline towards extinction if prey conditions worsen and anthropogenic mortalities are not reduced (Meyer-Gutbrod et al. 2018). In fact, recent data from the Gulf of Maine and Gulf of St. Lawrence indicate prey densities may already be in decline (Devine et al. 2017, Johnson et al. 2017, Meyer-Gutbrod et al. 2018).

Factors Outside the Action Area Affecting the Status of Right Whale: Fishery Interactions and Vessel Strikes in Canadian Waters

In Canada, right whales are protected under the Species at Risk Act (SARA) and the Fisheries Act. The right whale was considered a single species and designated as endangered in 1980. SARA includes provisions against the killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling, or trading of individuals or its parts (SARA section 32) and damage or destruction of its residence (SARA section 33). In 2003, the species was split to allow separate designation of the North Atlantic right whale, which was listed as endangered under SARA in May 2003. All marine mammals are subject to the provisions of the marine mammal regulations under the Fisheries Act. These include requirements related to approach, disturbance, and reporting. In the St. Lawrence estuary and the Saguenay River, the approach distance for threatened or endangered whales is 1312 ft (400 m).

North Atlantic right whales have died or been seriously injured in Canadian waters by vessel strikes and entanglement in fishing gear (DFO 2014). Serious injury and mortality events are rarely observed where the initial entanglement occurs. After an event, live whales or carcasses may travel hundreds of miles before ever being observed. It is unknown exactly how many serious injuries and mortalities have occurred in Canadian waters historically. However, at least 14 right whale carcasses and 20 injured right whales were sighted in Canadian waters between 1988 and 2014 (Davies and Brillant 2019); 25 right whale carcasses were first sighted in Canadian waters or attributed to Canadian fishing gear from 2015 through 2019. In the sections to follow, information is provided on the fishing and shipping industry in Canadian waters, as well as measures the Canadian government is taking (or will be taking) to reduce the level of serious injuries and mortalities to North Atlantic rights resulting from incidental entanglement in fishing gear or vessel strikes.

Fishery Interactions in Canadian Waters

There are numerous fisheries operating in Canadian waters. Rock and toad crab fisheries, as well as fixed gear fisheries for cod, Atlantic halibut, Greenland halibut, winter flounder and herring have historically had few interactions. While these fisheries deploy gear that pose some risk, this analysis focuses on fisheries that have a demonstrated interactions with ESA-listed species (i.e., lobster, snow crab, mackerel, and whelk). Based on information provided by the Department of Fisheries and Oceans Canada (DFO), a brief summary of these fisheries is provided below.

The American lobster fishery is DFO's largest fishery, by landings. It is managed under regional management plans with 41 Lobster Fisheries Areas (Figure 32), in which 10,000 licensed harvesters across Atlantic Canada and Quebec participate.⁹ In addition to the one permanent closure in Lobster Fishery Area 40 (Figure 32) fisheries are generally closed during the summer to protect molts. Lobster fishing is most active in the Gulf of Maine, Bay of Fundy, Southern Gulf of St. Lawrence and coastal Nova Scotia. Most fisheries take place in shallow waters less than 130 ft (40 m) deep and within 8 nmi (15 km) of shore, although some fisheries will fish much farther out and in waters up to 660 ft (200 m) deep. Management measures are tailored to each Area and include limits on the number of licenses issued, limits on the number of traps, limited and staggered fishing seasons, limits on minimum and maximum carapace size (which differs depending on the Area), protection of egg-bearing females (females must be notched and released alive), and ongoing monitoring and enforcement of fishing regulations and license conditions. The Canadian lobster fisheries use trap/pot gear consistent with the gear used in the American lobster fishery. While both Canada and the U.S. lobster fisheries employ similar gears, the two nations employ different management strategies that result in divergent prosecution of the fisheries.

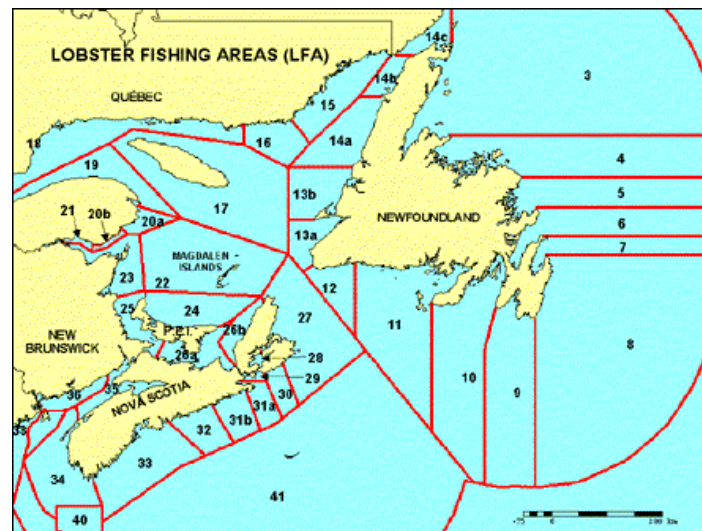


Figure 32: Lobster fishing areas in Atlantic Canada (<https://www.dfo-mpo.gc.ca/fisheries-peches/commercial-commercial/atl-arc/lobster-homard-eng.html>)

The snow crab fishery is [DFO's](#) second largest fishery, by landings. It is managed under regional management plans with approximately 60 Snow Crab Management Areas in Canada spanning

⁹ Of the 41 Lobster Fisheries Areas, one is for the offshore fishery, and one is closed for conservation.

four regions (Scotia-Fundy, Southern Gulf of St. Lawrence, Northern Gulf of St. Lawrence, and Newfoundland and Labrador). In 2010, 4,326 snow crab fishery licenses were issued. The DFO website (<http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se17-eng.htm>) indicated that 3,703 permits were issued in 2017. The management of the snow crab fishery is based on annual total allowable catch, individual quotas, trap and mesh restrictions, minimum legal size, mandatory release of female crabs, minimum mesh size of traps, limited seasons and areas. Protocols are in place to close grids when a percentage of soft-shell crabs in catches is reached. Harvesters use baited conical traps and pots set on muddy or sand-mud bottoms usually at depths of 230-460 ft (70-140 m). Annual permit conditions have been used since 2017 to minimize the impacts to North Atlantic right whales, as described below.

DFO manages the Atlantic mackerel fishery under one Atlantic management [plan](#), established in 2007. Management measures include fishing seasons, total allowable catch, gear, Safety at Sea fishing areas, licensing, minimum size, fishing gear restrictions, and monitoring. The plan allows the use of the following gear: gillnet, handline, trap net, seine, and weir. When established, the DFO issued 17,182 licenses across four regions, with over 50 percent of these licenses using gillnet gear. In 2017, [DFO issued](#) 7,965 licenses (<http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se17-eng.htm>); no gear information was available. Commercial harvest is timed with the migration of mackerel into and out of Canadian waters. In Nova Scotia, the gillnet and trap fisheries for mackerel take place primarily in June and July. Mackerel generally arrive in southwestern Nova Scotia in May, and Cape Breton in June. Migration out of the Gulf of St. Lawrence begins in September, and the fishery can continue into October or early November. They may enter the Gulf of St. Lawrence, depending on temperature conditions. The gillnet fishery in the Gulf of St. Lawrence also occurs in June and July. Most nets are fixed, except for a drift fishery in Chaleurs Bay and the part of the Gulf between New Brunswick, Prince Edward Island, and the Magdalen Islands.

Conservation harvesting plans are used to manage waved whelk in Canadian waters, which are harvested in the Gulf of St. Lawrence, Quebec, Maritimes, and Newfoundland and Labrador regions. The fishery is managed using quotas, fishing gear requirements, dockside monitoring, traps limits, seasons, tagging, and area requirements. In 2017, there were 240 whelk license holders in Quebec; however, only 81 of them were active. Whelk traps are typically weighted at the bottom with cement or other means and a rope or other mechanism is positioned in the center of the trap to secure the bait. Between 50 and 175 traps are authorized per license. The total number of authorized traps for all licenses in each fishing area varies between 550 and 6,400 traps, while the number of used or active traps is lower, with 200 to 1,700 traps per fishing area.

Since 2017, the Government of Canada has implemented measures to protect right whales from entanglement. These measures have included seasonal and dynamic closures for fixed gear fisheries, changes to the fishing season for snow crab, reductions in traps in the mid-shore fishery in Crab Fishing Area 12, and license conditions to reduce the amount of rope in the water. Measures to better track gear, require reporting of gear loss, require reporting of interactions with marine mammals, and increased surveillance for right whales have also been implemented. Measures to reduce interactions with fishing gear are adjusted annually. In 2021, mandatory closures for non-tended fixed gear fisheries, including lobster and crab, will be put in place for 15 days when right whales are sighted. If a whale is detected in days 9-15 of the closure, the closure will be extended. In the Bay of Fundy and the critical habitats in the Roseway and Grand Manan basins, this extension will be for an additional 15 days. If a right

whale is detected in the Gulf of St. Lawrence, the closure will be season-long (until November 15, 2021). Outside the dynamic area, closures are considered on a case-by-case basis. There are also gear marking and reporting requirements for all fixed gear fisheries. The Government of Canada will also continue to support industry trials of innovative fishing technologies and methods to prevent and mitigate whale entanglement. This includes authorizing ropeless gear trials in closed areas in 2021. Measures to implement weak rope or weak-breaking points were delayed and will be implemented by the end of 2022. Measures related to maximum rope diameters, sinking rope between traps, and reductions in vertical and floating rope will be implemented after 2022. More information on these measures is available at <https://www.dfo-mpo.gc.ca/fisheries-peches/commercial-commerciale/atl-arc/narw-bnan/management-gestion-eng.html>.

In August 2016, NMFS published the MMPA Import Provisions Rule (81 FR 54389, August 15, 2016), which established criteria for evaluating a harvesting nation's regulatory program for reducing marine mammal bycatch and the procedures for obtaining authorization to import fish and fish products into the United States. Specifically, to continue in the international trade of seafood products with the United States, other nations must demonstrate that their marine mammal mitigation measure for commercial fisheries are, at a minimum, equivalent to those in place in the United States. A five-year exemption period (beginning January 1, 2017) was created in this process to allow foreign harvesting nations time to develop, as appropriate, regulatory programs comparable in effectiveness to U.S. programs at reducing marine mammal bycatch. To comply with its requirements, it is essential that these interactions are reported, documented and quantified. To guarantee that fish products have access to the U.S. markets, DFO must implement procedures to reliably certify that the level of mortality caused by fisheries does not exceed U.S. standards. DFO must also demonstrate that the regulations in place to reduce accidental death of marine mammals are comparable to those of the United States.

Vessel Strikes in Canadian Waters

Vessel strikes are a threat to right whales throughout their range. In Canadian waters where right whales are present, vessels include recreational and commercial vessels, small and large vessels, and sail, and power vessels. Vessel categories include oil and gas exploration, fishing and aquaculture, cruise ships, offshore excursions (whale and bird watching), tug/tow, dredge, cargo, and military vessels. At the time of development of the Gulf of St. Lawrence management plan, approximately 6400 commercial vessels transited the Cabot Strait and the Strait of Belle Isle annually. This represents a subset of the vessels in this area as it only includes commercial vessels (DFO 2013). To address vessel strikes in Canadian waters, the International Maritime Organization (IMO) amended the Traffic Separation Scheme in the Bay of Fundy to reroute vessels around high use areas. In 2007, IMO adopted and Canada implemented a voluntary seasonal Area to Be Avoided (ATBA) in Roseway Basin to further reduce the risk of vessel strike (DFO 2020). In addition, Canada has implemented seasonal speed restrictions and developed a proposed action plan to identify specific measures needed to address threats and achieve recovery (DFO 2020).

The Government of Canada has also implemented measures to mitigate vessel strikes in Canadian waters. Each year since August 2017, the Government has implemented seasonal speed restrictions (maximum 10 knots) for vessels 20 meters or longer in the western Gulf of St. Lawrence. In 2019, the area was adjusted and the restriction was expanded to apply to vessels greater than 13 m. Smaller vessels are encouraged to respect the limit. Dynamic area

management has also been used in recent years. Currently, there are two shipping lanes, south and north of Anticosti Island, where dynamic speed restrictions (mandatory slowdown to 10 knots) can be activated when right whales are present. In 2020 and 2021, the Government of Canada also implemented a trial voluntary speed restriction zone from Cabot Strait to the eastern edge of the dynamic shipping zone at the beginning and end of the season and a mandatory restricted area in or near Shediac Valley mid-season. More information is available at <https://www.tc.gc.ca/en/services/marine/navigation-marine-conditions/protecting-north-atlantic-right-whales-collisions-ships-gulf-st-lawrence.html>. Modifications to measures in 2021 include refining the size, location, and duration of the mandatory restricted area in and near Shediac Valley and expanding the speed limit exemption in waters less than 20 fathoms to all commercial fishing vessels

Critical Habitat

We have determined that the proposed action is not likely to adversely affect designated critical habitat for North Atlantic right whales (see section 4.1.10; Figure 29).

Recovery Goals

Under the ESA, NOAA publishes recovery plans that outline the path and task required to restore and secure self-sustaining wild population. If successfully implemented, recovery plans result in listed species being reclassified from endangered or threatened or delisting and removal of the species from ESA protection. Recovery plans include objective criteria for measuring recovery. The 2005 Recovery Plan for the North Atlantic right whale (NMFS 2005) does not include delisting criteria. Criteria for downlisting include:

Downlisting

1. Population ecology and vital rates are indicative of an increasing population;
2. Population has increased for 35 years at an average rate of increase equal to or greater than 2 percent per year;
3. None of the known threats are known to limit the population's growth rate; and
4. The population has no more than a 1 percent chance of quasi-extinction in 100 years.

In addition, it includes the following actions/objectives:

1. Significantly reduce sources of human-caused death, injury and disturbance (e.g., vessel collisions, fishery interactions).
2. Develop demographically-based recovery criteria.
3. Identify, characterize, protect and monitor important habitats.
4. Monitor the status and trends of abundance and distribution of the western North Atlantic right whale population.
5. Coordinate federal, state, local, international and private efforts to implement the recovery plan.

4.2.1.2. Fin Whale (*Balaenoptera physalus*)

Globally there is one species of fin whale, *Balaenoptera physalus*. Fin whales occur in all major oceans of the Northern and Southern Hemispheres (NMFS 2010c) (Figure 33). Within this range, three subspecies of fin whales are recognized: *B. p. physalus* in the Northern Hemisphere, and *B. p. quoyi* and *B. p. patachonica* (a pygmy form) in the Southern Hemisphere (NMFS 2010c). For management purposes in the northern Hemisphere, the United States divides, *B. p. physalus*, into

four stocks: Hawaii, California/Oregon/Washington, Alaska (Northeast Pacific), and Western North Atlantic (Hayes et al. 2019, NMFS 2010c).



Figure 33: Range of the fin whale

Fin whales are distinguishable from other whales by a sleek, streamlined body, with a V-shaped head, a tall hooked dorsal fin, and a distinctive color pattern of a black or dark brownish-gray body and sides with a white ventral surface. The lower jaw is gray or black on the left side and creamy white on the right side. The fin whale was listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 2010c), recent stock assessment reports (Carretta et al. 2019a, Hayes et al. 2019, Muto et al. 2019a), the five-year status review (NMFS 2019d), as well as the recent International Union for the Conservation of Nature's (IUCN) fin whale assessment (Cooke 2018b) were used to summarize the life history, population dynamics and status of the species as follows.

Life History

Fin whales can live, on average, 80 to 90 years. They have a gestation period of less than one year, and calves nurse for six to seven months. Sexual maturity is reached between 6 and 10 years of age with an average calving interval of two to three years. They mostly inhabit deep, offshore waters of all major oceans. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed, although some fin whales appear to be residential to certain areas.

Population Dynamics

The pre-exploitation estimate for the fin whale population in the entire North Atlantic was approximately 30,000-50,000 animals (NMFS 2010c), and for the entire North Pacific Ocean, approximately 42,000 to 45,000 animals (Ohsumi and Wada 1974). In the Southern Hemisphere, prior to exploitation, the fin whale population was approximately 40,000 whales (Mizroch et al. 1984b). In the North Atlantic Ocean, fin whales were heavily exploited from 1864 to the 1980s; over this timeframe, approximately 98,000 to 115,000 fin whales were killed (IWC 2017). Between 1910-1975, approximately 76,000 fin whales were recorded taken by modern whaling in the North Pacific; this number is likely higher as many whales killed were not identified to species or while killed, where not successfully landed (Allison 2017). Over 725,000 fin whales were killed in the Southern Hemisphere from 1905 to 1976 (Allison 2017).

In the North Atlantic Ocean, the IWC has defined seven management stocks of fin whales: (1) North Norway (2) East Greenland and West Iceland (EGI); (3) West Norway and the Faroes; (4) British Isles, Spain and Portugal; (5) West Greenland and (6) Nova Scotia, (7) Newfoundland and Labrador (Donovan 1991, NMFS 2010c). Based on three decades of survey data in various portions of the North Atlantic, the IWC estimates that there are approximately 79,000 fin whales in this region. Under the present IWC scheme, fin whales off the eastern United States, Nova Scotia and the southeastern coast of Newfoundland are believed to constitute a single stock; in U.S. waters, NMFS classifies these fin whales as the Western North Atlantic stock (Donovan 1991, Hayes et al. 2019, NMFS 2010c). NMFS' best estimate of abundance for the Western North Atlantic Stock of fin whales is 7,418 individuals ($N_{\min}=6,029$); this estimate is the sum of the 2016 NOAA shipboard and aerial surveys and the 2016 Canadian Northwest Atlantic International Sightings Survey (Hayes 2019). Currently, there is no population estimate for the entire fin whale population in the North Pacific (Cooke 2018b). However, abundance estimates for three stocks in U.S. Pacific Ocean waters do exist: Northeast Pacific ($N=3,168$; $N_{\min}=2,554$), Hawaii ($N=154$; $N_{\min}=75$), and California/Oregon/Washington ($N=9,029$; $N_{\min}=8,127$) (Nadeem et al. 2016). Abundance data for the Southern Hemisphere stock remain highly uncertain; however, available information suggests a substantial increase in the population has occurred (Thomas et al. 2016).

In the North Atlantic, estimates of annual growth rate for the entire fin whale population in this region is not available (Cooke 2018b). However, in U.S. Atlantic waters NMFS has determined that until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0 percent will be used for the Western North Atlantic stock (Hayes et al. 2019). In the North Pacific, estimates of annual growth rate for the entire fin whale population in this region is not available (Cooke 2018b). However, in U.S. Pacific waters, NMFS has determined that until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0 percent will be used for the Northeast Pacific stock (Muto et al. 2019b, NMFS 2016c). Overall population growth rates and total abundance estimates for the Hawaii stock of fin whales are not available at this time (Carretta et al. 2018). Based on line transect studies between 1991-2014, there was estimated a 7.5 percent increase in mean annual abundance in fin whales occurring in waters off California, Oregon, and Washington; to date, this represents the best available information on the current population trend for the overall California/Oregon/Washington stock of fin whales (Carretta et al. 2019a, Nadeem et al. 2016).¹⁰ For Southern Hemisphere fin whales, as noted above, overall information suggests a substantial increase in the population; however the rate of increase remains poorly quantified (Cooke 2018b).

Archer et al. (2013) examined the genetic structure and diversity of fin whales globally. Full sequencing of the mitochondrial DNA genome for 154 fin whales sampled in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere, resulted in 136 haplotypes, none of which were shared among ocean basins suggesting differentiation at least at this geographic scale. However, North Atlantic fin whales appear to be more closely related to the Southern Hemisphere population, as compared to fin whales in the North Pacific Ocean, which may

¹⁰ Since 2005, the fin whale abundance increase has been driven by increases off northern California, Oregon, and Washington; numbers off Central and Southern California have remained stable (Carretta et al. 2020, Nadeem et al. 2016).

indicate a revision of the subspecies delineations is warranted. Generally, haplotype diversity was found to be high both within and across ocean basins (Archer et al. 2013). Such high genetic diversity and lack of differentiation within ocean basins may indicate that despite some populations having small abundance estimates, the species may persist long-term and be somewhat protected from substantial environmental variance and catastrophes.

Status

The fin whale is endangered as a result of past commercial whaling. Prior to commercial whaling, hundreds of thousands of fin whales existed. Fin whales may be killed under “aboriginal subsistence whaling” in Greenland, under Japan’s scientific whaling program, and Iceland’s formal objection to the IWC’s ban on commercial whaling. Additional threats include vessel strikes, reduced prey availability due to overfishing or climate change, and sound. The species’ overall large population size may provide some resilience to current threats, but trends are largely unknown.

Critical Habitat

No critical habitat has been designated for the fin whale.

Recovery Goals

Under the ESA, NOAA publishes recovery plans that outline the path and task required to restore and secure self-sustaining wild population. If successfully implemented, recovery plans result in listed species being reclassified from endangered or threatened or delisting and removal of the species from ESA protection. Recovery plans include objective criteria for measuring recovery. The 2010 Recovery Plan for the fin whale (NMFS 2010c) includes the following criteria for downlisting and delisting:

Downlisting

1. The population in the ocean basin in which it occurs has no more than 1 percent chance of extinction in 100 years and has at least 500 mature reproductive individuals (consisting of at least 250 females and 250 males) in each ocean basin.
2. None of the known threats are known to limit the continued growth of the populations.

Delisting

1. The population in the ocean basin in which it occurs has less than a 10 percent probability of becoming endangered in 20 years.
2. None of the known threats are known to limit the continued growth of the populations.

It also includes the following recovery actions/objectives:

1. Coordinate state, federal, and international actions to implement recovery actions and maintain international regulation of whaling for fin whales.
2. Determine population discreteness and population structure of fin whales.
3. Develop and apply methods to estimate population size and monitor trends in abundance.
4. Conduct risk analysis.
5. Identify, characterize, protect, and monitor habitat important to fin whale populations in U.S. waters and elsewhere.
6. Investigate causes and reduce the frequency and severity of human-caused injury and mortality.
7. Determine and minimize any detrimental effects of anthropogenic noise in the oceans.

8. Maximize efforts to acquire scientific information from dead, stranded, and/or entrapped fin whales.
9. Develop post-delisting monitoring plan.

4.2.1.3. Sei Whale (*Balaenoptera borealis*)

Globally there is one species of sei whale, *Balaenoptera borealis borealis*. Sei whales occur in subtropical, temperate and subpolar marine waters across the Northern and Southern Hemispheres (Figure 34) (Cooke 2018a, NMFS 2011b). For management purposes, in the Northern Hemisphere, the United States recognizes four sei whale stocks: Hawaii, Eastern North Pacific, and Nova Scotia (NMFS 2011b).

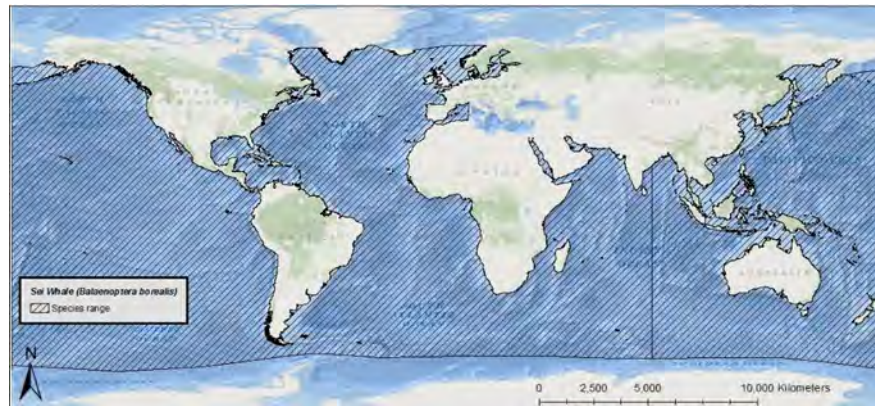


Figure 34: Range of the sei whale

Sei whales are distinguishable from other whales by a long, sleek body that is dark bluish-gray to black in color and pale underneath, and a single ridge located on their rostrum. The sei whale was listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 2011b), recent stock assessment reports (Carretta et al. 2019a, Hayes 2019, Hayes et al. 2017a), status review (NMFS 2012f), as well as the recent IUCN sei whale assessment (Cooke 2018a) were used to summarize the life history, population dynamics and status of the species as follows.

Life History

Sei whales can live, on average, between 50 and 70 years. They have a gestation period of 10 to 12 months, and calves nurse for six to nine months. Sexual maturity is reached between 6 and 12 years of age with an average calving interval of two to three years. Sei whales mostly inhabit continental shelf and slope waters far from the coastline. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed on a range of prey types, including: plankton (copepods and krill), small schooling fishes, and cephalopods.

Population Dynamics

There are no estimates of pre-exploitation sei whale abundance in the entire North Atlantic Ocean; however, approximately 17,000 sei whales were documented caught by modern whaling in the North Atlantic (Allison 2017). In the North Pacific, the pre-whaling sei abundance was estimated to be approximately 42,000 (Tillman 2977 as cited in NMFS 2011b). In the Southern Hemisphere, approximately 63,100 to 65,000 occurred in the Southern Hemisphere prior to exploitation (Mizroch et al. 1984a, NMFS 2011b).

In the North Atlantic, the entire North Atlantic sei whale population, in 1989, was estimated to be 10,300 whales (Cattanach et al. 1993 as cited in NMFS 2011b). While other surveys have been completed in portions of the North Atlantic since 1989, the survey coverage levels in these studies are not as complete as those done in Cattanach et al. (1993) (Cooke 2018a). As a result, to date, updated abundance estimates for the entire North Atlantic population of sei whales are not available. However, in the western North Atlantic, Palka et al. (2017) has provided a recent abundance estimate for the Nova Scotia stock of sei whales. Based on survey data collected from Halifax, Nova Scotia, to Florida between 2010 and 2013, it is estimated that there are approximately 6,292 sei whales ($N_{\min}=3,098$) (Palka et al. 2017); this estimate is considered the best available for the Nova Scotia stock (Hayes 2019). In the North Pacific, an abundance estimate for the entire North Pacific population of sei whales is not available. However, in the western North Pacific, it is estimated that there are 35,000 sei whales (Cooke 2018a). In the eastern North Pacific (considered east of longitude 180°), two stocks of sei whales occur in U.S. waters: Hawaii and Eastern North Pacific. Abundance estimates for the Hawaii stock are 391 sei whales ($N_{\min}=204$), and for Eastern North Pacific stock, 519 sei whales ($N_{\min}=374$) (Carretta et al. 2019a). In the Southern Hemisphere, recent abundance of sei whales is estimated at 9,800 to 12,000 whales. Population growth rates for sei whales are not available at this time as there are little to no systematic survey efforts to study sei whales; however, in U.S. waters, NMFS has determined that until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0 percent will be used for the Hawaii, Eastern North Pacific, and Hawaii stocks of sei whales (Hayes 2019).

Based on genetic analyses, there appears to be some differentiation between sei whale populations in different ocean basins. In an early analysis of genetic variation in sei whales some differences between Southern Ocean and the North Pacific sei whales were detected (Wada and Numachi 1991). However, more recent analyses of mtDNA control region variation show no significant differentiation between Southern Ocean and the North Pacific sei whales, though both appear to be genetically distinct from sei whales in the North Atlantic (Huijser et al. 2018). Within ocean basin, there appears to be intermediate to high genetic diversity and little genetic differentiation despite there being different managed stocks (Danielsdottir et al. 1991, Kanda et al. 2011, Kanda et al. 2006, Kanda et al. 2013, Kanda et al. 2015).

Status

The sei whale is endangered as a result of past commercial whaling. Now, only a few individuals are taken each year by Japan; however, Iceland has expressed an interest in targeting sei whales. Current threats include vessel strikes, fisheries interactions (including entanglement), climate change (habitat loss and reduced prey availability), and anthropogenic sound. Given the species' overall abundance, they may be somewhat resilient to current threats. However, trends are largely unknown, especially for individual stocks, many of which have relatively low abundance estimates.

Critical Habitat

No critical habitat has been designated for the sei whale.

Recovery Goals

Under the ESA, NOAA publishes recovery plans that outline the path and tasks required to restore and secure self-sustaining wild populations. If successfully implemented, recovery plans result in listed species being reclassified from endangered or threatened or delisting and removal

of the species from ESA protection. Recovery plans include objective criteria for measuring recovery. The 2011 Recovery Plan for the sei whale (NMFS 2011b) includes the following criteria for downlisting/delisting.

Downlisting

1. The population in the ocean basin in which it occurs has no more than 1 percent chance of extinction in 100 years and the global population has at least 1,500 mature reproductive individuals (consisting of at least 250 mature females and at least 250 mature males in each ocean basin).
2. None of the known threats are known to limit the continued growth of the populations.

Delisting

3. The population in the ocean basin in which it occurs has less than a 10 percent probability of becoming endangered in 20 years.
4. None of the known threats are known to limit the continued growth of the populations.

It also includes the following recovery actions/objectives:

1. Coordinate state, federal, and international actions to maintain international regulation of whaling for sei whales.
2. Develop and apply methods to collect sei whale data.
3. Support existing studies to investigate population discreteness and population structure of sei whales using genetic analyses.
4. Continue to collect data on threats (e.g., fishery interactions, anthropogenic noise, vessel interactions, climate change) and severity of threats to sei whale recovery.
5. Maximize efforts to acquire scientific information from dead, stranded, and entangled sei whales.
6. Estimate population size and monitor trends in abundance.
7. Initiate new studies to determine population discreteness and population structure of sei whales.
8. Conduct risk analyses;
9. Identify, characterize, protect, and monitor habitat important to sei whale populations in U.S. waters and elsewhere.
10. Investigate human-caused threats, and, should they be determined to be medium or high, reduce frequency and severity.
11. Develop post-delisting monitoring plan.

4.2.1.4. Sperm Whale (*Physeter microcephalus*)

Globally there is one species of sperm whale, *Physeter macrocephalus*. Sperm whales occur in all major oceans of the Northern and Southern Hemispheres (NMFS 2010d) (Figure 35). For management purposes, in the Northern Hemisphere, the United States recognizes six sperm whale stocks: California/Oregon/Washington, Hawaii, North Pacific, North Atlantic, Northern Gulf of Mexico, and Puerto Rico and the U.S. Virgin Islands (NMFS 2010d); see NMFS Marine Mammal Stock Assessment Reports: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-species-stock>).

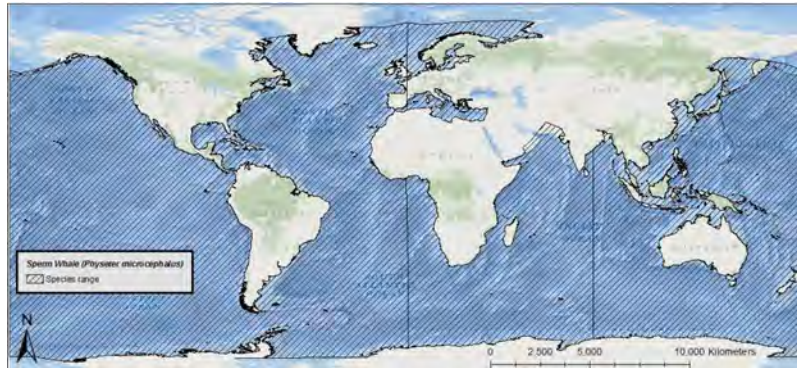


Figure 35: Range of the sperm whale

The sperm whale is the largest toothed whale and distinguishable from other whales by its extremely large head, which takes up 25 to 35 percent of its total body length and a single blowhole asymmetrically situated on the left side of the head near the tip. The sperm whale was originally listed as endangered on December 2, 1970 (35 FR 18319).

Information available from the recovery plan (NMFS 2010d), recent stock assessment reports (Carretta et al. 2018, Hayes et al. 2018b, Muto et al. 2018), status review (NMFS 2015e), as well as the recent IUCN sperm whale assessment (Taylor et al. 2019) were used to summarize the life history, population dynamics and status of the species as follows.

Life History

The average lifespan of sperm whales is estimated to be at least 50 years (Whitehead 2009). They have a gestation period of one to one and a half years, and calves nurse for approximately two years, though they may begin to forage for themselves within the first year of life (Tønnesen et al. 2018). Sexual maturity is reached between 7 and 13 years of age for females with an average calving interval of four to six years. Male sperm whales reach full sexual maturity in their 20s. Sperm whales mostly inhabit areas with a water depth of 1970 ft (600 m) or more, and are uncommon in waters less than 985 ft (300 m) deep. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed primarily on squid; other prey includes octopus and demersal fish (including teleosts and elasmobranchs).

Population Dynamics

Pre-whaling, the global population of sperm whales was estimated to be approximately 1,100,000 animals (Taylor et al. 2019, Whitehead 2002). By 1880, due to whaling, the population was approximately 71 percent of its original level (Whitehead 2002). In 1999, ten years after the end of large-scale whaling, the population was estimated to be about 32 percent of its original level (Whitehead 2002).

The most recent global sperm whale population estimate is 360,000 whales (Whitehead 2009). There are no reliable estimates for sperm whale abundance across the entire (North and South) Atlantic Ocean. However, estimates are available for two of three U.S. stocks in the western North Atlantic Ocean; the Northern Gulf of Mexico stock is estimated to consist of 763 individuals ($N_{\min}=560$) (Waring et al. 2016) and the North Atlantic stock is estimated to consist of 4,349 individuals ($N_{\min}=3,451$) (Hayes 2019). There are insufficient data to estimate abundance for the Puerto Rico and U.S. Virgin Islands stock. Similar to the Atlantic Ocean, there are no reliable estimates for sperm whale abundance across the entire (North and South) Pacific Ocean. However, estimates are available for two of three U.S. stocks that occur in (Waring et al.

2010) the eastern Pacific; the California/Oregon/ Washington stock is estimated to consist of 1,997 individuals ($N_{\min}=1,270$; Carretta et al. 2019b), and the Hawaii stock is estimated to consist of 4,559 individuals ($N_{\min}=3,478$) (Carretta et al. 2019a). We are aware of no reliable abundance estimates for sperm whales in other major oceans in the Northern and Southern Hemispheres. Although maximum net productivity rates for sperm whales have not been clearly defined, population growth rates for sperm whale populations are expected to be low (i.e., no more than 1.1 percent per year) (Whitehead 2002). In U.S. waters, NMFS determined that, until additional data is available, the cetacean maximum theoretical net productivity rate of 4.0 percent will be used for, among others, the North Atlantic, Northern Gulf of Mexico, and Puerto Rico and the U.S. Virgin Islands stocks of sperm whales (Carretta et al. 2019a, Carretta et al. 2019b, Hayes 2019, Muto et al. 2019a, Muto et al. 2019b, Waring et al. 2010, Waring et al. 2016).

Ocean-wide genetic studies indicate sperm whales have low genetic diversity, suggesting a recent bottleneck, but strong differentiation between matrilineally-related groups (Lyrholm and Gyllenstein 1998). Consistent with this, two studies of sperm whales in the Pacific Ocean indicate low genetic diversity (Mesnick et al. 2011, Rendell et al. 2012). Furthermore, sperm whales from the Gulf of Mexico, the western North Atlantic Ocean, the North Sea, and the Mediterranean Sea all have been shown to have low levels of genetic diversity (Engelhaupt et al. 2009). As none of the stocks for which data are available have high levels of genetic diversity, the species may be at some risk to inbreeding and ‘allee’ effects¹¹, although the extent to which is currently unknown. Sperm whales have a global distribution and can be found in relatively deep waters in all ocean basins. While both males and females can be found in latitudes less than 40 degrees, only adult males venture into the higher latitudes near the poles.

Status

The sperm whale is endangered as a result of past commercial whaling. Although the aggregate abundance worldwide is probably at least several hundred thousand individuals, the extent of depletion and degree of recovery of populations are uncertain. Commercial whaling is no longer allowed, however, illegal hunting may occur. Continued threats to sperm whale populations include vessel strikes, entanglement in fishing gear, competition for resources due to overfishing, population, loss of prey and habitat due to climate change, and sound. The Deepwater Horizon Natural Resource Damage Assessment Trustees assessed effects of oil exposure on sea turtles and marine mammals. Sperm whales in the Gulf of Mexico were impacted by the oil spill with 3 percent of the stock estimated to have died (DWH NRDA Trustees 2016). The species’ large population size shows that it is somewhat resilient to current threats.

Critical Habitat

No critical habitat has been designated for the sperm whale.

Recovery Goals

Under the ESA, NOAA publishes recovery plans that outline the path and tasks required to restore and secure self-sustaining wild populations. If successfully implemented, recovery plans result in listed species being reclassified from endangered or threatened or delisting and removal

¹¹ Allee effects are broadly characterized as a decline in individual fitness in populations with a small size or density.

of the species from ESA protection. Recovery plans include objective criteria for measuring recovery. The 2010 Recovery Plan for the sperm whale (NMFS 2010d) includes the following downlisting/delisting criteria:

Downlisting

1. The population in the ocean basin in which it occurs has no more than 1 percent chance of extinction in 100 years and has at least 1,500 mature reproductive individuals (consisting of at least 250 females and 250 males) in each ocean basin.
2. None of the known threats are known to limit the continued growth of the populations.

Delisting

1. The population in the ocean basin in which it occurs has less than a 10 percent probability of becoming endangered in 20 years.
2. None of the known threats are known to limit the continued growth of the populations.

It also includes the following recovery actions/objectives:

1. Coordinate state, federal, and international actions to implement recovery action and maintain international regulation of whaling for sperm whales.
2. Develop and apply methods to estimate population size and monitor trends in abundance.
3. Determine population discreteness and population structure of sperm whales.
4. Conduct risk analyses.
5. Identify, characterize, protect, and monitor habitat important to sperm whale populations in U.S. waters and elsewhere.
6. Investigate causes of, and reduce the frequency and severity of, human-caused injury and mortality.
7. Determine and minimize any detrimental effects of anthropogenic noise in the oceans;
8. Maximize efforts to acquire scientific information from dead, stranded, and entangled sperm whales.
9. Develop post-delisting monitoring plan.

4.2.2. *Sea Turtles*

Kemp's ridley and leatherback sea turtles are currently listed under the ESA at the species level; green and loggerhead sea turtles are listed at the DPS level. Therefore, we include information on the range-wide status of Kemp's ridley and leatherback sea turtles to provide the overall status of each species. Information on the status of loggerhead and green sea turtles is for the DPS affected by this action. Additional background information on the range-wide status of these species can be found in a number of published documents, including sea turtle status reviews and biological reports (Conant et al. 2009, Hirth 1997, NMFS and USFWS 1995, Seminoff et al. 2015, TEWG 1998, 2000, 2007, 2009) and recovery plans and five-year reviews for the loggerhead sea turtle (Bolten et al. 2019, NMFS and USFWS 2008), Kemp's ridley sea turtle (NMFS and USFWS 2015, NMFS et al. 2011), green sea turtle (NMFS and USFWS 1991b), and leatherback sea turtle (NMFS and USFWS 1992, 1998a, 2013).

4.2.2.1. *Green Sea Turtle (North Atlantic DPS)*

The green sea turtle has a circumglobal distribution, occurring throughout tropical, subtropical and, to a lesser extent, temperate waters. They commonly inhabit nearshore and inshore waters. It is the largest of the hardshell marine turtles, growing to a weight of approximately 350 lbs (159 kg) and a straight carapace length of greater than 3.3 ft (1 m). The species was listed under

the ESA on July 28, 1978 (43 FR 32800) as endangered for breeding populations in Florida and the Pacific coast of Mexico and threatened in all other areas throughout its range. On April 6, 2016, NMFS listed 11 DPSs of green sea turtles as threatened or endangered under the ESA (81 FR 20057). The North Atlantic DPS of green turtle is found in the North Atlantic Ocean and Gulf of Mexico (Figure 36) and is listed as threatened. Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5° N, 77° W) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick, Canada (48° N, 77° W) in the north. The range of the DPS then extends due east along latitudes 48° N and 19° N to the western coasts of Europe and Africa.

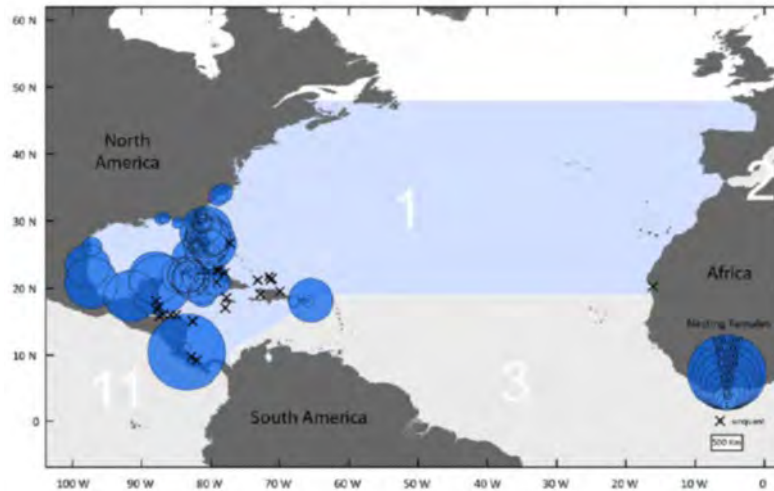


Figure 36: Range of the North Atlantic distinct population segment of green turtle with location and abundance of nesting females (Seminoff et al. 2015).

We used information available in the 2015 Status Review (Seminoff et al. 2015), relevant literature, and recent nesting data from the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWRI) to summarize the life history, population dynamics and status of the species, as follows.

Life history

Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, Quintana Roo), United States (Florida) and Cuba (Figure 36) support nesting concentrations of particular interest in the North Atlantic DPS (Seminoff et al. 2015). The largest nesting site in the North Atlantic DPS is in Tortuguero, Costa Rica, which hosts 79 percent of nesting females for the DPS (Seminoff et al. 2015). In the southeastern United States, females generally nest between May and September (Seminoff et al. 2015, Witherington et al. 2006). Green sea turtles lay an average of three nests per season with an average of one hundred eggs per nest (Hirth 1997, Seminoff et al. 2015). The remigration interval (period between nesting seasons) is two to five years (Hirth 1997, Seminoff et al. 2015). Nesting occurs primarily on beaches with intact dune structure, native vegetation and appropriate incubation temperatures during the summer months.

Sea turtles are long-lived animals. Size and age at sexual maturity have been estimated using several methods, including mark-recapture, skeletochronology, and marked, known-aged individuals. Skeletochronology analyzes growth marks in bones to obtain growth rates and age at sexual maturity estimates. Estimates vary widely among studies and populations, and methods continue to be developed and refined (Avens and Snover 2013). Early mark-recapture studies in

Florida estimated the age at sexual maturity 18-30 years (Frazer and Ehrhart 1985, Goshe et al. 2010, Mendonça 1981). More recent estimates of age at sexual maturity are as high as 35–50 years (Avens and Snover 2013, Goshe et al. 2010), with lower ranges reported from known age (15–19 years) turtles from the Cayman Islands (Bell et al. 2005) and Caribbean Mexico (12–20 years) (Zurita et al. 2012). A study of green turtles that use waters of the southeastern United States as developmental habitat found the age at sexual maturity likely ranges from 30 to 44 years (Goshe et al. 2010). Green turtles in the Northwestern Atlantic mature at 2.8-33+ ft (85–100+ cm) straight carapace lengths (SCL) (Avens and Snover 2013).

Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Adult green turtles feed primarily on seagrasses and algae, although they also eat other invertebrate prey (Seminoff et al. 2015).

Population dynamics

The North Atlantic DPS has a globally unique haplotype, which was a factor in defining the discreteness of the DPS. Evidence from mitochondrial DNA studies indicates that there are at least four independent nesting subpopulations in Florida, Cuba, Mexico and Costa Rica (Seminoff et al. 2015). More recent genetic analysis indicates that designating a new western Gulf of Mexico management unit might be appropriate (Shamblin et al. 2016).

Compared to other DPSs, the North Atlantic DPS exhibits the highest nester abundance, with approximately 167,424 females at seventy-three nesting sites (using data through 2012), and available data indicated an increasing trend in nesting (Seminoff et al. 2015). Counts of nests and nesting females are commonly used as an index of abundance and population trends, even though there are doubts about the ability to estimate the overall population size.

There are no reliable estimates of population growth rate for the DPS as a whole, but estimates have been developed at a localized level. The status review for green sea turtles assessed population trends for seven nesting sites with more 10 years of data collection in the North Atlantic DPS. The results were variable with some sites showing no trend and others increasing. However, all major nesting populations (using data through 2011-2012) demonstrated increases in abundance (Seminoff et al. 2015).

More recent data is available for the southeastern United States. The FWRI monitors sea turtle nesting through the Statewide Nesting Beach Survey (SNBS) and Index Nesting Beach Survey (INBS). Since 1979, the SNBS had surveyed approximately 215 beaches to collect information on the distribution, seasonality, and abundance of sea turtle nesting in Florida. Since 1989, the INBS has been conducted on a subset of SNBS beaches to monitor trends through consistent effort and specialized training of surveyors. The INBS data uses a standardized data-collection protocol to allow for comparisons between years and is presented for green, loggerhead, and leatherback sea turtles. The index counts represent 27 core index beaches. The index nest counts represent approximately 67 percent of known green turtle nesting in Florida (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>).

Nest counts at Florida's core index beaches have ranged from less than 300 to almost 41,000 in 2019. The nest numbers show a mostly biennial pattern of fluctuation (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>; Figure 37).

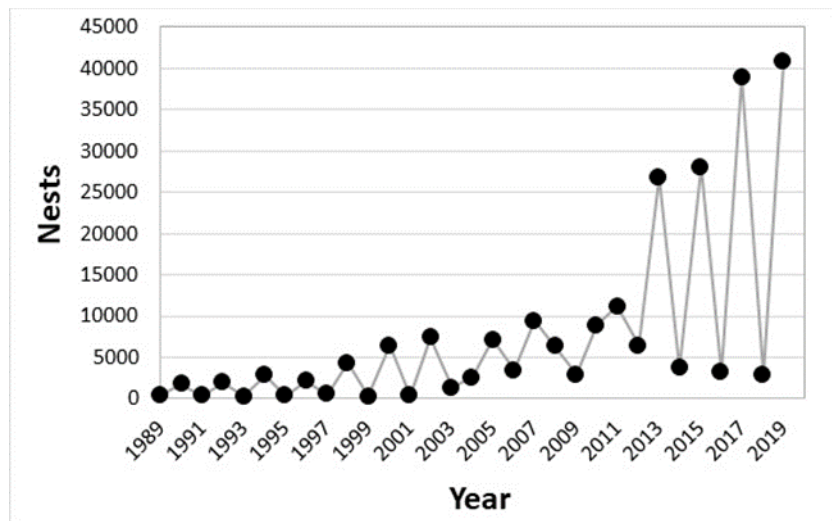


Figure 37: Number of green sea turtle nests counted on core index beaches in Florida from 1989-2019 (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>)

Status

Historically, green sea turtles in the North Atlantic DPS were hunted for food, which was the principle cause of the population's decline. Apparent increases in nester abundance for the North Atlantic DPS in recent years are encouraging but must be viewed cautiously, as the datasets represent a fraction of a green sea turtle generation which is between 30 and 40 years (Seminoff et al. 2015). While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue, the North Atlantic DPS appears to be somewhat resilient to future perturbations.

Critical Habitat

Critical habitat in effect for the North Atlantic DPS of green sea turtles surrounds Culebra Island, Puerto Rico (66 FR 20058, April 6, 2016), which is outside the action area.

Recovery Goals

The recovery plan for green sea turtles has not been recently updated. In the plan, the recovery goal for the U.S. population of green sea turtles is delist the species once the recovery criteria are met (NMFS and USFWS 1991b). The recovery plan includes criteria for delisting related to nesting activity, nesting habitat protection, and reduction in mortality.

Delisting can be considered if, over a period of 25 years,:

1. Florida nesting has increased to an average of 5,000 nests per year for at least six years.
2. At least 25 percent (105 km) of available nesting beaches is in public ownership and encompasses greater than 50 percent of nesting activity.
3. Stage class mortality reduction is reflected in higher abundance counts on foraging grounds.

4. All priority one tasks have been successfully implemented (NMFS and USFWS 1991b).

Major actions needed to help meet the recovery goals include:

1. Providing long-term protection to important nesting beaches.
2. Ensuring at least a 60 percent hatch rate success on major nesting beaches.
3. Implementing effective lighting ordinances/plans on nesting beaches.
4. Determining distribution and seasonal movements of all life stages in the marine environment.
5. Minimizing commercial fishing mortality.
6. Reducing threat to the population and foraging habitat from marine pollution.

4.2.2.2. *Kemp's Ridley Sea Turtle*

The range of Kemp's ridley sea turtles extends from the Gulf of Mexico to the Atlantic coast (Figure 38). They have occasionally been found in the Mediterranean Sea, which may be due to migration expansion or increased hatchling production (Tomás and Raga 2008). They are the smallest of all sea turtle species, with a nearly circular top shell and a pale yellowish bottom shell. The species was first listed under the Endangered Species Conservation Act (35 FR 18319, December 2, 1970) in 1970. The species has been listed as endangered under the ESA since 1973.

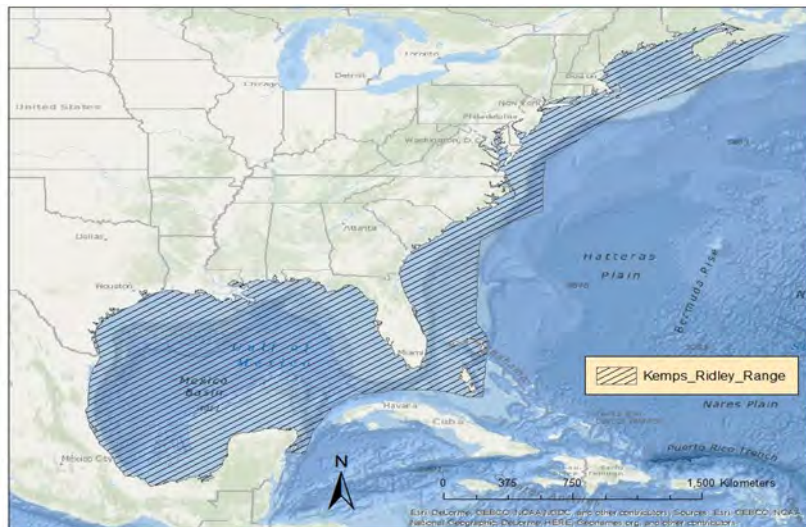


Figure 38: Range of the Kemp's ridley sea turtle

We used information available in the revised recovery plan (NMFS et al. 2011), the five-year review (NMFS and USFWS 2015), and published literature to summarize the life history, population dynamics and status of the species, as follows.

Life History

Kemp's ridley nesting is essentially limited to the western Gulf of Mexico. Approximately 97 percent of the global population's nesting activity occurs on a 90-mile (146-km) stretch of beach that includes Rancho Nuevo in Mexico (Wibbels and Bevan 2019). In the United States, nesting occurs primarily in Texas and occasionally in Florida, Alabama, Georgia, South Carolina, and North Carolina (NMFS and USFWS 2015). Nesting occurs from April to July in large arribadas (synchronized large-scale nesting). The average remigration interval is two years, although

intervals of 1 and 3 years are not uncommon (NMFS et al. 2011, TEWG 1998, 2000). Females lay an average of 2.5 clutches per season (NMFS et al. 2011). The annual average clutch size is 95 to 112 eggs per nest (NMFS and USFWS 2015). The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately two years before returning to nearshore coastal habitats (Epperly et al. 2013, NMFS and USFWS 2015, Snover et al. 2007). Modeling indicates that oceanic-stage Kemp's ridley turtles are likely distributed throughout the Gulf of Mexico into the northwestern Atlantic (Putman et al. 2013). Kemp's ridley nearing the age when recruitment to nearshore waters occurs are more likely to be distributed in the northern Gulf of Mexico, eastern Gulf of Mexico, and the western Atlantic (Putman et al. 2013).

Several studies, including those of captive turtles, recaptured turtles of known age, mark-recapture data, and skeletochronology, have estimated the average age at sexual maturity for Kemp's ridleys between 5 to 12 years (captive only) (Bjorndal et al. 2014), 10 to 16 years (Chaloupka and Zug 1997, Schmid and Witzell 1997, Schmid and Woodhead 2000, Zug et al. 1997), 9.9 to 16.7 years (Snover et al. 2007), 10 and 18 years (Shaver and Wibbels 2007), 6.8 to 21.8 years (mean 12.9 years) (Avens et al. 2017).

During spring and summer, juvenile Kemp's ridleys generally occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida and along the U.S. Atlantic coast from southern Florida to the Mid-Atlantic and New England. In addition, the NEFSC caught a juvenile Kemp's ridley during a recent research project in deep water south of Georges Bank (NEFSC, unpublished data). In the fall, most Kemp's ridleys migrate to deeper or more southern, warmer waters and remain there through the winter. As adults, many turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 2011). Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 meters) deep (Seney and Landry 2008, Shaver et al. 2005, Shaver and Rubio 2008), although they can also be found in deeper offshore waters. As larger juveniles and adults, Kemp's ridleys forage on swimming crabs, fish, mollusks, and tunicates (NMFS et al. 2011).

Population Dynamics

Of the sea turtles species in the world, the Kemp's ridley has declined to the lowest population level. Nesting aggregations at a single location (Rancho Nuevo, Mexico) were estimated at 40,000 females in 1947. By the mid-1980s, the population had declined to an estimated 300 nesting females. From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased at 15 percent annually (Heppell et al. 2005). However, due to recent declines in nest counts, decreased survival of immature and adult sea turtles, and updated population modeling, this rate is not expected to continue and the overall trend is unclear (Caillouet et al. 2018, NMFS and USFWS 2015). In 2019, there were 11,090 nests, a 37.61 percent decrease from 2018 and a 54.89 percent decrease from 2017, which had the highest number (24,587) of nests (Figure 39; unpublished data). The reason for this recent decline is uncertain.

Using the standard IUCN protocol for sea turtle assessments, the number of mature individuals was recently estimated at 22,341 (Wibbels and Bevan 2019). The calculation took into account the average annual nests from 2016-2018 (21,156), a clutch frequency of 2.5 per year, a remigration interval of 2 years, and a sex ratio of 3.17 females:1 male. Based on the data in their

analysis, the assessment concluded the current population trend is unknown (Wibbels and Bevan 2019).

Genetic variability in Kemp's ridley turtles is considered to be high, as measured by nuclear DNA analyses (i.e., microsatellites) (NMFS et al. 2011). If this holds true, rapid increases in population over one or two generations would likely prevent any negative consequences in the genetic variability of the species (NMFS et al. 2011). Additional analysis of the mtDNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton et al. 2006).

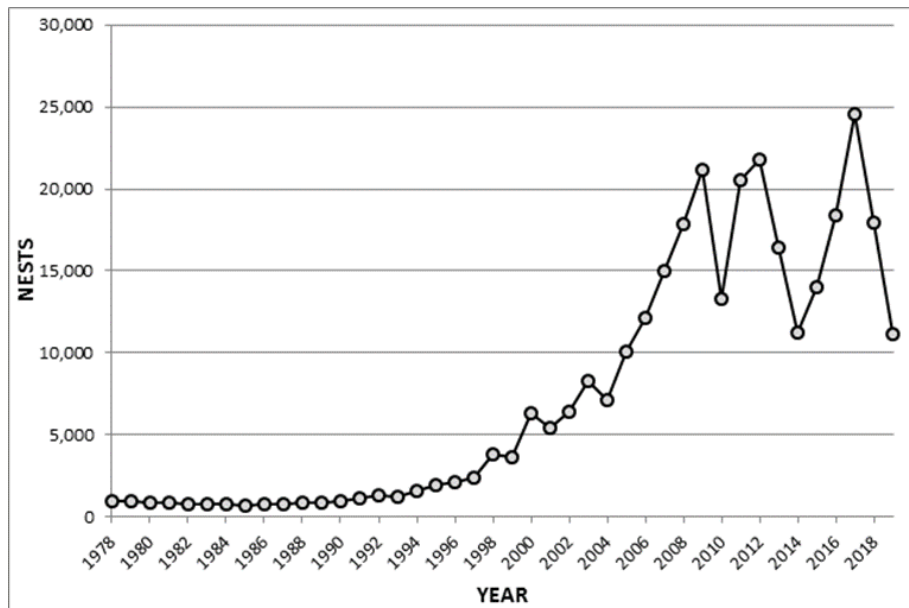


Figure 39: Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2019)

Status

The Kemp's ridley was listed as endangered in response to a severe population decline, primarily the result of egg collection. In 1973, legal ordinances in Mexico prohibited the harvest of sea turtles from May to August, and in 1990, the harvest of all sea turtles was prohibited by presidential decree. In 2002, Rancho Nuevo was declared a Sanctuary. Nesting beaches in Texas have been re-established. Fishery interactions are the main threat to the species. Other threats include habitat destruction, oil spills, dredging, disease, cold stunning, and climate change. The current population trend is uncertain. While the population has increased, recent nesting numbers have been variable. In addition, the species' limited range and low global abundance make it vulnerable to new sources of mortality as well as demographic and environmental randomness, all of which are often difficult to predict with any certainty. Therefore, its resilience to future perturbation is low.

Critical Habitat

Critical habitat has not been designated for Kemp's ridley sea turtles.

Recovery Goals

As with other recovery plans, the goal of the Kemp's ridley recovery plan is to conserve and protect the species so that the listing is no longer necessary. The recovery criteria relate to the number of nesting females, hatchling recruitment, habitat protection, social and/or economic

initiatives compatible with conservation, reduction of predation, turtle excluder device (TED) or other protective measures in trawl gear, and improved information available to ensure recovery. The recovery plan includes the complete downlisting/delisting criteria (NMFS et al. 2011). These criteria, which are related to demographic and listing factor criteria, are summarized here.

Downlisting criteria include:

1. A population of at least 10,000 nesting females in a season distributed at primary nesting beaches.
2. Recruitment of at least 300,000 hatchlings to the marine environment per season at the three primary nesting beaches in Mexico.
3. Listing factor criteria related to long-term protection of habitat at two of the primary nesting beaches; initiation of social and/or economic community initiatives; reduction of nest predation; maintenance and enforcement of TED regulations; and identification and review of data on foraging areas, interesting habitats, mating areas, and adult migration routes to provide information to ensure recovery.

Delisting criteria include:

1. Average population of at least 40,000 nesting females per season over a 6-year period distributed among nesting beaches.
2. Average annual recruitment of hatchlings over a 6-year period sufficient to maintain a population of at least 40,000 nesting females per nesting season.
3. Listing factor criteria related to maintaining long-term habitat protection at nesting beaches of Tamaulipas and Texas; maintaining and expanding community socioeconomic programs; reducing nest predation through protective measures; implementing specific, comprehensive legislation/regulations to ensure post-delisting protection, as appropriate; establishing a network on in-water sites to monitor population and implementing surveys; initiating monitoring programs in commercial and recreational fisheries have been initiated and implementing measures to minimize mortality in fisheries; ensuring all other significant anthropogenic mortalities have been sufficiently addressed to ensure recruitment to maintain population level criterion; and continuing STSSN research and data collection to monitor the effectiveness of protection and restoration activities.

Major actions needed to meet the recovery goals include:

1. Protect and manage terrestrial and marine habitats and Kemp's ridley populations.
2. Maintain the STSSN.
3. Manage captive stocks.
4. Develop local, state, national government and community partnerships.
5. Educate the public.
6. Maintain and expand legal protections, promote awareness of these, and increase enforcement.
7. Implement international agreements.

4.2.2.3. *Loggerhead Sea Turtle (Northwest Atlantic Ocean DPS)*

Loggerhead sea turtles are circumglobal and are found in the temperate and tropical regions of the Indian, Pacific and Atlantic Oceans. The loggerhead sea turtle is distinguished from other turtles by its reddish-brown carapace, large head and powerful jaws. The species was first listed as threatened under the Endangered Species Act in 1978 (43 FR 32800, July 28, 1978). On September 22, 2011, the NMFS and USFWS designated nine distinct population segments of loggerhead sea turtles, with the Northwest Atlantic Ocean DPS listed as threatened (76 FR 58868). The Northwest Atlantic Ocean DPS of loggerheads is found along eastern North America, Central America, and northern South America (Figure 40).



Figure 40: Range of the Northwest Atlantic Ocean DPS of loggerhead sea turtles

We used information available in the 2009 Status Review (Conant et al. 2009), the final listing rule (76 FR 58868, September 22, 2011), the relevant literature, and recent nesting data from the FWRI to summarize the life history, population dynamics and status of the species, as follows.

Life History

Nesting occurs on beaches where warm, humid sand temperatures incubate the eggs. Northwest Atlantic females lay an average of five clutches per year. The annual average clutch size is 115 eggs per nest. Females do not nest every year. The average remigration interval is three years. There is a 54 percent emergence success rate (Conant et al. 2009). As with other sea turtles, temperature determines the sex of the turtle during the middle of the incubation period. Turtles spend the post-hatchling stage in pelagic waters. The juvenile stage is spent first in the oceanic zone and later in coastal waters. Some juveniles may periodically move between the oceanic zone and coastal waters (Bolten 2003, Conant et al. 2009, Mansfield 2006, Morreale and Standora 2005, Witzell 2002). Coastal waters provide important foraging, inter-nesting, and migratory habitats for adult loggerheads. In both the oceanic zone and coastal waters, loggerheads are primarily carnivorous, although they do consume some plant matter as well (Conant et al. 2009). Loggerheads have been documented to feed on crustaceans, mollusks, jellyfish and salps, and algae (Bjorndal 1997, Donaton et al. 2019, Seney and Musick 2007).

Avens et al. (2015) used three approaches to estimate age at maturation. Mean age predictions associated with minimum and mean maturation straight carapace lengths were 22.5-25 and 36-38 years for females and 26-28 and 37-42 years for males. Male and female sea turtles have similar post-maturation longevity, ranging from 4 to 46 (mean 19) years (Avens et al. 2015).

Loggerhead hatchlings from the western Atlantic disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. MtDNA evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71 percent-88 percent) of individuals found in foraging grounds throughout the western and eastern Atlantic: Nicaragua, Panama, Azores and Madeira, Canary Islands and Andalusia, Gulf of Mexico, and Brazil (Masuda 2010). LaCasella et al. (2013) found that loggerheads, primarily juveniles, caught within the Northeast Distant (NED) waters of the North Atlantic mostly originated from nesting populations in the southeast United States and, in particular, Florida. They found that nearly all loggerheads caught in the NED came from the Northwest Atlantic DPS (mean = 99.2 percent), primarily from the large eastern Florida rookeries. There was little evidence of contributions from the South Atlantic, Northeast Atlantic, or Mediterranean DPSs (LaCasella et al. 2013).

A more recent analysis assessed sea turtles captured in fisheries in the Northwest Atlantic and included samples from 850 (including 24 turtles caught during fisheries research) turtles caught from 2000-2013 in coastal and oceanic habitats (Stewart et al. 2019). The turtles were primarily captured in pelagic longline and bottom otter trawls. Other gears included bottom longline, hook and line, gillnet, dredge, and dip net. Turtles were identified from 19 distinct management units; the western Atlantic nesting populations were the main contributors with little representation from the Northeast Atlantic, Mediterranean, or South Atlantic DPSs (Stewart et al. 2019). There was a significant split in the distribution of small (≤ 2 ft (63 cm) SCL) and large (> 2 ft (63 cm) SCL) loggerheads north and south of Cape Hatteras, North Carolina. North of Cape Hatteras, large turtles came mainly from southeast Florida (44 percent $\pm$ 15 percent) and the northern United States management units (33 percent $\pm$ 16 percent); small turtles came from central east Florida (64 percent $\pm$ 14 percent). South of Cape Hatteras, large turtles came mainly from central east Florida (52 percent $\pm$ 20 percent) and southeast Florida (41 percent $\pm$ 20 percent); small turtles came from southeast Florida (56 percent $\pm$ 25 percent). The authors concluded that bycatch in the western North Atlantic would affect the Northwest Atlantic DPS almost exclusively (Stewart et al. 2019).

Population Dynamics

A number of stock assessments and similar reviews (Conant et al. 2009, Heppell et al. 2005, NMFS SEFSC 2001, 2009, Richards et al. 2011, TEWG 1998, 2000, 2009) have examined the stock status of loggerheads in the Atlantic Ocean, but none have been able to develop a reliable estimate of absolute population size. As with other species, counts of nests and nesting females are commonly used as an index of abundance and population trends, even though there are doubts about the ability to estimate the overall population size.

Based on genetic analysis of nesting subpopulations, the Northwest Atlantic Ocean DPS is divided into five recovery units: Northern, Peninsular Florida, Dry Tortugas, Northern Gulf of Mexico, and Greater Caribbean (Conant et al. 2009). A more recent analysis using expanded mtDNA sequences revealed that rookeries from the Gulf and Atlantic coasts of Florida are genetically distinct (Shamblin et al. 2014). The recent genetic analyses suggest that the

Northwest Atlantic Ocean DPS should be considered as ten management units: (1) South Carolina and Georgia, (2) central eastern Florida, (3) southeastern Florida, (4) Cay Sal, Bahamas, (5) Dry Tortugas, Florida, (6) southwestern Cuba, (7) Quintana Roo, Mexico, (8) southwestern Florida, (9) central western Florida, and (10) northwestern Florida (Shamblin et al. 2012).

The Northwest Atlantic Ocean's loggerhead nesting aggregation is considered the largest in the world (Casale and Tucker 2017). Using data from 2004-2008, the adult female population size of the DPS was estimated at 20,000 to 40,000 females (NMFS SEFSC 2009). More recently, Ceriani and Meylan (2017) reported a 5-year average (2009-2013) of more than 83,717 nests per year in the southeast United States and Mexico (excluding Cancun, Quintana Roo, Mexico; approximately 3.7% of nests in Quintana Roo). These estimates included sites without long-term (≥ 10 years) datasets. When they used data from 86 index sites (representing 63.4 percent of the estimated nests for the whole DPS with long-term datasets, they reported 53,043 nests per year. Trends at the different index nesting beaches ranged from negative to positive. In a trend analysis of the 86 index sites, the overall trend for the Northwest Atlantic DPS was positive (+2 percent) (Ceriani and Meylan 2017). Uncertainties in this analysis include, among others, using nesting females as proxies for overall population abundance and trends, demographic parameters, monitoring methodologies, and evaluation methods involving simple comparisons of early and later 5-year average annual nest counts. However, the authors concluded that the subpopulation is well monitored and the data evaluated represents 63.4 percent of the total estimated annual nests of the subpopulation and, therefore, are representative of the overall trend (Ceriani and Meylan 2017).

About 80 percent of loggerhead nesting in the southeast United States occurs in six Florida counties (NMFS and USFWS 2008). The Peninsula Florida Recovery Unit and the Northern Recovery Unit represent approximately 87 percent and 10 percent, respectively of all nesting effort in the Northwest Atlantic DPS (Ceriani and Meylan 2017, NMFS and USFWS 2008). As described above, FWRI's INBS collects standardized nesting data. The index nest counts for loggerheads represent approximately 53 percent of known nesting in Florida. There have been three distinct intervals observed: increasing (1989-1998), decreasing (1998-2007), and increasing (2007-2019) (Figure 41). At core index beaches in Florida, nesting totaled a minimum of 28,876 nests in 2007 and a maximum of 65,807 nests in 2016 (<https://myfwc.com/research/wildlife/seaturtles/nesting/beach-survey-totals/>). In 2019, more than 53,000 nests were documented (Figure 41). The nest counts in Figure 42 represent peninsular Florida and do not include an additional set of beaches in the Florida Panhandle and southwest coast that were added to the program in 1997 and more recent years. Nest counts at these Florida Panhandle index beaches have an upward trend since 2010 (Figure 42).

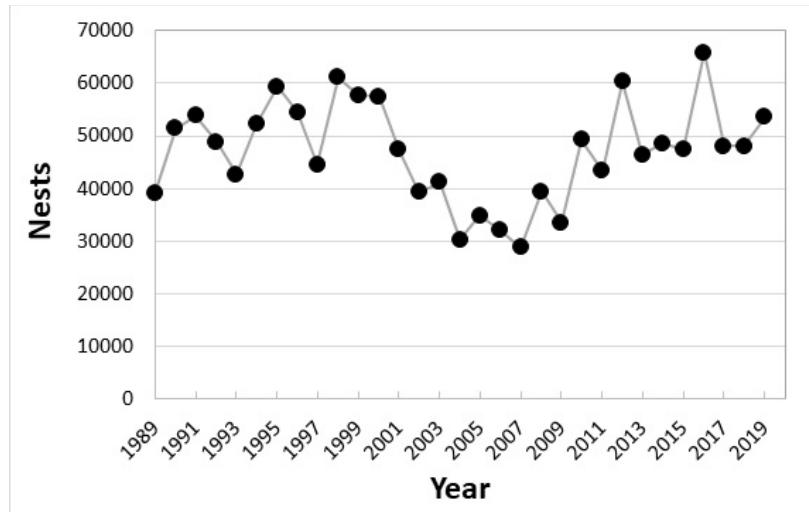


Figure 41: Annual nest counts of loggerhead sea turtles on Florida core index beaches in peninsular Florida, 1989-2019 (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>)

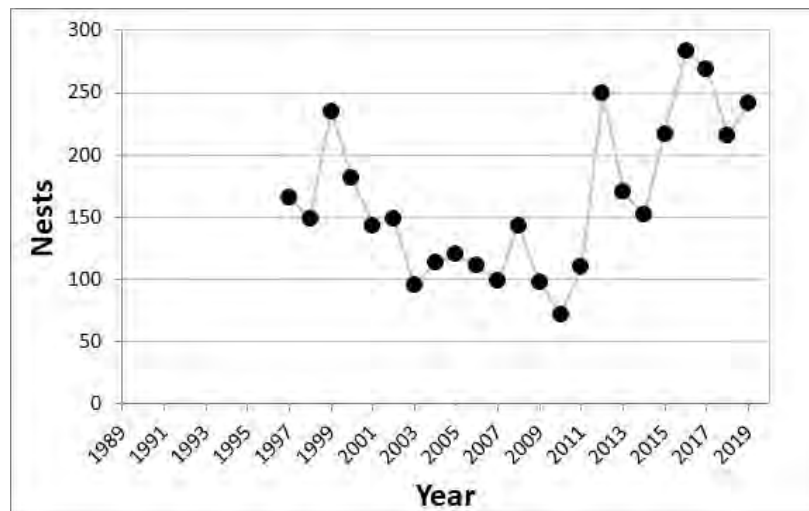


Figure 42: Annual nest counts of loggerhead sea turtles on index beaches in the Florida Panhandle, 1997-2019 (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>)

The annual nest counts on Florida's index beaches fluctuate widely, and we do not fully understand what drives these fluctuations. In assessing the population, Ceriani and Meylan (2017) and Bolten et al. (2019) looked at trends by recovery unit. Trends by recovery unit were variable.

The Peninsular Florida Recovery Unit extends from the Georgia-Florida border south and then north (excluding the islands west of Key West, Florida) through Pinellas County on the west coast of Florida. Annual nest counts from 1989 to 2018 ranged from a low of 28,876 in 2007 to a high of 65,807 in 2017 (Bolten et al. 2019). More recently (2008-2018), counts have ranged from 33,532 in 2009 to 65,807 in 2016 (Bolten et al. 2019). Nest counts taken at index beaches in Peninsular Florida showed a significant decline in loggerhead nesting from 1989 to 2007, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington et al. 2009). Trend analyses have been completed for various periods. From 2009 through 2013, a 2 percent decrease for this recovery unit was reported (Ceriani and Meylan

2017). Using a longer time series from 1989-2018, there was no significant change in the number of annual nests (Bolten et al. 2019). It is important to recognize that an increase in the number of nests has been observed since 2007. The recovery team cautions that using short term trends in nesting abundance can be misleading and trends should be considered in the context of one generation (50 years for loggerheads) (Bolten et al. 2019).

The Northern Recovery Unit, ranging from the Florida-Georgia border through southern Virginia, is the second largest nesting aggregation in the DPS. Annual nest totals for this recovery unit from 1983 to 2019 have ranged from a low of 520 in 2004 to a high of 5,555 in 2019 (Bolten et al. 2019). From 2008 to 2019, counts have ranged from 1,289 nests in 2014 to 5,555 nests in 2019 (Bolten et al. 2019). Nest counts at loggerhead nesting beaches in North Carolina, South Carolina, and Georgia declined at 1.9 percent annually from 1983 to 2005 (NMFS and USFWS 2008). Recently, the trend has been increasing. Ceriani and Meylan (2017) reported a 35 percent increase for this recovery unit from 2009 through 2013. A longer-term trend analysis based on data from 1983 to 2019 indicates that the annual rate of increase is 1.3 percent (Bolten et al. 2019).

The Dry Tortugas Recovery Unit includes all islands west of Key West, Florida. A census on Key West from 1995 to 2004 (excluding 2002) estimated a mean of 246 nests per year, or about 60 nesting females (NMFS and USFWS 2008). No trend analysis is available because there was not an adequate time series to evaluate the Dry Tortugas recovery unit (Ceriani et al. 2019, Ceriani and Meylan 2017), which accounts for less than 1 percent of the Northwest Atlantic DPS (Ceriani and Meylan 2017).

The Northern Gulf of Mexico Recovery Unit is defined as loggerheads originating from beaches in Franklin County on the northwest Gulf coast of Florida through Texas. From 1995 to 2007, there were an average of 906 nests per year on approximately 300 km of beach in Alabama and Florida, which equates to about 221 females nesting per year (NMFS and USFWS 2008). Annual nest totals for this recovery unit from 1997-2018 have ranged from a low of 72 in 2010 to a high of 283 in 2016 (Bolten et al. 2019). Evaluation of long-term nesting trends for the Northern Gulf of Mexico Recovery Unit is difficult because of changed and expanded beach coverage. However, there are now over 20 years of Florida index nesting beach survey data. A number of trend analyses have been conducted. From 1995 to 2005, the recovery unit exhibited a significant declining trend (Conant et al. 2009, NMFS and USFWS 2008). Nest numbers have increased in recent years (Bolten et al. 2019) (see <https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>). In the 2009-2013 trend analysis by Ceriani and Meylan (2017), a 1 percent decrease for this recovery unit was reported, likely due to diminished nesting on beaches in Alabama, Mississippi, Louisiana, and Texas. A longer-term analysis from 1997-2018 found that there has been a non-significant increase of 1.7 percent (Bolten et al. 2019).

The Greater Caribbean Recovery Unit encompasses nesting subpopulations in Mexico to French Guiana, the Bahamas, and the Lesser and Greater Antilles. The majority of nesting for this recovery unit occurs on the Yucatán Peninsula, in Quintana Roo, Mexico, with 903 to 2,331 nests annually (Zurita et al. 2003). Other significant nesting sites are found throughout the Caribbean, including Cuba, with approximately 250 to 300 nests annually (Ehrhart et al. 2003), and over 100 nests annually in Cay Sal in the Bahamas (NMFS and USFWS 2008). In the trend analysis by Ceriani and Meylan (2017), a 53 percent increase for this Recovery Unit was reported from 2009 through 2013.

Status

Fisheries bycatch is the highest threat to the Northwest Atlantic DPS of loggerhead sea turtles (Conant et al. 2009). Other threats include boat strikes, marine debris, coastal development, habitat loss, contaminants, disease, and climate change. Nesting trends for each of the loggerhead sea turtle recovery units in the Northwest Atlantic Ocean DPS are variable. Overall, short-term trends have shown increases, however, over the long-term the DPS is considered stable.

Critical Habitat

We have determined that the proposed action is not likely to adversely affect loggerhead critical habitat (see section 4.1.11).

Recovery Goals

The recovery goal for the Northwest Atlantic loggerhead is to ensure that each recovery unit meets its recovery criteria alleviating threats to the species so that protection under the ESA are not needed. The recovery criteria relate to the number of nests and nesting females, trends in abundance on the foraging grounds, and trends in neritic strandings relative to in-water abundance. The 2008 Final Recovery Plan for the Northwest Atlantic Population of Loggerheads includes the complete delisting criteria (NMFS and USFWS 2008).

Delisting criteria include:

1. Each recovery unit has recovered to a viable level and has increased for at least one generation. By recovery unit, over a 50-year period, the annual rate of increase is greater than or equal to 2 percent resulting in at least 14,000 nests annually for the Northern Recovery Unit; greater than or equal to 1 percent resulting in 106,100 nests annually for the Peninsular Florida Recovery Unit; greater than or equal to 3 percent resulting in at least 1,100 nests for the Dry Tortugas Recovery unit; and greater than or equal to 3 percent resulting in at least 4,000 nests annually for the Northern Gulf of Mexico Recovery Unit. For the Greater Caribbean Recovery Unit, the demographic criteria specifies that the total annual number of nests at a minimum of three nesting assemblages, averaging greater than 100 nests annually, has increased over 50 years.
2. The increases in the number of nests for each recovery unit must be a result of corresponding increases in the number of nesting females.
3. A network of in-water sites across the foraging range is established and measure abundance. A composite estimate of relative abundance from these sites is increasing for at least one generation.
4. Stranding trends are not increasing at a rate greater than the in-water relative abundance trends for similar age classes for at least one generation.
5. Listing factor recover criteria include criteria related to maintenance and protection of nesting habitat; development and implementation of a strategy to protect marine habitats important to loggerheads; implementation of nest protection strategies; elimination of legal harvest; reduction of nest predation; implementing legislation to ensure long-term protection of loggerheads and their habitats; implementation of strategies to reduce fisheries bycatch, marine debris ingestion and entanglement, and vessel strikes.

The recovery objectives to meet these goals include:

1. Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females.

2. Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.
3. Manage sufficient nesting beach habitat to ensure successful nesting.
4. Manage sufficient feeding, migratory and internesting marine habitats to ensure successful growth and reproduction.
5. Eliminate legal harvest.
6. Implement scientifically based nest management plans.
7. Minimize nest predation.
8. Recognize and respond to mass/unusual mortality or disease events appropriately.
9. Develop and implement local, state, federal and international legislation to ensure long-term protection of loggerheads and their terrestrial and marine habitats.
10. Minimize bycatch in domestic and international commercial and artisanal fisheries.
11. Minimize trophic changes from fishery harvest and habitat alteration.
12. Minimize marine debris ingestion and entanglement.
13. Minimize vessel strike mortality.

4.2.2.4. *Leatherback Sea Turtle*

The leatherback sea turtle is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. It ranges from tropical to subpolar latitudes, worldwide (Figure 43).



Figure 43: Range of the leatherback sea turtle (<https://www.fisheries.noaa.gov/species/leatherback-turtle>).

Leatherbacks are the largest living turtle, reaching lengths of six feet long, and weighing up to one ton. Leatherback sea turtles have a distinct black leathery skin covering their carapace with pinkish white skin on their plastron. The species was first listed under the Endangered Species Conservation Act (35 FR 8491, June 2, 1970) and has been listed as endangered under the ESA since 1973. In 2020, seven leatherback populations that met the discreteness and significance criteria of the DPS were identified (NMFS and USFWS 2020). The population found within the action is area is the Northwest Atlantic DPS (Figure 44). NMFS and USFWS concluded that the seven populations, which met the criteria for DPSs, all met the definition of an endangered species. NMFS and USFWS determined that the listing of DPSs was not warranted; leatherbacks continue to be listed at the global level (85 FR 48332, August 10, 2020). Therefore, information is presented on the range-wide status. We used information available in the five-year review

(NMFS and USFWS 2013), the critical habitat designation (44 FR 17710, March 23, 1979), the status review (NMFS and USFWS 2020), relevant literature, and recent nesting data from the Florida FWRI to summarize the life history, population dynamics and status of the species, as follows.

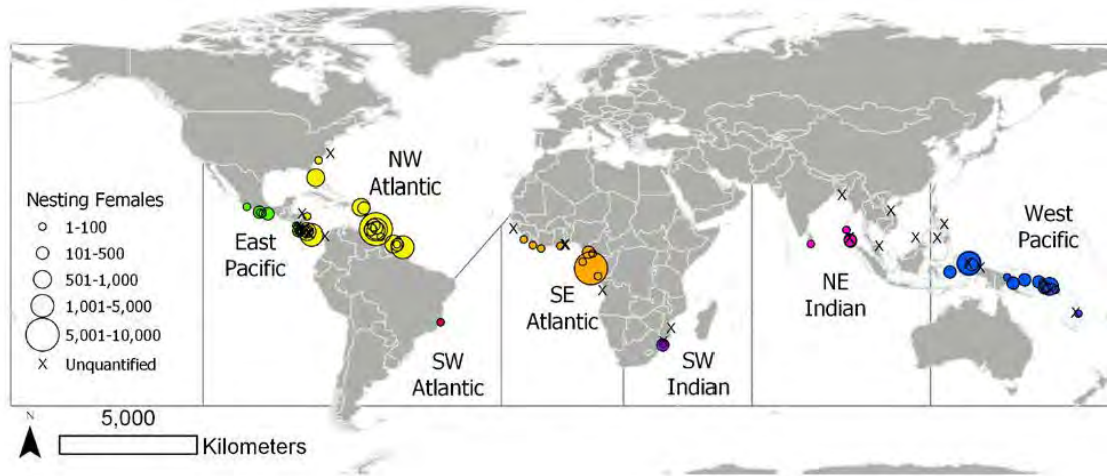


Figure 44: Leatherback sea turtle DPSs and nesting beaches (NMFS and USFWS 2020)

Life History

Leatherbacks are a long-lived species. Preferred nesting grounds are in the tropics; though, nests span latitudes from 34 °S in western Cape, South Africa to 38 °N in Maryland (Eckert et al. 2012, Eckert et al. 2015). Females lay an average of five to seven clutches (range: 1-14 clutches) per season, with 20 to over 100 eggs per clutch (Eckert et al. 2012, Reina et al. 2002, Wallace et al. 2007). The average clutch frequency for the Northwest Atlantic DPS is 5.5 clutches per season (NMFS and USFWS 2020). In the western Atlantic, leatherbacks lay about 82 eggs per clutch (Sotherland et al. 2015). Remigration intervals are 2-4 years for most populations (range 1-11 years) (Eckert et al. 2015, NMFS and USFWS 2020); the remigration interval for the Northwest Atlantic DPS is approximately 3 years (NMFS and USFWS 2020). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergence success) is approximately 50 percent worldwide (Eckert et al. 2012).

Age at sexual maturity has been challenging to obtain given the species physiology and habitat use (Avens et al. 2019). Past estimates ranged from 5-29 years (Avens et al. 2009, Spotila et al. 1996). More recently, Avens et al. (2019) used refined skeletochronology to assess the age at sexual maturity for leatherback sea turtles in the Atlantic and the Pacific. In the Atlantic, the mean age at sexual maturity was 19 years (range 13-28) and the mean size at sexual maturity was 4.2 ft (129.2 cm) CCL (range 3.7-5 ft (112.8-153.8 cm)). In the Pacific, the mean age at sexual maturity was 17 years (range 12-28) and the mean size at sexual maturity was 4.2 ft (129.3 cm) CCL (range 3.6- 5 ft (110.7-152.3 cm)) (Avens et al. 2019).

Leatherbacks have a greater tolerance for colder waters compared to all other sea turtle species due to their thermoregulatory capabilities (Paladino et al. 1990, Shoop and Kenney 1992, Wallace and Jones 2008). Evidence from tag returns, satellite telemetry, and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between temperate/boreal and tropical waters (Bond and James 2017, Dodge et al. 2015, Eckert et al. 2006, Fossette et al. 2014, James et al. 2005a, James et al. 2005b, James et al. 2005c, NMFS and

USFWS 1992). Tagging studies collectively show a clear separation of leatherback movements between the North and South Atlantic Oceans (NMFS and USFWS 2020).

Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. These gelatinous prey are relatively nutrient-poor, such that leatherbacks must consume large quantities to support their body weight. Leatherbacks weigh about 33 percent more on their foraging grounds than at nesting, indicating that they probably catabolize fat reserves to fuel migration and subsequent reproduction (James et al. 2005c, Wallace et al. 2006). Studies on the foraging ecology of leatherbacks in the North Atlantic show that leatherbacks off Massachusetts primarily consumed lion's mane, sea nettles, and ctenophores (Dodge et al. 2011). Juvenile and small sub-adult leatherbacks may spend more time in oligotrophic (relatively low plant nutrient usually accompanied by high dissolved oxygen) open ocean waters where prey is more difficult to find (Dodge et al. 2011). Sea turtles must meet an energy threshold before returning to nesting beaches. Therefore, their remigration intervals are dependent upon foraging success and duration (Hays 2000, Price et al. 2004).

Population Dynamics

The distribution is global, with nesting beaches in the Pacific, Atlantic, and Indian Oceans. Leatherbacks occur throughout marine waters, from nearshore habitats to oceanic environments (NMFS and USFWS 2020, Shoop and Kenney 1992). Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current boundaries, and coastal retention areas (Benson et al. 2011).

Analyses of mtDNA from leatherback sea turtles indicates a low level of genetic diversity (Dutton et al. 1999). Further analysis of samples taken from individuals from rookeries in the Atlantic and Indian Oceans suggest that each of the rookeries represent demographically independent populations (NMFS and USFWS 2013). Using genetic data, combined with nesting, tagging, and tracking data, researchers identified seven global regional management units (RMU) or subpopulations: Northwest Atlantic, Southeast Atlantic, Southwest Atlantic, Northwest Indian, Southwest Indian, East Pacific, and West Pacific (Wallace et al. 2010). The status review concluded that the RMUs identified by Wallace et al. (2010) are discrete populations and, then, evaluated whether any other populations exhibit this level of genetic discontinuity (NMFS and USFWS 2020).

To evaluate the RMUs and fine-scale structure in the Atlantic, Dutton et al. (2013) conducted a comprehensive genetic re-analysis of rookery stock structure. Samples from eight nesting sites in the Atlantic and one in the southwest Indian Ocean identified seven management units in the Atlantic and revealed fine scale genetic differentiation among neighboring populations. The mtDNA analysis failed to find significant differentiation between Florida and Costa Rica or between Trinidad and French Guiana/Suriname (Dutton et al. 2013). While Dutton et al. (2013) identified fine-scale genetic partitioning in the Atlantic Ocean, the differences did not rise to the level of marked separation or discreteness (NMFS and USFWS 2020). Other genetic analyses corroborate the conclusions of Dutton et al. (2013). These studies analyzed nesting sites in French Guiana (Molfetti et al. 2013), nesting and foraging areas in Brazil (Vargas et al. 2019), and nesting beaches in the Caribbean (Carreras et al. 2013). These studies all support three discrete populations in the Atlantic (NMFS and USFWS 2020). While these studies detected

fine-scale genetic differentiation in the NW, SW, and SE Atlantic populations, the status review team determined that none indicated that the genetic differences were sufficient to be considered marked separation (NMFS and USFWS 2020).

Population growth rates for leatherback sea turtles vary by ocean basin. An assessment of leatherback populations through 2010 found a global decline overall (Wallace et al. 2013). Using datasets with abundance data series that are 10 years or greater, they estimated that leatherback populations have declined from 90,599 nests per year to 54,262 nests per year over three generations ending in 2010 (Wallace et al. 2013).

Several more recent assessments have been conducted. The Northwest Atlantic Leatherback Working Group was formed to compile nesting abundance data, analyze regional trends, and provide conservation recommendations. The most recent, published IUCN Red List assessment for the NW Atlantic Ocean subpopulation estimated 20,000 mature individuals and approximately 23,000 nests per year (estimate to 2017) (Northwest Atlantic Leatherback Working Group 2019). Annual nest counts show high inter-annual variability within and across nesting sites (Northwest Atlantic Leatherback Working Group 2018). Using data from 24 nesting sites in 10 nations within the Northwest Atlantic DPS, the leatherback status review estimated that the total index of nesting female abundance for the Northwest Atlantic DPS is 20,659 females (NMFS and USFWS 2020). This estimate only includes nesting data from recently and consistently monitored nesting beaches. An index (rather than a census) was developed given that the estimate is based on the number of nests on main nesting beaches with recent and consistent data and assumes a 3-year remigration interval. This index provides a minimum estimate of nesting female abundance (NMFS and USFWS 2020). This index of nesting female abundance is similar to other estimates. The TEWG estimated approximately 18,700 (range 10,000 to 31,000) adult females using nesting data from 2004 and 2005 (TEWG 2007). As described above, the IUCN Red List Assessment estimated 20,000 mature individuals (male and female). The estimate in the status review is higher than the estimate for the IUCN Red List assessment, likely due to a different remigration interval, which has been increasing in recent years (NMFS and USFWS 2020).

Previous assessments of leatherbacks concluded that the Northwest Atlantic population was stable or increasing (TEWG 2007, Tiwari et al. 2013b). However, based on more recent analyses, leatherback nesting in the Northwest Atlantic is showing an overall negative trend, with the most notable decrease occurring during the most recent period of 2008-2017 (Northwest Atlantic Leatherback Working Group 2018). The analyses for the IUCN Red List assessment indicate that the overall regional, abundance-weighted trends are negative (Northwest Atlantic Leatherback Working Group 2018, 2019). The dataset for trend analyses included 23 sites across 14 countries/territories. Three periods were used for the trend analysis: long-term (1990-2017), intermediate (1998-2017), and recent (2008-2017) trends. Overall, regional, abundance-weighted trends were negative across the periods and became more negative as the time-series became shorter. At the stock level, the Working Group evaluated the NW Atlantic – Guianas-Trinidad, Florida, Northern Caribbean, and the Western Caribbean. The NW Atlantic – Guianas-Trinidad stock is the largest stock and declined significantly across all periods, which was attributed to an exponential decline in abundance at Awala-Yalimapo, French Guiana as well as declines in Guyana, Suriname, Cayenne, and Matura. Declines in Awala-Yalimapo were attributed, in part, due to a beach erosion and a loss of nesting habitat (Northwest Atlantic Leatherback Working Group 2018). The Florida stock increased significantly over the long-term, but declined from

2008-2017. The Northern Caribbean and Western Caribbean stocks also declined over all three periods. The Working Group report also includes trends at the site-level, which varied depending on the site and time period, but were generally negative especially in the recent time period. The Working Group identified anthropogenic sources (fishery bycatch, vessel strikes), habitat loss, and changes in life history parameters as possible drivers of nesting abundance declines (Northwest Atlantic Leatherback Working Group 2018). Fisheries bycatch is a well-documented threat to leatherback turtles. The Working Group discussed entanglement in vertical line fisheries off New England and Canada as potentially important mortality sinks. They also noted that vessels strikes result in mortality annually in feeding habitats off New England. Off nesting beaches in Trinidad and the Guianas, net fisheries take leatherbacks in high numbers (~3,000/yr) (Eckert 2013, Lum 2006, Northwest Atlantic Leatherback Working Group 2018).

Similarly, the leatherback status review concluded that the Northwest Atlantic DPS exhibits decreasing nest trends at nesting aggregations with the greatest indices of nesting female abundance. Significant declines have been observed at nesting beaches with the greatest historical or current nesting female abundance, most notably in Trinidad and Tobago, Suriname, and French Guiana. Though some nesting aggregations (see status review document for information on specific nesting aggregations) indicated increasing trends, most of the largest ones are declining. The declining trend is considered to be representative of the DPS (NMFS and USFWS 2020). The status review found that fisheries bycatch is the primary threat to the Northwest Atlantic DPS (NMFS and USFWS 2020).

Within the action area, leatherback sea turtles nest in the southeastern United States. From 1989-2019, leatherback nests at core index beaches in Florida have varied from a minimum of 30 nests in 1990 to a maximum of 657 in 2014 (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>). Leatherback nesting declined from 2014 to 2017. Although slight increases were seen in 2018 and 2019, nest counts remain low compared to the numbers documented from 2008-2015 (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>) (Figure 45). The status review found that the median trend for Florida from 2008-2017 was a decrease of 2.1 percent annually (NMFS and USFWS 2020).

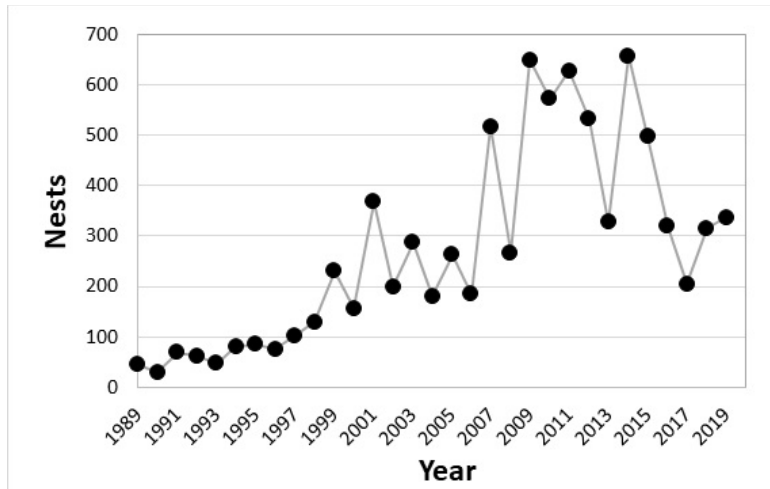


Figure 45: Number of leatherback sea turtle nests on core index beaches in Florida from 1989-2019
(<https://myfwc.com/research/wildlife/sea-turtles/nesting/>)

For the Southwest Atlantic DPS, the status review estimates the total index of nesting female abundance at approximately 27 females (NMFS and USFWS 2020). This is similar to the IUCN Red List assessment that estimated 35 mature individuals (male and female) using nesting data since 2010. Nesting has increased since 2010 overall, though the 2014-2017 estimates were lower than the previous three years. The trend is increasing, though variable (NMFS and USFWS 2020). The Southeast Atlantic DPS has an index of nesting female abundance of 9,198 females and demonstrates a declining nest trend at the largest nesting aggregation (NMFS and USFWS 2020). The Southeast DPS exhibits a declining nest trend (NMFS and USFWS 2020).

Populations in the Pacific have shown dramatic declines at many nesting sites (Mazaris et al. 2017, Santidrián Tomillo et al. 2017, Santidrián Tomillo et al. 2007, Sarti Martínez et al. 2007, Tapilatu et al. 2013). For an IUCN Red List evaluation, datasets for nesting at all index beaches for the West Pacific population were compiled (Tiwari et al. 2013a). This assessment estimated the number of total mature individuals (males and females) at Jamursba-Medi and Wermon beaches to be 1,438 turtles (Tiwari et al. 2013a). Counts of leatherbacks at nesting beaches in the western Pacific indicate that the subpopulation declined at a rate of almost 6 percent per year from 1984 to 2011 (Tapilatu et al. 2013). More recently, the leatherback status review estimated the total index of nesting female abundance of the West Pacific DPS at 1,277 females, and the DPS exhibits low hatchling success (NMFS and USFWS 2020). The total index of nesting female abundance for the East Pacific DPS is 755 nesting females. It has exhibited a decreasing trend since monitoring began with a 97.4 percent decline since the 1980s or 1990s, depending on nesting beach (Wallace et al. 2013). The low productivity parameters, drastic reductions in nesting female abundance, and current declines in nesting place the DPS at risk (NMFS and USFWS 2020).

Population abundance in the Indian Ocean is difficult to assess due to lack of data and inconsistent reporting. Available data from southern Mozambique show that approximately 10 females nest per year from 1994 to 2004, and about 296 nests per year were counted in South Africa (NMFS and USFWS 2013). A 5-year status review in 2013 found that, in the southwest Indian Ocean, populations in South Africa are stable (NMFS and USFWS 2013). More recently, the 2020 status review estimated that the total index of nesting female abundance for the Southwest Indian DPS is 149 females and that the DPS is exhibiting a slight decreasing nest

trend (NMFS and USFWS 2020). While data on nesting in the Northeast Indian Ocean DPS is limited, the DPS is estimated at 109 females. This DPS has exhibited a drastic population decline with extirpation of the largest nesting aggregation in Malaysia (NMFS and USFWS 2020).

Status

The leatherback sea turtle is an endangered species whose once large nesting populations have experienced steep declines in recent decades. There has been a global decline overall. For all DPSs, including the Northwest Atlantic DPS, fisheries bycatch is the primary threat to the species (NMFS and USFWS 2020). Leatherback turtle nesting in the Northwest Atlantic showed an overall negative trend through 2017, with the most notable decrease occurring during the most recent time frame of 2008 to 2017 (Northwest Atlantic Leatherback Working Group 2018). Though some nesting aggregations indicated increasing trends, most of the largest ones are declining. Therefore, the leatherback status review in 2020 concluded that the Northwest Atlantic DPS exhibits an overall decreasing trend in annual nesting activity (NMFS and USFWS 2020). Threats to leatherback sea turtles include loss of nesting habitat, fisheries bycatch, vessel strikes, harvest of eggs, and marine debris, among others (Northwest Atlantic Leatherback Working Group 2018). Because of the threats, once large nesting areas in the Indian and Pacific Oceans are now functionally extinct (Tiwari et al. 2013a) and there have been range-wide reductions in population abundance. The species' resilience to additional perturbation both within the NW Atlantic and worldwide is low.

Critical Habitat

Critical habitat has been designated for leatherback sea turtles in the waters adjacent to Sandy Point, St. Croix, U.S. Virgin Islands (44 FR 17710, March 23, 1979) and along the U.S. West Coast (77 FR 4170, January 26, 2012), both of which are outside the action area.

Recovery Goals

There are separate plans for the U.S. Caribbean, Gulf of Mexico, and Atlantic (NMFS and USFWS 1992) and the U.S. Pacific (NMFS and USFWS 1998a) populations of leatherback sea turtles. Neither plan has been recently updated. As with other sea turtle species, the recovery plans for leatherbacks includes criteria for considering delisting. These criteria relate to increases in the populations, nesting trends, nesting beach and habitat protection, and implementation of priority actions. Criteria for delisting in the recovery plan for the U.S. Caribbean, Gulf of Mexico, and Atlantic are described here.

Delisting criteria

1. Adult female population increases for 25 years after publication of the recovery plan, as evidenced by a statistically significant trend in nest numbers at Culebra, Puerto Rico; St. Croix, U.S. Virgin Islands; and the east coast of Florida.
2. Nesting habitat encompassing at least 75 percent of nesting activity in the U.S. Virgin Islands, Puerto Rico, and Florida is in public ownership.
3. All priority one tasks have been successfully implemented (see the recovery plan for a list of priority one tasks).

Major recovery actions in the U.S. Caribbean, Gulf of Mexico and Atlantic include actions to:

1. Protect and manage terrestrial and marine habitats.
2. Protect and manage the population.
3. Inform and educate the public.
4. Develop and implement international agreements.

The Pacific leatherback is a NOAA Species in the Spotlight. The Species in the Spotlight program identifies those species most-at risk of extinction. A 5-year action plan has developed for these species to identify immediate, targeted efforts vital to stabilizing the population and preventing extinction. The following items were the top five recovery actions identified to support in the Leatherback Five Year Action Plan (NMFS 2016d):

1. Reduce fisheries interactions
2. Improve nesting beach protection and increase reproductive output
3. International cooperation
4. Monitoring and research
5. Public engagement

4.2.2.5. *Other factors outside the action area affecting the status of sea turtles - 2010 BP Deepwater Horizon Oil Spill*

The April 20, 2010, explosion of the Deepwater Horizon oil rig affected sea turtles in the Gulf of Mexico. While the spill occurred outside the action area, it does impact the same sea turtle populations occur in the action area. Therefore, we are considering it in the status of the species. This extensive oiling event contaminated important sea turtle foraging, migratory, and breeding habitats used by different life stages at the surface, in the water column, on the ocean bottom, and on beaches throughout the northern Gulf of Mexico. Sea turtles were exposed to oil when in contaminated water or habitats; by breathing oil droplets, oil vapors, and smoke; by ingesting oil-contaminated water and prey; and potentially by maternal transfer of oil compounds to embryos. Response activities and shoreline oiling also directly injured sea turtles, disrupting and deterring sea turtle nesting in the Gulf (DWH NRDA Trustees 2016).

During direct at-sea capture events, more than 900 turtles were sighted, 574 of which were captured and examined for oiling (Stacy 2012). Of the turtles captured during these operations, greater than 80 percent were visibly oiled (DWH NRDA Trustees 2016). Most of the rescued turtles were taken to rehabilitation facilities; more than 90 percent of the turtles admitted to rehabilitation centers eventually recovered and were released (Stacy 2012, Stacy and Innis 2015). Recovery efforts also included relocating nearly 275 sea turtle nests from the northern Gulf to the Florida Panhandle, with the goal of preventing hatchlings from entering the oiled waters of the northern Gulf. More than 28,000 eggs were moved to an incubation facility in Cape Canaveral, Florida, where they were incubated until emergence and release. Approximately 14,000 hatchlings were released off the Atlantic coast of Florida, 95 percent of which were loggerheads (<https://www.fisheries.noaa.gov/national/marine-life-distress/deepwater-horizon-oil-spill-2010-sea-turtles-dolphins-and-whales>).

Direct observations of the effects of oil on turtles obtained by at-sea captures, sightings, and strandings represent a fraction of the scope of the injury. As such, the Deep Water Horizon (DWH) National Resource Damage Assessment (NRDA) Trustees used expert opinion, surface oiling maps, and statistical approaches to apply the directly observed adverse effects of oil exposure to turtles in areas and at times that could not be surveyed. The Trustees estimated that between 4,900 and 7,600 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and hard-shelled sea turtles not identified to species), and between 55,000 and 160,000 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hard-shelled sea turtles not identified to species) died due to the DWH oil spill. Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were also injured by response activities (DWH

NRDA Trustees 2016). Despite uncertainties and some unquantified injuries to sea turtles (e.g., injury to leatherbacks, unrealized reproduction), the Trustees conclude that this assessment adequately quantifies the nature and magnitude of injuries to sea turtles caused by the DWH oil spill and related activities. Other impacts assessed include reproductive failure and adverse health effects. The NRDA report chapter 4 includes details of the assessment and results (DWH NRDA Trustees 2016).

In addition, Wallace et al. (2017) later determined through a modeling approach that the highest probabilities of heavy oil exposure were limited to areas nearest the wellhead and the probability of heavy oiling decreased with increasing distance from the wellhead. They also determined that the estimated distribution of heavily oiled neritic turtles was similar to the estimated distribution of heavily oiled oceanic turtles (Wallace et al. 2017). This modeling approach produced reasonable estimates of heavy oiling probability for both turtles and surface habitats that were not directly observed during the NRDA response and survey efforts. A toxicological estimation of mortality of oceanic sea turtles oiled during the spill concluded that, overall, approximately 30 percent of all oceanic turtles in the region affected by the spill that were not heavily oiled would have died from ingestion of oil (Mitchelmore et al. 2017).

Response methods used to minimize the extent and harm resulting from a spill can also affect sea turtles. These responses may include collection of oil, in situ burning, use of oil booms, and application of dispersants. Incidental entrapment and mortalities can result from oil removal via skimming or burning. The effects of dispersants on sea turtles is poorly understood, and there is a lack of empirical studies and controlled experiments (Stacy et al. 2019). Exposure over the short-term to a dispersant and a mixture of oil/dispersant affected hydration and weight gain in loggerhead hatchlings (Harms et al. 2014). While the effects of dispersants on sea turtles is largely unknown, they remain a concern in sea turtles based on observations in other species (Stacy et al. 2019).

Based on these quantifications of sea turtle injuries and mortalities caused by the DWH oil spill, hard-shelled sea turtles from all life stages and all geographic areas were lost from the northern Gulf of Mexico ecosystem. Injuries to leatherback sea turtles could not be quantified (DWH NRDA Trustees 2016). The DWH NRDA Trustees (2016) conclude that the recovery of sea turtles in the northern Gulf of Mexico from injuries and mortalities caused by the DWH oil spill will require decades of sustained efforts to reduce the most critical threats and enhance survival of turtles at multiple life stages. The ultimate population level effects of the spill and impacts of the associated response activities are likely to remain unknown for some period into the future.

4.2.3. *ESA-listed Fish*

4.2.3.1. *Atlantic Sturgeon*

An estuarine-dependent anadromous species, Atlantic sturgeon occupy ocean and estuarine waters, including sounds, bays, and tidal-affected rivers from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (ASSRT 2007) (Figure 46). On February 6, 2012, NMFS listed five DPSs of Atlantic sturgeon under the ESA: Gulf of Maine (GOM), New York Bight (NYB), Chesapeake Bay (CB), Carolina, and South Atlantic (77 FR 5880 and 77 FR 5914). The Gulf of Maine DPS is listed as threatened, and the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are listed as endangered.

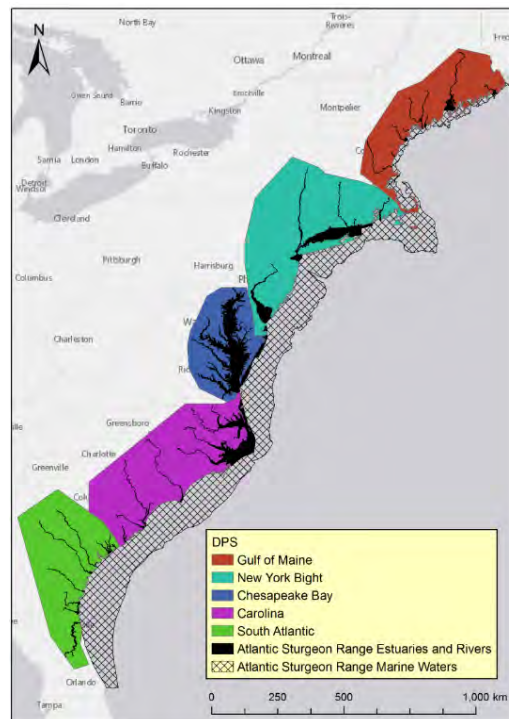


Figure 46: U.S. range of Atlantic sturgeon DPSs

Information available from the 2007 Atlantic sturgeon status review (ASSRT 2007), 2017 ASMFC benchmark stock assessment (ASMFC 2017), final listing rules (77 FR 5880 and 77 FR 5914; February 6, 2012), and material supporting the designation of Atlantic sturgeon critical habitat (NMFS 2017c) were used to summarize the life history, population dynamics, and status of the species.

Life history

Atlantic sturgeon are a late maturing, anadromous species (ASSRT 2007, Balazik et al. 2010, Hilton et al. 2016, Sulak and Randall 2002). Sexual maturity is reached between the ages of 5 to 34 years. Sturgeon originating from rivers in lower latitudes (e.g., South Carolina rivers) mature faster than those originating from rivers located in higher latitudes (e.g., Saint Lawrence River) (NMFS 2017c).

Atlantic sturgeon spawn in freshwater (ASSRT 2007, NMFS 2017d) at sites with flowing water and hard bottom substrate (Bain et al. 2000, Balazik et al. 2012b, Gilbert 1989, Greene et al. 2009, Hatin et al. 2002, Mohler 2003, Smith and Clugston 1997, Vladykov and Greeley 1963).

Water depths of spawning sites are highly variable, but may be up to 88.5 ft (27 m) (Bain et al. 2000, Crance 1987, Leland 1968, Scott and Crossman 1973). Based on tagging records, Atlantic sturgeon return to their natal rivers to spawn (ASSRT 2007), with spawning intervals ranging from one to five years in males (Caron et al. 2002, Collins et al. 2000b, Smith 1985) and two to five years in females (Stevenson and Secor 1999, Van Eenennaam et al. 1996, Vladykov and Greeley 1963). Some Atlantic sturgeon river populations may have up to two spawning seasons comprised of different spawning adults (Balazik and Musick 2015, Collins et al. 2000b), although the majority likely have just one, either in the spring or fall.¹² There is evidence of spring and fall spawning for the South Atlantic DPS (77 FR 5914, February 6, 2012, (Collins et al. 2000b, NMFS and USFWS 1998b), spring spawning for the Gulf of Maine and New York Bight DPSs (NMFS 2017c), and fall spawning for the Chesapeake and Carolina DPSs (Balazik et al. 2012a, Smith et al. 1984). While spawning has not been confirmed in the James River (Chesapeake Bay DPS), telemetry and empirical data suggest that there may be two potential spawning runs: a spring run from late March to early May and a fall run around September after an extended staging period in the lower river (Balazik et al. 2012a, Balazik and Musick 2015).

Following spawning, males move downriver to the lower estuary and remain there until outmigration in the fall (Bain 1997, Bain et al. 2000, Balazik et al. 2012a, Breece et al. 2013, Dovel and Berggren 1983a, Greene et al. 2009, Hatin et al. 2002, Ingram et al. 2019, Smith 1985, Smith et al. 1982). Females move downriver and may leave the estuary and travel to other coastal estuaries until outmigration to marine waters in the fall (Bain 1997, Bain et al. 2000, Balazik et al. 2012a, Breece et al. 2013, Dovel and Berggren 1983a, Greene et al. 2009, Hatin et al. 2002, NMFS 2017c, Smith 1985, Smith et al. 1982). Atlantic sturgeon deposit eggs on hard bottom substrate. They hatch into the yolk sac larval stage approximately 94 to 140 hours after deposition (Mohler 2003, Murawski and Pacheco 1977, Smith et al. 1980, Van Den Avyle 1984, Vladykov and Greeley 1963). Once the yolk sac is absorbed (eight to twelve days post-hatching), sturgeon are larvae. Shortly after, they become young of year and then juveniles. The juvenile stage can last months to years in the brackish waters of the natal estuary (ASSRT 2007, Calvo et al. 2010, Collins et al. 2000a, Dadswell 2006, Dovel and Berggren 1983b, Greene et al. 2009, Hatin et al. 2007, Holland and Yelverton 1973, Kynard and Horgan 2002, Mohler 2003, Schueller and Peterson 2010, Secor et al. 2000, Waldman et al. 1996). Upon reaching the sub-adult phase, individuals enter the marine environment, mixing with adults and sub-adults from other river systems (Bain 1997, Dovel and Berggren 1983a, Hatin et al. 2007, McCord et al. 2007). Once sub-adult Atlantic sturgeon have reached maturity/the adult stage, they will remain in marine or estuarine waters, only returning far upstream to the spawning areas when they are ready to spawn (ASSRT 2007, Bain 1997, Breece et al. 2016, Dunton et al. 2012, Dunton et al. 2015, Savoy and Pacileo 2003).

The life history of Atlantic sturgeon can be divided up into seven general categories as described in Table 43 (adapted from ASSRT 2007).

¹² Although referred to as spring spawning and fall spawning, the actual time of Atlantic sturgeon spawning may not occur during the astronomical spring or fall season (Balazik and Musick 2015).

Table 43: Descriptions of Atlantic sturgeon life history stages

Age Class	Size	Duration	Description
Egg	~2 mm – 3 mm diameter (Van Eenennaam et al. 1996); p. 773)	Hatching occurs ~3-6 days after egg deposition and fertilization (ASSRT 2007); p. 4)	Fertilized or unfertilized
Yolk-sac larvae (YSL)	~6 mm – 14 mm (Bath et al. 1981); pp. 714-715)	8-12 days post hatch (ASSRT 2007); p. 4)	Negative photo-taxis, nourished by yolk sac
Post yolk-sac larvae (PYSL)	~14mm – 37mm (Bath et al. 1981); pp. 714-715)	12-40 days post hatch	Free swimming; feeding; Silt/sand bottom, deep channel; fresh water
Young of Year (YOY)	0.3 grams <410mm TL	From 40 days to 1 year	Fish that are > 40 days and < 1 year; capable of capturing and consuming live food
Juveniles	>410mm and <760mm TL	1 year to time at which first coastal migration is made	Fish that are at least age 1 and are not sexually mature and do not make coastal migrations.
Subadults	>760 mm and <1500 mm TL	From first coastal migration to sexual maturity	Fish that are not sexually mature but make coastal migrations
Adults	>1500 mm TL	Post-maturation	Sexually mature fish

Population dynamics

A population estimate was derived from the NEAMAP trawl surveys.¹³ For this Opinion, as we did in the prior 2013 Opinion, we are relying on the population estimates derived from the NEAMAP swept area biomass assuming a 50 percent catchability (i.e., net efficiency x availability) rate. We consider that the NEAMAP surveys sample an area utilized by Atlantic sturgeon but do not sample all the locations and times where Atlantic sturgeon are present. We also consider that the trawl net captures some, but likely not all, of the Atlantic sturgeon present in the sampling area. Therefore, we assume that net efficiency and the fraction of the population exposed to the NEAMAP surveys in combination result in a 50 percent catchability (NMFS 2013b). The 50 percent catchability assumption reasonably accounts for the robust, yet not complete, sampling of the Atlantic sturgeon oceanic temporal and spatial ranges and the documented high rates of encounter with NEAMAP survey gear. As these estimates are derived directly from empirical data with fewer assumptions than have been required to model Atlantic sturgeon populations to date, we believe these estimates continue to serve as the best available information. Based on the above approach, the overall abundance of Atlantic sturgeon in U.S. Atlantic waters is estimated to be 67,776 fish (see table16 in Kocik et al. 2013). Based on genetic frequencies of occurrence in the sampled area, this overall population estimate was subsequently partitioned by DPS (Table 44). Given the proportion of adults to sub-adults in the NMFS NEFSC observer data (approximate ratio of 1:3), we have also estimated the number of adults and sub-adults originating from each DPS. However, this cannot be considered an estimate of the total number of sub-adults because it only considers those sub-adults that are of a size that are present and vulnerable to capture in commercial trawl and gillnet gear in the marine environment.

It is important to note, the NEAMAP-based estimates do not include young-of-the-year (YOY) fish and juveniles in the rivers; however, those segments of the Atlantic sturgeon populations are at minimal risk from the proposed actions since they are rare to absent within the action area. The NEAMAP surveys are conducted in waters that include the preferred depth ranges of sub-adult and adult Atlantic sturgeon and take place during seasons that coincide with known Atlantic sturgeon coastal migration patterns in the ocean. However, the estimated number of sub-adults in marine waters is a minimum count because it only considers those sub-adults that are captured in a portion of the action area and are present in the marine environment, which is only a fraction of the total number of sub-adults. In regards to adult Atlantic sturgeon, the estimated population in marine waters is also a minimum count as the NEAMAP surveys sample only a portion of the action area, and therefore a portion of the Atlantic sturgeon's range.

¹³ Since fall 2007, NEAMAP trawl surveys (spring and fall) have been conducted from Cape Cod, Massachusetts to Cape Hatteras, North Carolina in nearshore waters at depths up to 60 ft (18.3 m). Each survey employs a spatially stratified random design with a total of 35 strata and 150 stations.

Table 44: Calculated population estimates based upon the NEAMAP survey swept area model, assuming 50 percent efficiency

DPS	Estimated Ocean Population Abundance	Estimated Ocean Population of Adults	Estimated Ocean Population of Sub-adults (of size vulnerable to capture in fisheries)
GOM	7,455	1,864	5,591
NYB	34,566	8,642	25,925
CB	8,811	2,203	6,608
Carolina	1,356	339	1,017
SA	14,911	3,728	11,183
Canada	678	170	509

Precise estimates of population growth rate (intrinsic rates) are unknown for the five listed DPSs of Atlantic sturgeon due to a lack of long-term abundance data. The Commission's 2017 stock assessment referenced a population viability assessment (PVA) that was done to determine population growth rates for the five DPSs based on a few long-term survey programs, but most results were statistically insignificant or utilized a model for which the available did not or poorly fit. In any event, the population growth rates reported from that PVA ranged from -1.8 percent to 4.9 percent (ASMFC 2017).

The genetic diversity of Atlantic sturgeon throughout its range has been well-documented (ASSRT 2007, Bowen and Avise 1990, O'Leary et al. 2014, Ong et al. 1996, Waldman et al. 1996, Waldman and Wirgin 1998). Overall, these studies have consistently found populations to be genetically diverse, and the majority can be readily differentiated. Relatively low rates of gene flow reported in population genetic studies (Fritts et al. 2016, Savoy et al. 2017, Wirgin et al. 2002) indicate that Atlantic sturgeon return to their natal river to spawn, despite extensive mixing in coastal waters.

The range of all five listed DPSs extends from Canada through Cape Canaveral, Florida. All five DPSs use the action area. Based on a recent genetic mixed stock analysis (Kazyak et al. 2020, Kazyak et al. 2021)¹⁴, we expect Atlantic sturgeon throughout the action area originate from the five DPSs at the following frequencies: Gulf of Maine 8.7 percent; New York Bight 71.4 percent; Chesapeake Bay 10.7 percent; Carolina 2.6 percent; and South Atlantic 5.6 percent. Approximately 1.0 percent of the Atlantic sturgeon throughout the action area are expected to originate from Canadian rivers or management units. The authors of this recent analysis used 12 microsatellite markers to characterize the stock composition of 1,704 Atlantic sturgeon encountered across the U.S. Atlantic coast dating back to 1980. The primary method to determine the origin of Atlantic sturgeon when they are encountered away from natal habitats is through the use of genetic assignment testing, as was done in Kazyak et al. (2020). However, one

¹⁴ The preliminary analysis (Kazyak 2020) included GARFO and SERO as regions in the output. As the GARFO area most closely aligns with the distribution of fishing effort considered in this Opinion, we used this region in our analysis. See Kazyak 2021 for the published paper based on the same underlying data as the preliminary analysis.

caveat with genetic assignment testing is that not all populations have been discovered and not all discovered populations were used for this assessment. Assignment testing can only assign an individual to a known or defined category. Even if there is very little similarity with the best match, that is where that sample is assigned. Nevertheless, our analyses in this Opinion are done at the DPS level, and we are confident that the five DPSs listed above, in addition to a small percentage of Canadian origin fish which are not differentiated by DPS, represent all the populations of Atlantic sturgeon that occur in the action area and that they occur and may interact with the ten fisheries at the above frequencies.

Depending on life stage, sturgeon may be present in marine and estuarine ecosystems. The action area for this Opinion occurs in marine waters; therefore, this section will focus only on the distribution of Atlantic sturgeon life stages (sub-adult and adult) in marine waters; it will not discuss the distribution of Atlantic sturgeon life stages (eggs, larvae, juvenile, sub-adult, adult) in freshwater ecosystems, specifically, their movements into/out of natal river systems. For more information on Atlantic sturgeon distribution in freshwater ecosystems, refer to ASSRT (2007); 77 FR 5880 (February 6, 2012); 77 FR 5914 (February 6, 2012); NMFS (2017); and ASMFC (2017).

The marine range of U.S. Atlantic sturgeon extends from Labrador, Canada, to Cape Canaveral, Florida. As Atlantic sturgeon travel long distances in these waters, all five DPSs of Atlantic sturgeon have the potential to be anywhere in this marine range. Results from genetic studies show that, regardless of location, multiple DPSs can be found at any one location along the Northwest Atlantic coast, although the Hudson River population from the New York Bight DPS dominates (ASMFC 2017, ASSRT 2007, Dadswell 2006, Dovel and Berggren 1983a, Dunton et al. 2012, Dunton et al. 2015, Dunton et al. 2010, Erickson et al. 2011, Kynard et al. 2000, Laney et al. 2007, O'Leary et al. 2014, Stein et al. 2004b, Waldman et al. 2013, Wirgin et al. 2015a, Wirgin et al. 2015b, Wirgin et al. 2012).

Based on fishery-independent, fishery dependent, tracking, and tagging data, Atlantic sturgeon appear to primarily occur inshore of the 164 ft (50 m) depth contour (Dunton et al. 2012, Dunton et al. 2010, Erickson et al. 2011, Laney et al. 2007, O'Leary et al. 2014, Stein et al. 2004a, b, Waldman et al. 2013, Wirgin et al. 2015a, Wirgin et al. 2015b). However, they are not restricted to these depths and excursions into deeper (e.g., 250 ft (75 m)) continental shelf waters have been documented (Colette and Klein-MacPhee 2002, Collins and Smith 1997, Erickson et al. 2011, Stein et al. 2004b, Timoshkin 1968). Data from fishery-independent surveys and tagging and tracking studies also indicate that some Atlantic sturgeon may undertake seasonal movements along the coast (Dunton et al. 2010, Erickson et al. 2011, Hilton et al. 2016, Oliver et al. 2013, Post et al. 2014, Wippelhauser 2012). For instance, studies found that satellite-tagged adult sturgeon from the Hudson River concentrated in the southern part of the Mid-Atlantic Bight, at depths greater than 66 ft (20 m), during winter and spring; while, in the summer and fall, Atlantic sturgeon concentrations shifted to the northern portion of the Mid-Atlantic Bight at depths less than 66 ft (20 m) (Erickson et al. 2011).

In the marine range, several marine aggregation areas occur adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard (i.e., waters off North Carolina, Chesapeake Bay; Delaware Bay; New York Bight; Massachusetts Bay; Long Island Sound; and Connecticut and Kennebec River Estuaries). Depths in these areas are generally no greater than 82 ft (25 m) (Bain et al. 2000, Dunton et al. 2010, Erickson et al. 2011, Laney et al.

2007, O’Leary et al. 2014, Oliver et al. 2013, Savoy and Pacileo 2003, Stein et al. 2004b, Waldman et al. 2013, Wippelhauser 2012, Wippelhauser and Squiers 2015). Although additional studies are still needed to clarify why Atlantic sturgeon aggregate at these sites, there is some indication that they may serve as thermal refugia, wintering sites, or marine foraging areas (Dunton et al. 2010, Erickson et al. 2011, Stein et al. 2004b).

Status

Atlantic sturgeon were once present in 38 river systems and, of these, spawned in 35 (ASSRT 2007). They are currently present in 36 rivers and are probably present in additional rivers that provide sufficient forage base, depth, and access (ASSRT 2007). The benchmark stock assessment evaluated evidence for spawning tributaries and sub-populations of U.S. Atlantic sturgeon in 39 rivers. They confirmed (eggs, embryo, larvae, or YOY observed) spawning in ten rivers, considered spawning highly likely (adults expressing gametes, discrete genetic composition) in nine rivers, and suspected (adults observed in upper reaches of tributaries, historical accounts, presence of resident juveniles) spawning in six rivers. Spawning in the remaining rivers was unknown (ten) or suspected historical (four) (ASMFC 2017). The decline in abundance of Atlantic sturgeon has been attributed primarily to the large U.S. commercial fishery, which existed for the Atlantic sturgeon through the mid-1990s. Based on management recommendations in the ISFMP, adopted by the Commission in 1990, commercial harvest in Atlantic coastal states was severely restricted and ultimately eliminated from most coastal states (ASMFC 1998a). In 1998, the Commission placed a 20-40 year moratorium on all Atlantic sturgeon fisheries until the spawning stocked could be restored to a level where 20 subsequent year classes of adult females were protected (ASMFC 1998a, b). In 1999, NMFS closed the U.S. EEZ to Atlantic sturgeon retention, pursuant to the ACA (64 FR 9449; February 26, 1999). However, many state fisheries for sturgeon were closed prior to this.

The most significant threats to Atlantic sturgeon are incidental catch, dams that block access to spawning habitat in southern rivers, poor water quality, dredging of spawning areas, water withdrawals from rivers, and vessel strikes. Climate change related impacts on water quality (e.g., temperature, salinity, dissolved oxygen, contaminants) also have the potential to affect Atlantic sturgeon populations using impacted river systems.

In support of the above, the Commission released a new benchmark stock assessment for Atlantic sturgeon in October 2017 (ASMFC 2017). Based on historic removals and estimated effective population size, the 2017 stock assessment concluded that all five Atlantic sturgeon DPSs are depleted relative to historical levels (Table 45). However, the 2017 stock assessment does provide some evidence of population recovery at the coastwide scale, and mixed population recovery at the DPS scale (ASMFC 2017). The 2017 stock assessment also concluded that a variety of factors (i.e., bycatch, habitat loss, and ship strikes) continue to impede the recovery rate of Atlantic sturgeon (ASMFC 2017).

Table 45: Stock status determination for the coastwide stock and DPSs (recreated from the Commission's Atlantic Sturgeon Stock Assessment Overview, October 2017)

Population	Mortality Status	Biomass/Abundance Status	
	Probability that $Z > Z_{50\%EPR} 80\%*$	Relative to Historical Levels	Average probability of terminal year of indices > 1998** value
Coastwide	7%	Depleted	95%
Gulf of Maine	74%	Depleted	51%
New York Bight	31%	Depleted	75%
Chesapeake Bay	30%	Depleted	36%
Carolina	75%	Depleted	67%
South Atlantic	40%	Depleted	Unknown (no suitable indices)

*EPR= eggs per recruit. The EPR analysis was used to find the value of total mortality (Z) that resulted in an EPR that was 50% of the EPR at the unfished state for ages 4-21 ($Z_{50\%}$).

**For indices that started after 1998, the first year of the index was used as the reference value. The terminal year of a given survey was compared to the fitted abundance index from 1998 (the year the Commission's moratorium for Atlantic sturgeon was implemented).

Despite the depleted status, the Commission's assessment did include signs that the coastwide index is above the 1998 value (95 percent probability). Total mortality from the tagging model was very low at the coastwide level. Small sample sizes made mortality estimates at the DPS level more difficult. By DPS (Table 45), the assessment concluded that there was a 51 percent probability that the Gulf of Maine DPS abundance has increased since 1998 but a 74 percent probability that mortality for this DPS exceeds the mortality threshold used for the assessment. There is a relatively high (75 percent) probability that the New York Bight DPS abundance has increased since 1998, and a 31 percent probability that mortality exceeds the mortality threshold used for the assessment. There is also a relatively high (67 percent) probability that the Carolina DPS abundance has increased since 1998, and a relatively high probability (75 percent) that mortality for this DPS exceeds the mortality threshold used in the assessment. However, the index from the Chesapeake Bay DPS (highlighted red) only had a 36 percent chance of being above the 1998 value and a 30 percent probability that the mortality for this DPS exceeds the mortality threshold for the assessment. There was not enough information available to assess the abundance for the for the South Atlantic DPS relative to the 1998 moratorium, but the assessment did conclude that there was 40 percent probability that the mortality for this DPS exceeds the mortality threshold used in the assessment (ASMFC 2017).

Critical Habitat

Critical habitat has been designated for the five DPSs of Atlantic sturgeon (82 FR 39160, August 17, 2017) in rivers of the eastern United States. These areas are outside the action area.

Recovery Goals

Recovery Plans have not yet been drafted for any of the Atlantic sturgeon DPSs. A recovery outline (see <https://www.fisheries.noaa.gov/resource/document/recovery-outline-atlantic-sturgeon-distinct-population-segments>) has been developed as interim guidance to direct recovery efforts, including recovery planning, until a full recovery plan is approved.

4.2.3.2. *Atlantic Salmon (Gulf of Maine DPS)*

The Atlantic salmon is an anadromous fish, migrating up rivers from the ocean to spawn. There are three Atlantic salmon DPSs in the United States: Long Island Sound, Central New England, and the Gulf of Maine DPSs (Fay et al. 2006). The Gulf of Maine (GOM) DPS Atlantic salmon is genetically distinct from other Atlantic salmon. As of 2014, non-native Atlantic salmon were still present in the Central New England and Long Island Sound population segments as an artifact of a reintroduction program that existed in the Connecticut and Merrimack Rivers from 1967 to 2012. In 2013, the USFWS discontinued the federal programs to rebuild these stocks. However, Atlantic salmon persist in some rivers in the Long Island Sound and Central New England DPS because of state efforts. The Atlantic salmon used to support these programs are not part of the listed entity and, therefore, are not protected under the ESA. Only the Gulf of Maine population segment supports native salmon populations (USFWS and NMFS 2019). The GOM DPS, found in watersheds throughout Maine (Figure 47), is the only DPS listed under the ESA. Therefore, this is the only DPS considered in this Opinion.

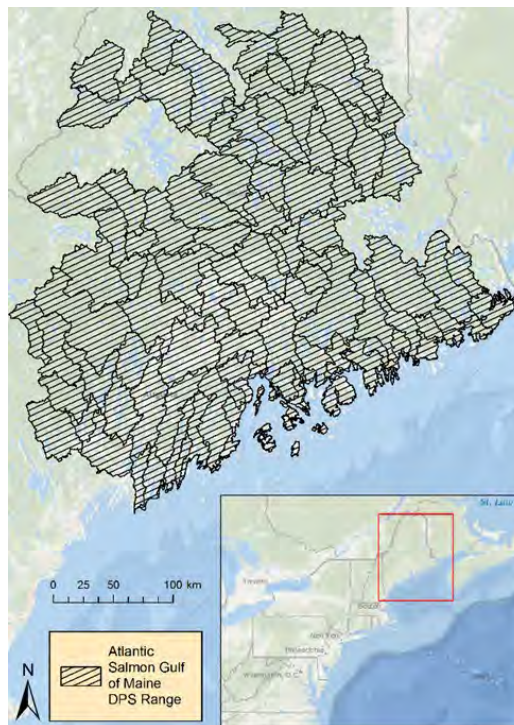


Figure 47: Range of Gulf of Maine DPS of Atlantic salmon

The GOM DPS of Atlantic salmon was initially listed as endangered on November 17, 2000 (65 FR.69459). In 2009, NMFS and USFWS expanded the geographic range for the GOM DPS. The GOM DPS is defined as all anadromous Atlantic salmon whose freshwater range occurs in the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River, and wherever these fish occur in the estuarine and marine environment. The marine range of the GOM DPS extends from the Gulf of Maine, throughout the Northwest Atlantic Ocean, to the coast of Greenland. Included in the GOM DPS are all associated conservation hatchery populations used to supplement these natural populations. Excluded from the GOM DPS are landlocked Atlantic salmon and those salmon raised in commercial hatcheries for the aquaculture industry (74 FR 29344, June 19, 2009).

In describing the GOM DPS, there are three salmon habitat recovery units (SHRUs). The three SHRUs are the Downeast Coastal SHRU, Penobscot Bay SHRU, and Merrymeeting Bay SHRU. The SHRU delineations were designed to: 1) ensure that a recovered Atlantic salmon population has widespread geographic distribution to help maintain genetic variability; and 2) provide protection from demographic and environmental variation. A widespread distribution of salmon across the three SHRUs will provide a greater probability of population sustainability in the future, which will be needed to achieve recovery of the GOM DPS.

We used information available in the 2006 status review (Fay et al. 2006), the recovery plan (USFWS and NMFS 2019), and recent scientific publications to summarize the life history, population dynamics and status of the species, as follows.

Life History

Atlantic salmon spend most of its adult life in the ocean and return to freshwater to reproduce. Its complex life history includes territorial rearing in rivers to extensive feeding migrations on the high seas. During their life cycle, Atlantic salmon go through several distinct phases that are identified by specific changes in behavior, physiology, morphology, and habitat requirements. They return to rivers in Maine from the Atlantic Ocean primarily between May and early July (Baum and Atlantic Salmon Board 1997), although, they may enter any time from early spring to late summer. Spawning typically occurs in late October through November, and eggs hatch in late March or April (Fay et al. 2006). After spawning, the adults move downstream toward the sea. After reaching the ocean, few survive as indicated by the lack of repeat spawners in the GOM DPS (NMFS and USFWS 2005).

After hatching, Atlantic salmon go through several stages in the river before entering the ocean. Smoltification (the physiological and behavioral changes required for the transition to saltwater) usually occurs at age two for the GOM DPS Atlantic salmon (USASAC 2005). Once entering the marine environment, they travel mainly at the surface of the water column (Renkawitz and Sheehan 2012) and may form shoals, possibly of fish from the same river (Shelton et al. 1997). Atlantic salmon can experience high mortality during the transition to saline environments for reasons that are not well understood (Kocik et al. 2009, Thorstad et al. 2012)

During the late summer and autumn of the first year, North American Atlantic salmon are concentrated in the Labrador Sea and off the west coast of Greenland (Reddin 1985, Reddin and Friedland 1992, Reddin and Short 1991, Renkawitz and Sheehan 2012). The following spring, first year winter and older fish are generally located in the Gulf of St. Lawrence, off the coast of Newfoundland, and on the east coast of the Grand Banks (Dutil and Coutui 1988, Friedland et al. 1999, Reddin 1985, Reddin and Friedland 1992, Ritter 1989).

Population Dynamics

The historic distribution of Atlantic salmon in Maine has been described extensively (Baum 1997). In short, substantial populations of Atlantic salmon existed in nearly every river in Maine that was large enough to maintain a spawning population. The upstream extent of the species' distribution extended far into the headwaters of even the largest rivers. Today, the spatial distribution of Atlantic salmon is limited by obstructions to passage and low abundance levels. Within the range of the GOM DPS, the Kennebec, Androscoggin, Union, Narraguagus, and Penobscot Rivers contain dams that severely limit passage of salmon to significant amounts of spawning and rearing habitat.

Contemporary abundance levels of Atlantic salmon within the GOM DPS are several orders of magnitude lower than historical abundance estimates. For example, Foster and Atkins estimated that roughly 100,000 adult salmon returned to the Penobscot River alone (Foster and Atkins 1869) before the river was dammed, whereas estimates of abundance for the entire GOM DPS have rarely exceeded 5,000 individuals in any given year since 1967 (Fay et al. 2006, USASAC 2013). In the early 1990s, marine survival rates decreased, leading to the declining trend in adult abundance observed throughout the 1990s and early 2000s. Adult returns have fluctuated over the past decade.

Adult returns of Atlantic salmon from 1997 to 2018 ranged from 450 to 4,178. In 2018, there were 869 returns to rivers in the United States. Most (99.2 percent) returns were to the GOM DPS (USASAC 2019). From 2010-2019, the ten year average returns was 1,247 adults, with 120 returns to the Downeast Coastal SHRU, 56 to the Merrymeeting Bay SHRU, and 1,071 to the Penobscot Bay SHRU (Kircheis et al. 2020). The counts include both wild and hatchery-origin fish. The DPS encompasses all anadromous Atlantic salmon in a freshwater range covering the watersheds from the Androscoggin River northward along the Maine coast to the Dennys River and includes all associated conservation hatchery populations used to supplement these natural populations (USFWS and NMFS 2019). Most (88.1 percent in 2018 and 76 percent in 2019) returns were hatchery smolt origin. The remaining returns originated from natural reproduction, 0+ fall stocked parr, hatchery fry, or eggs (USASAC 2019, 2020). Each year, the Penobscot River supported the majority of adult returns (92-98 percent); the Narraguagus River supported between 0.8 to 4.1 percent of adult (Fay et al. 2006). In 2017, over 4 million juvenile salmon (eggs, fry, parr and smolts) and 4,849 adults were stocked in the Connecticut, Merrimack, Saco, Penobscot and five other coastal rivers in Maine. Over 5.5 million juvenile and 5,715 adults were released U.S. rivers in 2018 (USASAC 2019); over 4.7 million juvenile and 5,710 adults were released into U.S. rivers in 2019 (USASAC 2020). Low abundances of both hatchery-origin and naturally reared adult salmon returns to Maine demonstrate continued poor marine survival.

Status

Atlantic salmon face a number of threats to their survival, which are outlined in the recovery plan (USFWS and NMFS 2019). The most significant threats to the GOM DPS of Atlantic salmon include, among others: lack of access to spawning and rearing habitat; reduced habitat complexity; sedimentation of spawning/rearing habitat; degraded water quality; water withdrawal; recreational bycatch; poaching; foreign intercept fishery; competition from introduced species; disease; predation; improper hatchery practices; and climate change.

Genetic diversity is monitored by assessing sea-run adults for the Penobscot River and juvenile fish for other populations. Allelic diversity has remained relatively constant since the mid-1990s; though, slight decreases were detected in the East Machias and Dennys populations (USASAC 2019). The GOM DPS of Atlantic salmon currently exhibits critically low spawner abundance, poor marine survival, and is confronted with a variety of additional threats. The abundance of GOM DPS Atlantic salmon has been low and either stable or declining over the past several decades. The proportion of fish that are of natural origin is small and displays no sign of growth. The spatial distribution of the GOM DPS has been severely reduced relative to historical distribution patterns. The conservation hatchery program assists in slowing the decline and helps stabilize populations at low levels, but has not contributed to an increase in the overall abundance of salmon and has not been able to halt the decline of the naturally reared component of the GOM DPS. Continued reliance on the conservation hatchery program could prevent

extinction in the short term, but recovery of the GOM DPS must be accomplished through increases in naturally reared salmon. Based on the information above, the species would likely have a low resilience to additional perturbations.

Critical Habitat

Critical habitat for the GOM DPS of Atlantic salmon has been designated, but is outside the action area of this Opinion.

Recovery Goals

As with other plans, the overall goal of the recovery plan is delisting (USFWS and NMFS 2019). The interim goal is to downlist the DPS from endangered to threatened. Complete down listing/delisting criteria for each SHRUs recovery goals are included in the recovery plan. Reclassification objectives include maintaining sustainable, naturally reared populations with access to suitable habitat in at least two of the SHRUs, ensuring management options for marine survival are better understood, and reducing/eliminating threats that pose an imminent risk of extinction. Delisting criteria include maintaining self-sustaining, wild populations with access to suitable habitat for all SHRUs, ensuring necessary management options for marine survival are in place, and reducing/eliminating threats that pose a risk of endangerment to the DPS (USFWS and NMFS 2019). Recovery actions include:

1. Enhance connectivity between ocean and freshwater habitats important for recovery.
2. Increase adult spawners through the freshwater production of smolts.
3. Increase Atlantic salmon survival through increased ecosystem understanding and identification of spatial and temporal constraints to salmon marine productivity to inform and support management actions that improve survival.
4. Collaborate with partners and engage interested parties in recovery efforts.
5. Ensure federal agencies and associated programs continue to recognize and uphold federal Tribal Trust responsibilities.
6. Provide demographic support and maintain genetic diversity appropriate for recovery through the conservation hatchery program.
7. Maintain the genetic diversity and promote increased fitness of Atlantic salmon populations over time.
8. Identify funding programs that support State, local and NGO conservation efforts.

4.2.3.3. *Giant Manta Ray*

The giant manta ray (*Manta birostris*) is an elasmobranch that is found worldwide in tropical, subtropical, and temperate oceanic waters and near productive coastlines (Figure 48). The giant manta ray has a diamond-shaped body with wing-like pectoral fins measuring up to 25 feet (8 meters) across. It was listed as threatened on January 22, 2018 (83 FR 2916).



Figure 48: Extent of occurrence (EOO) and area of occurrence (AOO) of giant manta rays (Lawson et al. 2017)

We used information available in the status review (Miller and Klimovich 2017), the final listing (83 FR 2916, January 22, 2018), and recent scientific publications to summarize the life history, population dynamics, and status of the species, as follows.

Life History

Giant manta rays are planktivores, using gill plates (also known as gill rakers) to feed on zooplankton. Reaching sexual maturity at about four to five years old, they give birth to live young, one pup every two to three years. Gestation lasts between 12 to 13 months. Manta rays can live up to 40 years, a female may produce between five to 15 pups in a lifetime. In the western North Atlantic, the maximum age of the giant manta rays is unknown, the age at maturing is 4.3-4.6 for females and >3.5 for males, and the litter size is 1 (Miller and Klimovich 2017).

Giant manta rays are commonly found offshore, in oceanic waters, and near productive coastlines (Kashiwagi et al. 2011, Marshall et al. 2009). In the northwest Atlantic, they have been documented as far north as New Jersey. Additionally, giant manta rays exhibit a high degree of plasticity in terms of their use of depths within their habitat, with tagging studies that show the species conducting night descents of 656-1,312 ft (200-450 m) depths (Rubin and Kumli 2008, Stewart et al. 2016b) and capable of diving to depths exceeding 3,280 ft (1,000 m) (Miller and Klimovich 2017).

The giant manta ray is considered to be a migratory species, with estimated distances travelled of up to 810 nmi (1,500 km) (Miller and Klimovich 2017). However, there is some evidence that *M. birostris* may actually exist as well-structured subpopulations that exhibit a high degree of residency (Stewart et al. 2016a). The species may be capable of occasional long-distance movements; although, these movements may be rare and may not contribute to substantial gene flow or interpopulation mixing of individuals (Stewart et al. 2016a). Additional research is required to better understand the distribution and movement of the species throughout its range.

Population Dynamics

There are no current or historical estimates of range-wide abundance, although there are some rough estimates of subpopulation size based on anecdotal accounts from fishermen and divers. It is difficult to obtain reliable abundance estimates as the species is only sporadically observed. There are about 11 (perhaps more) subpopulations worldwide (Miller and Klimovich 2017). Based on anecdotal diver or fisherman observations, populations potentially range from 100 to

1,500 individuals each (FAO 2012, Miller and Klimovich 2017). While observations of individuals in local aggregations range from around 40 individuals to over 600, estimates of subpopulation size have only been calculated for Mozambique (n=600) and Isla de la Plata, Ecuador (n=1,500) (Miller and Klimovich 2017).

The only abundance data for giant manta rays in the Atlantic are records of more than 70 individuals in the Flower Garden Banks Marine Sanctuary in the Gulf of Mexico, more than 90 individuals off the east coast of Florida, and 60 individuals in the waters off Brazil (Miller and Klimovich 2017). Based on personal observation during aerial surveys conducted off of St. Augustine, Florida, from 2009-2012, F. Young (pers. comm. 2017 as cited in Miller and Klimovich 2017) noted vast schools of giant manta rays, with over 500 manta rays observed per 6-8 hour day of aerial survey. There is no population growth rate available for the giant manta ray. In areas where the species is not subject to fishing, populations may be stable. Population declines in waters where the manta rays are protected have also been observed but attributed to overfishing of the species in adjacent areas within its large home range and its migratory nature.

Status

In areas where the species is not subject to fishing, populations may be stable. However, in regions where giant manta rays are (or were) actively targeted or caught as bycatch populations appear to be decreasing (Miller and Klimovich 2017). Overfishing is the most significant threat to giant manta rays. Giant manta rays are both targeted and caught as bycatch. Manta rays are caught throughout their range in commercial and artisanal fisheries. Fishermen targeting manta rays primarily use harpoons and nets, while significant manta bycatch occurs in purse seine, gillnet, and trawl fisheries targeting other species. The gill plates are highly valued in international trade for use in traditional medicine. Cartilage and skins are also traded internationally while meat is consumed or used for bait locally (Miller and Klimovich 2017).

Due to their association with nearshore habitats, manta rays are at elevated risk for exposure to a variety of contaminants and pollutants, including brevetoxins, heavy metals, polychlorinated biphenyls, and plastics. Many pollutants in the environment have the ability to bioaccumulate in fish species; however, only a few studies have specifically examined the accumulation of heavy metals in the tissues of manta rays (Essumang 2010, Ooi et al. 2015). Plastics within the marine environment may also be a threat to the giant manta ray, as the animals ingest microplastics (through filter feeding) or become entangled in plastic debris, potentially contributing to increased mortality rates. There are few known natural threats to giant manta rays. Disease and shark attacks were ranked as low risk threats, and giant manta rays exhibit high survival rates after maturity (Miller and Klimovich 2017).

Giant manta rays are at risk throughout a significant portion of their range, due in large part to the observed declines in the Indo-Pacific. There have been decreases in landings of up to 95 percent in the Indo-Pacific; such declines have not been observed in other subpopulations such as Mozambique and Ecuador (Miller and Klimovich 2017).

Overall, given the evidence of minimal bycatch of the species in U.S. waters (see Miller and Klimovich (2017) for additional discussion), it is unlikely that overutilization as a result of bycatch mortality is a significant threat to *M. birostris* in the Atlantic Ocean (83 FR 2916; January 22, 2018). As described in section 7.6, between 2010 and 2019, two giant manta rays have been captured in trawl gear and two in gillnet gear in the action area. However, information

is severely lacking on both population sizes and distribution of the giant manta ray as well as current catch and fishing effort on the species throughout this portion of its range.

While there is considerable uncertainty regarding the species' current abundance throughout its range, the best available information indicates that the species has experienced population declines of potentially significant magnitude within areas of the Indo-Pacific and eastern Pacific portions of its range, primarily due to fisheries-related mortality (Miller and Klimovich 2017). Yet, larger subpopulations of the species still exist, including off Mozambique, Ecuador, and potentially Thailand. While we assume that declining populations within the Indo-Pacific and eastern Pacific portions of its range will likely translate to overall declines in the species throughout its entire range, there is very little information on the abundance, spatial structure, or extent of fishery-related mortality of the species within the Atlantic portion of its range (Miller and Klimovich 2017).

Critical Habitat

No critical habitat has been designated for the giant manta ray.

Recovery Goals

NMFS has not prepared a recovery plan for the giant manta ray.

5. ENVIRONMENTAL BASELINE

The environmental baseline for this Opinion refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline. (50 CFR 402.02).

The *Environmental Baseline* includes the effects of several activities that may affect the survival and recovery of right, fin, sei, and sperm whales; loggerhead (Northwest Atlantic DPS), leatherback, Kemp's ridley, and green (North Atlantic DPS) sea turtles; and Atlantic sturgeon, Atlantic salmon, and giant manta rays in the action area. The activities that shape the *Environmental Baseline* of this consultation generally include: federal fisheries management plans; aquaculture; hopper dredging, sand mining and beach nourishment activities; research and other permitted activities; federal vessel operations; military operations; offshore oil and gas; offshore energy development; non-federally regulated fisheries; maritime industry; pollution; coastal development; and recovery activities associated with reducing impacts to listed species.

The overall impacts of each state, federal, and private action or other human activities have on ESA-listed species is not fully known. For actions outside the action area, the impacts of human activities on ESA-listed species are discussed and incorporated into the status of each species (section 4) considered in this Opinion. Section 4 also recognizes the benefits of recovery activities already implemented. In some cases, the benefits of a recovery action may not be evident in the status of the respective population for years, or even decades, given the relatively

late age some species (e.g., sea turtles) reach maturity and depending on the age class(es) affected. This section characterizes actions within the action area and their impacts on ESA-listed species.

5.1. Federal Actions with Formal or Early Section 7 Consultations

NMFS has conducted a number of section 7 consultations to address the effects of federal actions on threatened and endangered species in the action area. Each of those consultations sought to develop ways to avoid and reduce impacts of the action on listed species.

As described in section 2.1, we have consulted previously on the operation of the fisheries considered in this Opinion. Gears used in these fisheries (i.e., trap/pot, sink gillnet, bottom trawl, hook and line) are known to have affected ESA-listed species, with some interactions causing injury and death. Therefore, the *Environmental Baseline* for this action includes the effects of the past operation of these fisheries.

5.1.1. Authorization of Fisheries through Fishery Management Plans

In the Northwest Atlantic, NMFS GARFO manages federal fisheries from Maine to Cape Hatteras, North Carolina; however, the management areas for some of these fisheries range from Maine through Virginia, while others extend as far south as Key West, Florida. The NMFS Southeast Regional Office (SERO) manages federal fisheries from Cape Hatteras, North Carolina to Texas, including Puerto Rico and the U.S. Virgin Islands. Fisheries managed by NMFS GARFO and SERO overlap in some parts of the action area.

Both regions have conducted ESA section 7 consultation on all federal fisheries authorized under an FMP or ISFMP. NMFS SERO has formally consulted on the following fisheries: (1) coastal migratory pelagics (NMFS 2015d, 2017a); (2) snapper/grouper (NMFS 2015d); (3) dolphin/wahoo (NMFS 2003) (4) southeast shrimp trawl fisheries (NMFS 2021) (5) Atlantic highly migratory species, excluding pelagic longline (NMFS 2020c) and (6) pelagic longline Atlantic highly migratory species (NMFS 2020d). As described in the Consultation History, NMFS GARFO has formally consulted on the American lobster; Northeast multispecies; monkfish; spiny dogfish; Atlantic bluefish; Northeast skate complex; Atlantic mackerel/squid/butterfish; summer flounder/scup/black sea bass; Atlantic deep-sea red crab, and Atlantic sea scallop fisheries.

In these past opinions, only the consultation on the Atlantic highly migratory species, excluding pelagic longline, and the snapper/grouper opinions (NMFS 2020c) concluded that there was a potential for collisions between fishing vessels and an ESA-listed species (specifically, sea turtles). Any effects to their prey and/or habitat were found to be insignificant and discountable. We have also determined that the Atlantic herring, Atlantic surfclam and ocean quahog, and golden and blueline tilefish fisheries are not likely to adversely affect any ESA-listed species or their designated critical habitats (NMFS 2010b, 2017h, 2020e).

Impacts to Large Whales

North Atlantic right, fin, sei, and sperm whales are at risk from entanglement in fishing gear when in the action area. As discussed in the *Status of the Species*, entanglement in the vertical lines of fixed fishing gear is a leading cause of serious injury and mortality to large whales. Past consultations on the fisheries summarized below considered the potential adverse effects to large whales and included triggers for reinitiation if anticipated levels of entanglement are exceeded

(Table 46). It is important to note that whales may not die immediately from an entanglement in fishing gear but may gradually weaken or otherwise be affected so that further injury or death is likely (Hayes et al. 2018a). The sublethal stress of entanglements can have a serious impact on individual health and reproductive rates (Lysiak et al. 2018, Pettis et al. 2017, Robbins et al. 2015). No take of ESA-large whales due to vessel operations is anticipated in the biological opinions in Table 46.

Table 46: Most recent biological opinions prepared by NMFS GARFO and SERO for federally managed fisheries in the action area that result in takes of large whales and their respective reinitiation triggers. Unless noted, reinitiation triggers for take are reviewed on an annual basis.

	Date	Right whale	Fin whale	Sei whale	Sperm whale
GARFO FMPs					
American lobster	July 31, 2014	Up to 3.25 M/SI per year over 5 years	Up to 1.7 M/SI per year over 5 years	Up to 0.2 M/SI per year over 5 years	0
Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, Summer Flounder/Scup/Black Sea Bass (Batched Fisheries)	December 16, 2013 (amended March 10, 2016)	Up to 3 M/SI per year	Up to 3 M/SI per year	Up to 2 M/SI per year	0
Red Crab	February 6, 2002	0	Up to 1 M/SI annually	0	Up to 1 M/SI per year
SERO FMPs					
South Atlantic Snapper-Grouper	December 1, 2016	1 lethal every 25-42 years	0	0	0

Impacts to Sea Turtles

Each of the most recent GARFO and SERO fishery consultations noted above have considered adverse effects to green, Kemp's ridley, loggerhead, and leatherback sea turtles. In each of the fishery opinions, we concluded that the ongoing action was likely to adversely affect but was not likely to jeopardize the continued existence of any sea turtle species. Each of these opinions included an Incidental Take Statement (ITS) exempting a certain amount of lethal or non-lethal take resulting from interactions with the fisheries. These ITSs are summarized below (Table 47). Unless specifically noted, all numbers denote an annual number of captures that may be lethal or non-lethal. The Northeast Fisheries Science Center (NEFSC) has estimated the take of sea turtles in gillnet, dredge, and trawl gear in the Greater Atlantic Region (Table 48). When available, these estimates were considered in developing the ITSs.

Table 47: Most recent biological opinions prepared by NMFS GARFO and SERO for federally managed fisheries in the action area that result in the take of sea turtles and their respective ITSS. Unless noted, levels of incidental take exempted are on an annual basis.

	Date	Loggerhead	Kemp's ridley	Green	Leatherback
GARFO FMPs					
American lobster	July 31, 2014	1 (lethal or non-lethal)	0	0	7 (lethal or non-lethal)
Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass (Batched Fisheries)	December 16, 2013 (amended March 10, 2016)	1,345 (835 lethal) over 5 years in gillnets; 852 (284 lethal) over a 4 years in bottom trawls; 1 (lethal or non-lethal) in trap/pot gear	4 (3 lethal) in gillnets; 3 (2 lethal) in bottom trawls	4 (3 lethal) in gillnets; 3 (2 lethal) in bottom trawls	4 (3 lethal) in gillnets; 4 (2 lethal) in bottom trawls; 4 (lethal or non-lethal) in trap/pot gear
Atlantic sea scallop	July 12, 2012 (amended November 27, 2018)	322 (92 lethal) over 2 years in dredges; 700 (330 lethal) over 5 years in trawls	3 (2 lethal) in dredges and trawls combined	2 (lethal) in dredges and trawls combined	2 (lethal) in dredges and trawls combined
Red Crab	February 6, 2002	1 (lethal or non-lethal)	0	0	1 (lethal or non-lethal)
SERO FMPs					
Coastal migratory pelagics	June 18, 2015, amended 2017	27 over 3 years (7 lethal)	8 over 3 years (2 lethal)	31 over 3 years (9 lethal)*	1 over 3 years (1 lethal)
South Atlantic snapper-grouper	December 1, 2016	629 (208 lethal) over 3 years	180 (59 lethal) over 3 years	111 (42 lethal) over 3 years	6 (5 lethal) over 3 years
Southeastern U.S. shrimp	April 26, 2021	72,670 (2,150 lethal) over 5 years	84,495 (8,505 lethal) over 5 years	21,214 (1,700 lethal) over 5 years	130 (5 lethal) over 5 years
HMS fisheries, excluding pelagic longline	January 10, 2020	91 (51 lethal) over 3 years	22 (11 lethal) over 3 years	46 (21 lethal) over 3 years	7 (3 lethal) over 3 years

	Date	Loggerhead	Kemp's ridley	Green	Leatherback
HMS, pelagic longline	May 15, 2020	1080 (280 lethal) over 3 years	21 (8 lethal) combined Kemp's ridley, green (includes North Atlantic and South Atlantic DPS), hawksbill, or olive ridley over 3 years		996 (275 lethal) over 3 years
South-Atlantic dolphin-wahoo	August 27, 2003	12 (2 lethal)	3 (1 lethal) combination of Kemp's ridley, green, or hawksbill		12 (1 lethal)

*Coastal migratory pelagic consultation: 31 green sea turtle takes of both DPSs combined is expected, but no more than 30 from the North Atlantic DPS and no more than 2 from the South Atlantic DPS

Table 48 Estimates of average annual turtle interactions in fishing gear. Numbers in parentheses are adult equivalents

Gear	Years	Area	Estimated Interactions (adult equivalents)	Mortalities (adult equivalents)	Source
Sea Scallop Dredge	2009-2014	Mid-Atlantic	Loggerhead: 22 (2)	9-19* (1-2)	Murray (2015a)
Sink Gillnet	2012-2016	Mid-Atlantic	Loggerhead: 141(3.8) Kemp's ridley: 29 Leatherbacks: 5.4 Unid. hardshell: 22.4	Loggerhead: 111.4 Kemp's ridley: 23 Leatherbacks: 4.2 Unid. hardshell: 17.6	Murray (2018)
Bottom Trawl	2014-2018	Mid-Atlantic and Georges Bank	Loggerhead: 116.6 (36.4) Kemp's ridley: 9.2 Green: 3.2 Leatherbacks: 5.2	Loggerhead: 54.4 (17.4) Kemp's ridley: 4.6 Green: 1.6 Leatherbacks: 2.6	Murray (2020)

*Of these interactions, 9-19 would result in mortality depending on whether loggerheads that interacted with chain mats without being captured (the unobservable but quantifiable interactions) survived.

Given that past biological opinions in the Greater Atlantic Region considered the federal fishery to include federally-permitted vessels operating in state waters, the anticipated take of sea turtles in Table 47 includes gear interactions in both state and federal waters by federally-permitted vessels. The distribution and likelihood of sea turtle takes are highly variable such that interactions in nearshore and coastal waters in some years could be higher if greater fishing effort is expended (due to less travel time and ease of access to a wider range of vessels) or sea turtles are present in greater numbers in those waters. The amount of observer coverage allocated to nearshore versus offshore trips may also be a factor in how many sea turtle interactions are documented in certain waters for these fisheries.

Impacts to Atlantic sturgeon

Commercial fisheries that operate in the action area for this consultation capture Atlantic sturgeon originating from each of the five listed DPSs. Given this, consultations on fisheries in the Southeast and Greater Atlantic Regions have considered the take of Atlantic sturgeon (Table 49).

Table 49: Most recent biological opinions prepared by NMFS GARFO and SERO for federally managed fisheries in the action area that result in takes of the five DPSs of Atlantic sturgeon and their respective ITSs. Unless noted, levels of incidental take exempted are on an annual basis.

	Date	Gulf of Maine DPS	New York Bight DPS	Chesapeake Bay DPS	Carolina DPS	South Atlantic DPS
GARFO FMPs						
Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass (Batched Fisheries)	December 16, 2013 (amended March 10, 2016)	137 over a 5-year average in gillnet gear (17 adult equivalents lethal); 148 over a 5-year average in bottom trawl gear (5 adult equivalents lethal)	632 over a 5-year average in gillnet gear (79 adult equivalents lethal); 685 over a 5-year average in bottom trawl gear (21 adult equivalents lethal)	162 over a 5-year average in gillnet gear (21 adult equivalents lethal); 175 over a 5-year average in bottom trawl gear (6 adult equivalents lethal)	25 over a 5-year average in gillnet gear (4 adult equivalents lethal); 27 over a 5-year average in bottom trawl gear (1 adult equivalents lethal)	273 over a 5-year average in gillnet gear (34 adult equivalents lethal); 296 over a 5-year average in bottom trawl gear (9 adult equivalents lethal)
Atlantic sea scallop	July 12, 2012 (amended November 27, 2018)	One take annually in scallop trawl gear from any of the five DPSs (one lethal take every 20 years from any of the five DPSs)				
SERO FMPs						
Coastal migratory pelagics	June 18, 2015	2 (12)* every 3 years; 0 lethal	4 (12)* every 3 years; 0 lethal	3 (12)* every 3 years; 0 lethal	4 (12)* every 3 years; 0 lethal	10 (12)* every 3 years; 0 lethal
Southeastern U.S. shrimp	April 26, 2021	2 (0 lethal) every 5 years	7 (2 lethal) every 5 years	19 (4 lethal) every 5 years	66 (15 lethal) every 5 years	103 (24 lethal) every 5 years
HMS fisheries, excluding pelagic longline	January 10, 2020	34 (8 lethal) every 3 years	170 (36 lethal) every 3 years	40 (9 lethal) every 3 years	10 (5 lethal) every 3 years	75 (19 lethal) every 3 years

*The coastal migratory pelagics biological opinion estimates a total take of 12 Atlantic sturgeon. The biological opinion considered the percent each DPS, presented as a range, expected to be in the action area. To be conservative, the biological opinion considered the high end of the range in apportioning take between DPSs. However, in total, no more than 12 Atlantic sturgeon are anticipated to be taken (NMFS 2015d, 2017a).

In a review of bycatch rates on fishing trips from 1989 to 2000, Atlantic sturgeon were recorded in both gillnet and trawl gears, and bycatch rates varied by gear type and target species. Bycatch was highest for sink gillnets in specific areas of the coast. Mortality was higher in sink gillnets than trawls (Stein et al. 2004a). More recent analyses were completed in 2011 and 2016.

In 2011, the NEFSC prepared a bycatch estimate for Atlantic sturgeon captured in federally managed commercial sink gillnet and otter trawl fisheries from Maine through Virginia. This estimate indicated that from 2006-2010, an annual average of 3,118 Atlantic sturgeon were captured in these fisheries with 1,569 in sink gillnet and 1,548 in otter trawls. The mortality rate in sink gillnets was estimated at approximately 20 percent, and the mortality rate in otter trawls was estimated at 5 percent. Based on this estimate, 391 Atlantic sturgeon mortalities were estimated annually in federal fisheries prosecuted in the Greater Atlantic Region (Miller and Shepard 2011).

An updated, although unpublished, Atlantic sturgeon bycatch estimate in Northeast sink gillnet and otter trawl fisheries for 2011-2015 was prepared by the NEFSC in 2016. Using this information, the authors of the recent Atlantic Sturgeon Benchmark Stock Assessment (ASMFC 2017) estimated that 1,139 fish (295 lethal; 25 percent) were caught in gillnet fisheries and 1,062 fish (41 lethal; 4 percent) were caught in otter trawl fisheries each year from 2000-2015. Atlantic sturgeon bycatch estimates for Northeast gillnet and trawl gear from 2011-2015 (approximately 761 fish per year for gillnets, 777 per year for trawls) are substantially lower than those from 2006-2010 (approximately 1,074 fish per year for gillnets, 1,016 per year for trawls) (ASMFC 2017). It should be noted that the models used in 2011 and 2016 differed. While the model framework and selection methodology remained the same, the best performing models changed due to the nature of using a model-based approach in the estimation and the incorporation of additional years of observer data (memorandum from William A. Karp, NEFSC Director, to John Bullard, GARFO Regional Administrator, August 29, 2016).

Impacts to Atlantic Salmon

Atlantic salmon originating from the Gulf of Maine DPS may be captured and die in commercial trawl and gillnet fisheries operating in the action area. Based on observer reports assessed, NMFS, in the 2013 batched fisheries biological opinion, anticipated the observed take of up to five individuals (two lethal) over a five-year average in gillnet gear and up to five individuals (3 lethal) over a five-year average in bottom trawl gear. The Northeast Fisheries Observer Program (NEFOP) and At-Sea Monitor (ASM) observers have not recorded any interactions from 2014 through 2019. The anticipated level of incidental take of Atlantic salmon for the recreational components of the fisheries could not be estimated at the time.

Impacts to Giant Manta Rays

In the Atlantic Ocean, bycatch of giant manta rays has been observed in purse seine, trawl, and longline fisheries, but they do not appear to be a significant component of the bycatch (Miller and Klimovich 2017). The recent consultation on the Atlantic HMS fishery, excluding pelagic longline, anticipates the take of nine (no lethal) giant manta rays over a 3-year period (NMFS 2020c). The most recent consultation on the HMS pelagic longline fishery anticipates the take of 366 giant manta rays over a 3-year period, up to 6 may be lethal (NMFS 2020d)

In the U.S. bottom longline, trawl, and gillnet fisheries operating in the western Atlantic, giant manta rays are a very rare occurrence and available records of observed captures in U.S. fisheries indicate that the vast majority of giant manta rays are released alive (C. Horn, pers. comm. December 3, 2018). NEFSC observer data from 2001-2018 confirms that two giant manta rays were captured (both in 2014) in bottom otter trawl gear where the trip was targeting squid or butterfish. Additionally, seven unknown ray species reported captured in trawl gear and four

captured in gillnet gear, may have been giant manta rays. In all 13 cases, the animals were released alive.

Hook-and-line gear primarily affects giant manta rays through hooking, but also by entanglement and trailing of gear (NMFS 2020c). From 2008 through 2016, Southeast fisheries observers documented three giant manta rays in bottom longline fisheries (one in the Gulf of Mexico reef fish fishery and two in the South Atlantic shark bottom longline research fishery). Two of these giant manta rays are thought to have been released alive, and one was kept. Gillnet gear used the Coastal Migratory Pelagics (CMP) FMP is known to interact with giant manta ray. During 2005-2012, ten giant manta rays caught in CMP gillnet gear were observed to be released alive.

In the Southeast U.S. gillnet fisheries, bycatch of manta rays is low. The NMFS Southeast Gillnet Observer Program covers all anchored (sink and stab), strike, or drift gillnet fishing by vessels operating in waters from Florida to North Carolina and the Gulf of Mexico. From 1998-2015 the number of all mantas observed captured by observers ranged from 0 to 16, with the vast majority (around 89 percent) released alive (see NMFS reports available at <http://www.sefsc.noaa.gov/labs/panama/ob/gillnet.htm>). Since January 2013, no mantas have been observed caught as bycatch.

5.1.2. *Aquaculture*

Aquaculture has the potential to impact ESA-listed species through entanglement and/or other interaction with aquaculture gear (e.g., buoys, nets, and vertical lines), introduction or transfer of pathogens, increased vessel traffic and noise, impacts to habitat and benthic organisms, and water quality (Clement 2013, Lloyd 2003, Price and Morris 2013, Price et al. 2017). Current data suggest that documented interactions and entanglements of ESA-listed marine mammals and sea turtles with aquaculture gear are rare (Price et al. 2017). However, this information includes documented interactions only and may not be reflective of actual interaction. There are also concerns about interactions between Atlantic sturgeon and aquaculture with respect to, among others, entanglements, changes to water features related to migration and residency, and habitat conversion. Aquaculture projects have the potential to modify critical habitat through impacts to water quality and habitat conversion. Some components of aquaculture gear and gear used in commercial fisheries are similar; therefore, information on interactions in the similar gear may provide information on the risk aquaculture poses. There are very few reports of ESA-listed marine mammal interactions with aquaculture gear in the U.S. Atlantic, although, it is not always possible to determine whether the gear on animals is from aquaculture or commercial fisheries (Price et al. 2017). There are several reports of sea turtles in the North Atlantic entangled in aquaculture gear (Price et al. 2017), including one entanglement within the action area.

In the United States, marine aquaculture production increased an average of 3.3 percent per year from 2009-2014; however, globally, the United States remains a relatively minor aquaculture producer. Farmed items in the Atlantic include finfish (e.g., Atlantic salmon, steelhead trout), shellfish (e.g., American and European oyster, quahog, blue mussels, softshell clams, sea and bay scallops, and quahogs), and sea vegetables (e.g., sugar kelp). Trials with other species, such as cod and halibut have occurred previously and there is known interest to farm other marine fish species in the future, such as striped bass and black sea bass. Hatchery-raised species are also used to support important commercial and recreational fisheries, as well as for habitat and endangered species restoration. Aquacultured products are grown for medical research, pharmaceuticals, food additives, ornamentals, and aquarium commerce.

The 2018 Census on Aquaculture collected national data about the industry (USDA 2019). In this survey, aquaculture is the farming of aquatic organisms, including baitfish, crustaceans, food fish, mollusks, ornamental fish, sport/game fish, and other products. It includes algae and sea vegetables but does not include other aquatic plants. The 2018 Census reports 774 saltwater farms and 51,674 acres of saltwater aquaculture from Maine through Florida. It should be noted that this includes the west coast of Florida and that, for some states (Georgia, South Carolina, Delaware, New Jersey), the acreage is not reported to preserve confidentiality (USDA 2019). In addition, the farms reported may be in estuaries that are outside the action area.

Currently, marine aquaculture in the action area occurs mainly in state waters and at relatively modest scales; however, many are interested in expanding operations. States have different rules and regulations for permitting or leasing space and for monitoring required by developers. In the southeastern United States, marine aquaculture is dominated by shellfish production, primarily oysters and clams, with soft-shell crab, live rock, and sea vegetables produced at lower levels (Bacheler et al. 2018). Most farms are located in shallow, intertidal areas (Bacheler et al. 2018) where the fisheries in this Opinion do not operate. In the southeastern United States, there are no aquaculture farms in federal waters. In the 2018 Census, 70 percent of the farms and 98 percent of the acreage reported was in the Greater Atlantic Region (USDA 2019). Therefore, the remainder of the section will focus on the Greater Atlantic Region.

Aquaculture in the Greater Atlantic Region is, at present, primarily in state waters. Currently, there is one U.S. Army Corps of Engineers (ACOE) permit for a pilot scale blue mussel aquaculture operation in federal waters of the Atlantic coast. This project is located eight miles off Rockport, MA and has placed three longlines in the water. The permittee submitted an application to ACOE on 12/7/2019 to expand the operation to a total of 20 longlines, but at the time of this consultation has not yet submitted a completed Biological Assessment to initiate the section 7 consultation process.

As provided in Table 50 there are four categories of aquaculture gear used in the Greater Atlantic Region: floating gear, net pen, shell on bottom, and cage on bottom. Based on ESA section 7 consultations conducted in the Greater Atlantic Region between 2015 and January 2019,¹⁵ we compiled a list of states that have aquaculture farms, and, per state, the number and type of aquaculture gear used (Table 51). One case in 2014 was also included due to its offshore location.

The species grown in various gear types include shellfish, finfish, and seaweeds (Table 50). Floating gear includes surface longlines, submerged longlines, and a floating upweller system. Aquaculture longlines are not the same as longline gear used in fisheries. In aquaculture, surface longlines consist of horizontal longline suspended on/near the surface of the water with buoy lines or poles at each end. Various types of cages or flip bags may be used to keep organisms inside an enclosed space. In deeper and higher energy locations, submerged longline are used. Their design consists of horizontal longlines suspended below the surface with moorings/marker buoys at each end. Some may have another mooring in the middle of their run. The longlines are suspended below the water surface and use a series of buoys to maintain the depth. This gear category also includes a floating upweller system (FLUPSY). This system is a dock or pier with

¹⁵ Counts include experimental and/or gear that are no longer deployed.

tanks used to grow shellfish in open water while protecting them from predation. FLUPSY has a motor that pulls water through the bottom of the tanks. As the water moves through the system, it provides a continuous food supply to the shellfish by transporting algae.

Net pens are a type of enclosure culture and involve holding organisms captive within an enclosed space while maintaining a free exchange of water. They are enclosed on the bottom and sides by wooden, mesh or net screens. These types of gear are in direct contact with the surrounding environment. Shell on bottom refers to a technique used to grow shellfish, such as oysters, on the bottom of the ocean floor without cages. Shell on bottom also includes cases used for oyster bed restoration and maintenance, artificial oyster reefs creation, and spat collector installation. Cage on bottom also refers to a technique used to grow shells on the bottom of the ocean floor where cages are used.

Table 50: Examples of organisms grown by aquaculture gear type

Gear type	Examples of grown organisms
Floating gear	Kelp, mussels, oysters, scallops
Net pens	Fish (e.g., Atlantic salmon)
Shell on bottom	Oysters, clams, mussels
Cage on bottom	Oysters, clams

Aquaculture sites may use a combination of gear categories, referred to here as multimode. For instance, both cage on bottom and floating gear were used to grow oysters in the waters near Maryland, so this case was included in this “multimode” category.

Table 51: Aquaculture gear in the Greater Atlantic Region

State	Type of Aquaculture Gear					Total
	Floating Gear	Net Pen	Shell on bottom	Cage on bottom	Multimode	
ME	1	1	2	1	0	5
MA	10	0	1	3	0	15
CT	9	0	3	10	0	22
RI	1	0	0	1	1	3
NY	1	0	3	3	0	7
NJ	3	0	0	8	11	22
MD	7	0	115	33	8	163
VA	2	0	59	1	1	63
Total	34	1	183	60	21	299

5.1.3. *Hopper Dredging, Sand Mining, and Beach Nourishment*

The construction and maintenance of federal navigation channels and sand mining (“borrow”) areas may result in take of sea turtles, shortnose sturgeon, and/or Atlantic sturgeon. There are several dredge types used in the action area. A hopper dredge uses pumps to force water and sediment up the dragarm and into the hopper. Hopper dredges may be equipped with screens (UXO screens) for unexploded ordinance on the intake. Cutterhead dredges have a rotating cutter apparatus surrounding the intake of a suction pipe and may be hydraulic or mechanical. Bucket and clamshell dredges are mechanical devices that use buckets to excavate dredge materials (NMFS 2019b). Dredging projects are authorized or carried out by the U.S. ACOE. In the action area, these

projects are under the jurisdiction of the districts within the North Atlantic and South Atlantic Divisions.

Hard-shelled sea turtles may be injured by hopper dredges when the draghead is placed, impinged on the screen or entrained in the draghead. It is also possible that sea turtles may become entrained in other intake ports of these dredges. Sturgeon may become entrained during hopper or cutter head dredging or captured by mechanical dredges. Sediment suspension, blasting, and relocation associated with dredging projects may also impact protected species (NMFS 2019b). Relocation trawling may be undertaken to move sea turtles out of the area being dredged and placing them in an area outside of the dredge area.

NMFS has completed ESA section 7 consultations with the U.S. ACOE, NASA, and the U.S. Navy to consider the effects of these dredging, sand mining, and nourishment projects on ESA-listed species in the mid-Atlantic and Northeast (NMFS 2006, 2012a, c, d, 2014c, e, 2018f, 2019b, c, 2020a). Takes of sea turtles, shortnose sturgeon, and Atlantic sturgeon during relocation trawling activities are also included in the consultations and are described below. No takes of Atlantic salmon, giant manta rays, or large whales are anticipated to occur from these project activities.

A regional biological opinion on the U.S. ACOE's hopper dredging in the South Atlantic was completed in 2020. This South Atlantic Regional Biological Opinion (SARBO) (March 27, 2020) concluded that the proposed action would adversely affect, but not likely jeopardize the continued existence of 5 sea turtle species (North Atlantic DPS of green, South Atlantic DPS of green, Kemp's ridley, leatherback, and Northwest Atlantic DPS of loggerhead sea turtles), 6 sturgeon species (Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs of Atlantic sturgeon, and shortnose sturgeon), giant manta ray, smalltooth sawfish, Johnson's seagrass, and 5 coral species (elkhorn, staghorn, lobed star, mountainous star, and boulder star coral). Anticipated take of sea turtles and sturgeon are included in the table below. In addition, the biological opinion estimates the take of 89 (0 lethal) giant manta rays over a 3-year period (NMFS 2020a).

Aside from commercial fishing and fisheries research activities, these dredging projects represent one of the largest sources of incidental take for sea turtles, shortnose sturgeon, and Atlantic sturgeon in the action area, and, potentially, one of the largest sources of lethal take. Active opinions covering dredging, beach nourishment, and shoreline restoration/ stabilization projects in the action area and the associated ITSs for sea turtles are presented below (Table 52).

Table 52: NMFS' biological opinions for dredging projects in the action area and the anticipated take of sea turtles and sturgeon

Project	Date of Opinion	Loggerhead	Kemp's ridley	Green	Leatherback	Atlantic Sturgeon	Life of Project
ACOE Deepening and Maintenance of the Delaware River Federal Navigation Channel	11/22/2019	37 (37)	3 (3)			1763 non-lethal combination of NYB DPS or shortnose; 116 lethal any DPS or shortnose; 21 lethal NYB DPS or shortnose; 1.3% of each year class post yolk-sac larvae NYB DPS	2020-2070
U.S. Navy; ACOE Maintenance Dredging of the Kennebec River FNP	10/25/2019					5 (5) GOM DPS	2019-2029
ACOE Atlantic Coast of Maryland Shoreline Protection Project	11/30/2006	22(22)	2 (2)				2008-2044
U.S. Navy Shoreline Restoration and Protection Project, JEB Little Creek/ Fort Story, VA Beach	7/13/2012	1 (1) loggerhead or Kemp's ridley				2 (2) GOM, NYB, CB, Carolina, or SA DPS	2012-2020
NASA Wallops Island Shoreline Restoration/ Infrastructure Protection Program	8/3/2012	9 (9) of which no more than 1 (1) may be a Kemp's ridley				2 (2) GOM, NYB, CB, Carolina, or SA DPS	2012-2062

Project	Date of Opinion	Loggerhead	Kemp's ridley	Green	Leatherback	Atlantic Sturgeon	Life of Project
ACOE NY and NJ Harbor Deepening	10/25/2012	1 (1) loggerhead or Kemp's ridley				1 (1) GOM, NYB, CB, Carolina, or SA DPS	50 years
ACOE Sea Bright Offshore Borrow Area Beach Nourishment	3/7/2014	8 (8) loggerhead or Kemp's ridley (up to 3 Kemp's total)				2 NYB DPS 1 CB, GOM, CA, SA DPS; 2 Any DPS	50 years
ACOE Sand borrow areas for beach nourishment and hurricane protection, offshore DE and NJ	6/26/2014	29	2	1			50 years
ACOE Dredging of Chesapeake Bay Entrance Channels and Beach Nourishment	10/15/2018	1685 (748 lethal)	341 (66 lethal)	56 (18 lethal)		118 (18 lethal) GOM DPS; 418 (68 lethal) NYB DPS; 179 (29 lethal); 123 (23 lethal) CB DPS; 60 (10); Carolina DPS; SA DPS;	50 years
		Relocation Trawling: up to 938 captures (37 lethal) of loggerheads, 275 captures (11 lethal) of Kemp's ridleys, and 37 captures (2 lethal) of green sea turtles 0				Relocation Trawling: 700 (0 lethal) total; Of these, ≤ 100 GOM, ≤ 350 NYB DPS, ≤ 100 CB DPS; ≤ 50 Carolina DPS; ≤ 150 SA DPS	
SARBO	3/27/20	5,484 (214 lethal) and 65 lost egg clutches over 3 years	1,456 (116 lethal) and 1 lost egg clutch over 3 years	860 (118 lethal) and 3 lost egg clutches over 3 years	369 (4 lethal) and 6 lost egg clutches over 3 years	2 (1 lethal) GOM DPS; 39 (5 lethal) NYB DPS; 105 (14 lethal) CB DPS; 366 (47 lethal) Carolina DPS; 572 (73 lethal) SA DPS over 3 years	

5.1.4. ***Research and Other Permitted Activities***

Within the action area, NMFS has completed section 7 consultation on research (either conducted or funded by federal agencies) and other federally-permitted activities that may adversely affect ESA-listed marine mammals, sea turtles, and fish. Below, a description of recently completed section 7 consultations on research and other permitted activities are provided.

NEFSC Fisheries and Ecosystem Research

NEFSC scientists conduct fishery-independent research onboard NOAA-owned and operated vessels or on chartered vessels in coastal, estuarine, and marine waters of the U.S. Atlantic Ocean from Maine to Florida. A number of cooperative research projects also occur within the action area each year. The cooperative research projects are designed to address emerging needs of the fishing industry, for information about particular species, or for modifications to fishing gear to address conservation concerns. Grant programs that fund cooperative research along the U.S. Atlantic coast include the Cooperative Research Partners Program, Northeast Consortium Cooperative Research Program, Commercial Fisheries Research Foundation, and the Research Set-Aside (RSA) Program. A major research initiative is the (NEAMAP nearshore trawl surveys. These fishery surveys are conducted every spring and fall by the Virginia Institute of Marine Science (VIMS) in shallow (up to 120 feet), nearshore waters from Cape Hatteras, North Carolina to Montauk, New York. Those surveys are similar in design and are meant to complement the annual NEFSC spring and fall bottom trawl surveys, which are conducted in deeper waters of the U.S. Atlantic.

NEFSC-conducted or funded fisheries and ecosystem surveys that are known to interact with sea turtles, shortnose and Atlantic sturgeon, and Atlantic salmon include those that utilize bottom trawl, gillnet, and longline gear. Sea turtles have been caught in the following NEFSC survey programs: Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) gillnet and longline surveys, Spring and Fall NEFSC Bottom Trawl Surveys, Spring and Fall NEAMAP trawl surveys, and Apex Predators longline surveys. Atlantic sturgeon have been caught during the NEFSC bottom trawl surveys and the spring and fall NEAMAP bottom trawl surveys. A few short-term cooperative research projects have also captured Atlantic sturgeon. All observed catches of Atlantic salmon during NEFSC research activities have occurred in bottom trawls.

In June 2016, NMFS completed a programmatic biological opinion (NMFS 2016b) on all fisheries and ecosystem research activities to be conducted and funded by the NEFSC from June 2016 to June 2021. Based on the information presented in the opinion, we anticipate that these fisheries and ecosystem research projects, over the 5-year period, will result in the capture of:

- up to 85 Northwest Atlantic DPS of loggerhead sea turtles (ten lethal);
- up to 95 Kemp's ridley sea turtles (15 lethal);
- up to 10 North Atlantic DPS of green sea turtles (non-lethal);
- up to 10 leatherback sea turtles (five lethal);
- up to 10 shortnose sturgeon (one lethal);
- up to 595 Atlantic sturgeon (30 lethal)
 - up to 308 from the New York Bight DPS (15 lethal),
 - up to 130 from the South Atlantic DPS (seven lethal),
 - up to 70 from the Chesapeake Bay DPS (four lethal),
 - up to 60 from the Gulf of Maine DPS (three lethal),

- o up to 14 from the Carolina DPS (one lethal),
- o up to 13 Canadian origin (non-listed); and
- up to five Gulf of Maine DPS Atlantic salmon (two lethal).

USFWS Funded State Fisheries Surveys

Under the Dingell-Johnson Sport Fish Restoration Grant program and State Wildlife Grant programs, the USFWS Region 5 provides an annual apportionment of funds to 13 Northeast states and the District of Columbia. Vermont and West Virginia are the only two Northeast states that do not use these funds to conduct surveys in marine, estuarine, or riverine waters where ESA-listed species under NMFS jurisdiction are present. The 11 other states (Maine, New Hampshire, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia) and the District of Columbia are anticipated to carry out a total of 113 studies, mostly on an annual basis, under these grant programs. There are several broad categories of fisheries surveys including: hook and line; long line; beach seine; haul seine; bottom trawl; surface trawl; fishway trap; fish lift; boat, backpack, and/or barge electrofishing; fyke net; dip net; gill net; push net; hoop net; trap net; cast net; plankton net; pound net; and fish and/or eel trap/pot. These surveys occur in rivers, bays, estuaries, and nearshore ocean waters of those 11 states and the District of Columbia.

We completed a biological opinion on this grant program in October 2018. It bundled together 12 independent actions carried out by the USFWS (i.e., awarding of each grant fund to each state or district is an independent action) and provided an ITS by activity and a summary by state. Overall, we anticipate that the surveys described in the opinion, which will be carried out by the states from 2018 to 2022 will result in the capture of:

- Up to 37 sea turtles;
- Up to 55 shortnose sturgeon (including eight in beach/haul seine studies, one in the Westfield River fish passage facility, ten in bottom trawl studies, two in gill net studies, and 34 interactions during electrofishing activities); and,
- Up to 427 Atlantic sturgeon (including two in beach/haul seine studies, 266 in bottom trawl studies, 158 in gill net studies, and one interaction during electrofishing activities).

The only mortalities that we anticipate to occur are six Atlantic sturgeon (originating from any of the five DPSs) during gillnet surveys carried out by New York, New Jersey, Maryland, and Virginia.

Section 10(a)(1)(A) Permits

NMFS has issued research permits under section 10(a)(1)(A) of the ESA, which authorizes activities for scientific purposes or to enhance the propagation or survival of the affected species. The permitted activities do not operate to the disadvantage of the species and are consistent with the purposes of the ESA, as outlined in section 2 of the Act. Active section 10(a)(1)(A) permits for sea turtles and Atlantic sturgeon are provided in Table 53 and Table 54, respectively. No section 10 permits authorizing serious injury or mortality of marine mammals are currently active.

We searched for research permits on the NMFS' online application system for Authorization and Permits for Protected Species. The search criteria used confined our search to active permits that include take of sea turtles and Atlantic sturgeon within the Atlantic Ocean. Search criteria also limited the search to research states from Florida to Maine. However, many research activities

include both the Gulf of Mexico and the Atlantic Ocean, and the requested take did not always specify the waters where take would occur. Thus, some of the requested sea turtle take in Table 53 below include take for activities outside (i.e., in the Gulf of Mexico) the action area.

The requested take reported in Table 53 and Table 54 only includes take authorized under section 10(a)(1)(A) of the ESA. Permits related to stranding and salvage programs are described in that section. In addition, several research projects included take authorized under other authority, e.g., under section 7 of the ESA. These takes are included elsewhere in this Opinion and, therefore, are not included here to avoid double counting of take provided under the ESA.

Table 53: Active section 10(a)(1)(A) permits authorizing take of sea turtles for scientific research

Permittee	File #	Project	Area	Sea Turtle Takes	Research Period
NMFS Southeast Fisheries Center	16733	Demographic and life history studies of sea turtle populations in the Atlantic Ocean, Gulf of Mexico, Caribbean Sea, and tributaries.	Atlantic Ocean DE, MD, NC, NJ, NY, VA	Sample annually 925 loggerheads, 560 greens, 455 Kemp's ridleys, 65 hawksbills, 60 leatherbacks, 10 olive ridleys, and 24 unidentified/hybrid hardshells. In addition, 2620 loggerheads, 565 greens, 615 Kemp's ridleys, 287 hawksbills, 665 leatherbacks, 37 olive ridleys, and 2170 unidentified hardshells observed during aerial, vessel, and acoustic surveys annually	5 years, 08/13/2013 to 08/13/2019
NMFS Northeast Fisheries Science Center	17225	Conservation engineering to reduce sea turtle and Atlantic sturgeon bycatch in fisheries in the Northeast Region	U.S. locations including offshore waters	Over the course of the permit: Northern area (NH to NC): 8 green, 8 Kemp's, 8 leatherbacks, 26 loggerheads; no lethal (capture covered under other authorities) over the course of the permit Southern area (SC to GA): 10 green, 8 hawksbill, 62 Kemp's, 8 leatherback, 148 loggerhead. Incidental mortality: 6 unidentified	5 years, 01/01/2017 to 12/31/2021
Coonamessett Farm Foundation, Inc.	18526	Understanding the impact of the sea scallop fishery on loggerhead sea turtles through satellite tagging	Western Atlantic waters/Mid-Atlantic Bight from Cape Hatteras, North to NY LIS; and from coastal waters to the shelf break	Maximum of 200 loggerhead (20 captured and sonic tagged/80 approached unsuccessfully/100 observed and tracked with ROV). Non-Target species: 2 Kemp's ridley, green (captured and sonic tagged); 8 Kemp's ridley, green, leatherback, and/or unidentified (approached unsuccessfully); 20 Kemp's ridley, green, leatherback, and unidentified (observed and tracked with ROV) sea turtles per year.	5 years, 05/27/2015 to 05/31/2020
Atlantic Marine Conservation Society	20294	Marine mammal and sea turtle surveys to assess seasonal abundance and distribution in the Mid-Atlantic region.	Atlantic Ocean Focal area: New York Bight and surrounding waters; Research can occur off MA through N	Aerial Surveys: 125 Kemp's ridley, leatherback 85, 450 loggerhead, 450 unidentified.	5 years, 06/02/2017 to 06/01/2022

Permittee	File #	Project	Area	Sea Turtle Takes	Research Period
NMFS Southeast Fisheries Center (SEFSC)	20339	Application for a scientific research and enhancement permit under the ESA; development and testing of gear aboard commercial fishing vessels.	Project A: Turtle Excluder Device (TED) Evaluations in Atlantic and Gulf of Mexico Trawl Fisheries Project B research will occur solely within longline commercial fisheries where the incidental capture is already authorized by an existing ESA section 7 biological opinion.	Project A: annual take numbers: 220 (70 of these to include capture) loggerheads, 105 (25 captures) Kemp's ridleys, 85 (20 captures) leatherbacks, 50 (15 captures) greens, 30 (10 captures) hawksbills, 30 (10 captures) olive ridleys, and 75 (25 of captures) unidentified/hybrid turtles. A subset of these animals will be captured during trawl research authorized under this permit as noted in the parentheses; the rest of the turtles will be captured within fisheries managed by federal authority. Project B, annual take numbers: 30 loggerheads, 10 Kemp's ridleys, 30 leatherbacks, 10 greens, 10 hawksbills, 10 olive ridleys, and 10 unidentified/hybrid turtles. Incidental mortality: 2 green, 1 hawksbill, 2 Kemp's, 1 leatherback, 3 loggerhead, and 1 olive ridley over the course of the permit.	5 years, 05/23/2017 to 05/31/2022
Virginia Aquarium and Marine Science Center	20561	2018 renewal request for Virginia Aquarium sea turtle research permit	Atlantic Ocean, Long Island Sound, Delaware Bay, Chesapeake Bay, North Carolina Sounds/Estuarine and ocean waters from shore to the continental shelf off of NY through northern NC including inshore brackish waters.	Up to 72 turtles annually (25 green, 22 Kemp's ridley, 25 loggerhead) captured, sampled, and tagged. Up to one leatherback sea turtle may be opportunistically captured, sampled, and tagged. 18 turtles will be captured under other authority annually (5 green, 8 Kemp's, and 5 loggerhead)	10 years, 08/24/2018 to 09/30/2027

Permittee	File #	Project	Area	Sea Turtle Takes	Research Period
NMFS Northeast Fisheries Science Center (NEFSC)	21233	Demographic and life history studies of sea turtle populations in the Atlantic Ocean, Gulf of Mexico, Caribbean Sea, and tributaries	Project: 1) Cape Lookout Bight, NC 2) Gulf Stream Surveys, NC 3) North Carolina In-water Studies 4) Leatherback Studies, GOM and Atlantic 5) Biscayne National Park and Chassahowitzka National Wildlife Refuge 6) Florida Keys National Marine Sanctuary 7) Trawl captures in Gulf of Mexico 8) Programmatic In-water Studies	Project 1, 2, and 3: 555 loggerheads, 390 greens, 18 leatherbacks, 360 Kemp's ridleys, 21 hawksbills, 11 olive ridleys, and 18 unidentified hardshell/hybrids Project 4: 50 total leatherbacks captured and satellite tagged per year (25 GOM, 25 Atlantic). Up to 50 leatherbacks observed/pursued during vessel surveys but not captured during unsuccessful capture attempts. Up to 50 leatherbacks observed/pursued during aerial surveys but not captured. Up to 25 leatherbacks captured under other authority (e.g., pelagic longline fishery bycatch) Project 5: Up to 140 green turtles, 22 hawksbills, 85 Kemp's ridley and 115 loggerheads captured, processed and released in Biscayne National Park or Chassahowitzka annually. Up to 100 green, 50 loggerhead, and 20 Kemp's ridley turtles pursued without capture during vessel surveys and capture efforts annually. Project 6: Up to 60 greens, 35 hawksbills, 15 Kemp's ridleys and 30 loggerheads captured, processed, and released in the Florida Keys annually. Up to 5 hawksbills pursued without capture during survey and capture efforts. Project 7: 10 greens, 2 hawksbills, 10 Kemp's ridleys, 10 loggerheads, and 2 leatherbacks captured annually in the Gulf of Mexico Project 8: Up to 60 green turtles, 25 hawksbills, 60 Kemp's ridley, and 60 loggerheads captured, processed, and released annually. Up to 25 green turtles, 10 hawksbills, 25 Kemp's ridley, 25 leatherbacks, and 50 loggerheads processed and released after being legally captured under another authority (e.g., commercial fisheries, other section 10 permits) annually. All: Incidental mortality over the life of the permit (all capturing and processing) of 2 loggerheads, 2 Kemp's ridleys, 2 greens, 1 leatherback, 1 olive ridley, and 1 hawksbill	10 years, 08/07/2018 to 09/30/2027

Table 54: Active section 10(a)(1)(A) permits authorizing take of Atlantic sturgeon for scientific research

Permittee	File #	Project	Area	Atlantic Sturgeon Takes	Research Period
NMFS Northeast Fisheries Science Center	17225	Conservation engineering to reduce sea turtle and Atlantic sturgeon bycatch in fisheries in the Northeast Region	Western Atlantic waters (Massachusetts through Georgia, including inside COLREGs lines).	Northern area (NH to NC): Non-lethal – 223 sub-adult/adult (capture under other authority) over the course of the permit Southern area (SC to GA): Non-lethal: 204 juvenile/sub-adult/adult over the course of the study Incidental mortality: 6 juvenile/sub-adult/adult over the course of the permit	5 years, 01/01/2017 to 12/31/2021
Connecticut Department of Energy and Environmental Protection, Marine Fisheries	19641	Application to conduct scientific research and monitoring of shortnose sturgeon (<i>Acipenser brevirostrum</i>) and Atlantic sturgeon (<i>A. oxyrinchus oxyrinchus</i>) in Connecticut Waters and Long Island Sound.	CT waters	Non-lethal - 300 adult, sub-adult, and juvenile annually Incidental mortality: 1 adult/ sub-adult and 1 juvenile annually	10 years, 06/20/2016 to 03/31/2027
University of Maine	20347	Sturgeon of the Gulf of Maine	Gulf of Maine	100 (1 lethal) adults and sub-adults annually 20 (1 lethal) juveniles annually	10 years; 3/31/2017- 3/31/2027
Stony Brook University	20351	Atlantic and shortnose sturgeon population dynamics and life history in NY coastal marine and riverine waters	New York (Long Island Sound), New Jersey, Delaware	685 (up to 30 lethal) juveniles, sub-adults, adults annually	10 years; 02/27/2016- 03/31/2027
Delaware State University	20548	Reproduction, habitat use, and inter-basin exchange of Atlantic and shortnose sturgeon in the Mid-Atlantic	Coastal New York, New Jersey, Delaware	600 (up to 1 lethal) juvenile, sub-adult, and adult annually	10 years; 03/31/2017- 03/31/2027
NMFS, Office of Protected Resources	19642	Characterizing juvenile, sub-adult, and adult life stages of endangered Atlantic and shortnose sturgeon in the York, Rappahannock, Potomac, and Susquehanna Rivers, their tributaries, the Chesapeake Bay, and the Atlantic Coast.	Atlantic Ocean	200 non-lethal; any life stage (capture under other authority over the course of the permit)	5 years; 07/01/2016- 06/30/2021

Scientific research on ESA-listed Atlantic salmon has been authorized under the USFWS' endangered species blanket permit (No. 697823) under section 10(a)(1)(A), and covers a number of research projects carried out by NMFS and other research partners contracted by NMFS (e.g., University of Maine). However, the USFWS is anticipating re-structuring their permits. Specifically, the USFWS plans to issue new permits to cover only research directly under the NMFS' direct supervision. The USFWS is also planning to issue separate permits for different research activities conducted through other agencies or partners such as U.S. Geological Survey, Maine Department of Marine Resources (MDMR), and the University of Maine. This will provide a more efficient way of tracking individual take and will allow the USFWS to have a better understanding of ongoing research and level of take associated with these activities through annual reporting requirements.

USFWS is also authorized to conduct the conservation hatchery program at the Craig Brook and Green Lake National Fish Hatcheries. The mission of the hatcheries is to raise Atlantic salmon parr and smolts for stocking into selected Atlantic salmon rivers in Maine. Over 90 percent of adult returns to the GOM DPS are currently provided through production at the hatcheries. Approximately 600,000 smolts are stocked annually in the Penobscot River. The hatcheries provide a significant buffer from extinction for the species.

NMFS currently cooperates in research on Atlantic salmon in the Penobscot River to document changes in fish populations resulting from both the removal of the Veazie and Great Works projects, as well as the construction of the fish bypass at the Howland project. The study uses boat electrofishing techniques to document baseline conditions in the river prior to construction at the dams. Following dam removal and construction of the fish bypass, researchers will re-sample the river. This research will provide a better understanding of how dam removals and fish bypasses benefit Atlantic salmon.

NMFS also is monitoring biomass and species composition in the estuary to look at system-wide effects of dam removal projects. Although these activities will result in some take of Atlantic salmon, these takes are authorized by the existing ESA permit. The information gained from these activities will be used to further salmon conservation actions in the GOM DPS.

Section 10(a)(1)(B) Permits

Section 10(a)(1)(B) of the ESA authorizes NMFS, under some circumstances, to permit non-federal parties to take otherwise prohibited fish and wildlife if such taking is "incidental to, and not the purpose of carrying out otherwise lawful activities" (50 CFR 217-222). As a condition for issuance of a permit, the permit applicant must develop a conservation plan that minimizes negative impacts to the species. There are currently three active section 10(a)(1)(B) permits in the action area (Table 55). Active permits and permit applications are posted online for all species as they become available at <https://www.fisheries.noaa.gov/national/endangered-species-conservation/incidental-take-permits>.

Table 55: Active section 10(a)(1)(B) permits

Permittee	File #	Project	Area	Annual Endangered Species Takes	Dates
NC Department of Environment and Natural Resources, Division of Marine Fisheries	18102	Inshore anchored gillnet shallow water fishery	NC state waters; Management unit: A - Albemarle, Currituck, Croatan, Roanoke B - Pamlico Sound and the northern portion of Core Sound C - Pamlico, Pungo, Bay, and Neuse river drainages D - southern Core Sound, Back Sound, Bogue Sound, North River, and Newport River E - Atlantic Intracoastal Waterway and adjacent sounds and the New, Cape Fear, Lockwood Folly, White Oak, and Shallotte rivers	Large and small mesh fisheries combined Atlantic sturgeon Carolina DPS Total Lethal: 138 per year Total Non-lethal: 2,124 per year Unit A: 110 lethal and 2,063 non-lethal per year; Unit B: 11 lethal and 27 non-lethal per year; Unit C: 9 lethal and 10 non-lethal per year; Unit D: 4 lethal and 12 non-lethal per year; Unit E: 4 lethal and 12 non-lethal per year Atlantic sturgeon other DPS Total Lethal: 31 per year Total Non-lethal: 634 Unit A: 31 lethal and 618 non-lethal; Unit B: 0 lethal and 12 non-lethal; Unit C: 0 lethal and 4 non-lethal Unit D: no take; Unit E: no take	2014-2024
NC Department of Environment and Natural Resources, Division of Marine Fisheries	16230	Inshore anchored gillnet shallow water fishery	State waters of North Carolina: inshore waters 6 management units	Combined for small and large mesh Green sea turtle Lethal: 165 per year; Non-lethal: 330 per year; Either: 18 per year* Hawksbill sea turtle Lethal: n/a; Non-lethal: n/a; Either: 8 per year* Kemp's ridley sea turtle Lethal: 49 per year; Non-lethal: 98 per year; Either: 12 per year* Leatherback sea turtle Lethal: n/a; Non-lethal: n/a; Either: 8 per year* Loggerhead sea turtle Lethal: n/a; Non-lethal: n/a; Either: 24 per year* Any species Lethal: n/a; Non-lethal: n/a; Either: 8 per year* * Observed take, rest are estimated take based on observed take. N/A if not enough observed take occurred to provide an estimate.	2013-2023
GA Department of Natural Resources	16645	Commercial shad fishery conservation plan	Altamaha River, Savannah River, Ogeechee River	Altamaha: 140 Atlantic sturgeon (2.3% mortality) Savannah: 50 Atlantic sturgeon (2.3% mortality) Ogeechee: 10 Atlantic sturgeon (2.3% mortality)	2013-2022

MMPA Incidental Harassment Authorizations and Letters of Authorization

Under section 101(a)(5) of the MMPA, certain incidental taking, via harassment, of a small number of marine mammals during an activity (other than commercial fishing) is allowed through the issuance of Incidental Harassment Authorizations (IHAs) or Letters of Authorization (LOAs).¹⁶ ¹⁷ IHAs are issued for actions that have the potential to result in harassment of marine mammals only (i.e., injury or disturbance) and are effective for up to one year. LOAs are issued for actions that have the potential to result in harassment of marine mammals only (i.e., injury or disturbance) and are planned for multiple years, or have the potential to result in serious injury or mortality to the marine mammal species; these authorizations are effective for up to five years.¹⁸

The types of activities receiving IHAs and LOAs may involve acoustic harassment or habitat disturbance from yacht races, seismic surveys, exploratory drilling surveys, bridge construction, fireworks displays, sonar testing, Navy training and testing programs, and lighthouse restorations, among others. The types of authorized takes include behavioral responses, as well as injuries and mortalities. Currently, no LOAs allow serious injuries and mortalities for ESA-listed cetaceans.

Current and past applications are available for public review at <https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act>. Authorizations that are in process for activities in the action area include military readiness (1), other energy (i.e., renewable and liquefied natural gas) (6), construction (1), and fisheries research (1). Active authorizations in the action area include military readiness (3), other energy (9), construction (7), and fisheries and biological research (3). Most of these projects only affect marine mammals that are not listed under the ESA. For those activities that may affect ESA-listed species, NMFS has consulted under section 7 of the ESA on the issuance of the IHAs and LOAs (NMFS 2016b, 2018b, c).

5.1.5. Operation of Vessels Carrying out Federal Actions

Potential sources of adverse effects to whales, sea turtles, and Atlantic sturgeon from federal vessel operations in the action area include operations of the U.S. Navy (USN), U.S. Coast Guard (USCG), Bureau of Ocean Energy Management (BOEM), Maritime Administration (MARAD), Environmental Protection Agency (EPA), NOAA and ACOE vessels. NMFS has previously conducted formal consultations with the Navy and USCG on their vessel-based operations. NMFS has also conducted section 7 consultations with BOEM and MARAD on vessel traffic related to energy projects and has implemented conservation measures. Through the section 7 process, where applicable, NMFS has and will continue to establish conservation measures for federal vessel operations to avoid or minimize adverse effects to listed species.

¹⁶ The MMPA defines harassment as Level A or Level B. Level A harassment has the potential to injure a marine mammal or marine mammal stock. Level B harassment has the potential to disturb a marine mammal or marine mammal stock by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering, but which does not have the potential to injure a marine mammal or marine mammal stock (MMPA section 3(18)(C) and 3(18)(D)).

¹⁷ Note that incidental take of marine mammals during commercial fishing operations is covered separately under the Marine Mammal Authorization Program.

¹⁸ The MMPA defines “serious injury” as any injury that will likely result in mortality (50 CFR § 216.3).

5.1.6. *Military Operations*

NMFS has completed consultations on individual Navy and USCG activities (see <https://www.fisheries.noaa.gov/national/endangered-species-conservation/biological-opinions>). In the U.S. Atlantic, the operation of USCG boats and cutters are estimated to take no more than one individual sea turtle, of any species, per year (NMFS 1995, 1998).

In 2018, NMFS issued a biological opinion on the U.S. Navy Atlantic Fleet's military readiness training and testing activities and the promulgation of regulations for incidental take of marine mammals (NMFS 2018b). The action area includes the Gulf of Mexico and the western Atlantic. NMFS concluded that the action is not likely to jeopardize the continued existence of fin, North Atlantic right, sei, or sperm whales, green (North Atlantic DPS), loggerhead (Northwest Atlantic DPS), Kemp's ridley, or leatherback sea turtle ;Atlantic salmon (Gulf of Maine DPS), or Atlantic sturgeon (Gulf of Maine, New York, Chesapeake Bay, Carolina, South Atlantic DPS). NMFS anticipated the following takes from harm due to exposure to impulsive and non-impulsive acoustic stressors annually: 6 fin whales, 6 green (North Atlantic DPS), 5 Kemp's ridley, 97 loggerhead, and 24 leatherback sea turtles. In addition, two lethal takes of loggerhead sea turtles were anticipated. Other marine mammal and sea turtle takes from these stressors are expected to be in the form of harassment. Takes from vessel strikes were anticipated to include the lethal take annually of 1 fin, 1 sei, and 1 sperm whale, 55 green, 20 Kemp's ridley, 75 loggerhead, and 5 leatherback sea turtles. Four green, 4 hawksbill, 5 Kemp's ridley, 11 loggerhead, and 3 leatherbacks were anticipated have non-lethal injuries. For vessel strikes, the opinion also anticipates the take of no more than 6 Atlantic sturgeon (up to 1 from the Gulf of Maine DPS, 1 from the New York Bight DPS, 6 from the Chesapeake Bay DPS, 6 from the Carolina DPS, and 1 from the South Atlantic DPS) combined from all DPSs over a 5-year period. The ITS did not specify the amount or extent of take of ESA-listed fish, but rather used a surrogate expressed as a distance to reach effects in the water column with injury and sub-injury from acoustic stresses. In addition to takes due to acoustic stressors and vessel strikes, take was estimated to occur as a result of small and large ship shock trials. Thirty-six fin, 7 sei, and 6 sperm whales; 2 green (North Atlantic DPS), 1 hawksbill, 4 Kemp's ridley, 41 loggerhead, and 17 leatherback sea turtles are anticipated to be harmed over the course of the action. In addition, 2 lethal takes of loggerheads are estimated. Other takes due to ship shock trials included in the ITS are in the form of harassment. In addition, takes of blue whales, Bryde's whale – Gulf of Mexico subspecies, and Gulf sturgeon were also anticipated.

5.1.7. *Offshore Oil and Gas*

BOEM oversees leasing of outer continental shelf (OCS) energy and mineral resources; this includes administering the leasing program for OCS oil and gas resources. Currently, BOEM is working under the 2017-2022 National OCS Program, but has initiated a process to develop a program for 2019-2024. No lease sales are scheduled for the Atlantic OCS under the current plan. Under the proposed plan, BOEM has divided the Atlantic OCS into four planning areas: North Atlantic, Mid Atlantic, South Atlantic, and Straits of Florida Planning Areas. The action area overlaps with all four Planning Areas. The draft proposed program for leasing, published in 2018, calls for leasing in the North Atlantic Planning Area in 2021, 2023 and 2025, in the Mid Atlantic Planning Area in 2020, 2022 and 2024, in the South Atlantic Planning Area in 2020, 2022, and 2024; and in the Straits of Florida Planning Area in 2023. At this time, the proposed program has not been approved or finalized.

Geophysical and/or geotechnical surveys to identify hydrocarbon resources would occur if leasing is being pursued in the action area. On November 30, 2018, NMFS issued five IHAs under the MMPA to incidentally harass marine mammals to companies proposing to conduct geophysical surveys, including the use of air guns, in support of hydrocarbon exploration in the Atlantic Ocean (83 FR 63268, December 7, 2018). These were issued to five companies that provide services such as geophysical data acquisition, to the oil and gas industry. No mortality of any individuals is anticipated. Twelve fin whales are expected to experience harm; all other exempted take of marine mammals is in the form of harassment (e.g., behavioral disturbance) due to exposure to underwater. NMFS prepared a biological opinion that considered the effects of these activities on ESA-listed species in the action area. In addition to the incidental take of ESA-listed marine mammals, the biological opinion estimated the incidental take of Northwest Atlantic DPS of loggerhead, green, Kemp's ridley, and leatherback sea turtles. This take was in the form of harassment through behavioral responses and temporary hearing threshold shifts. The opinion did not anticipate the death of any individual cetacean or sea turtle exposed to seismic survey activities. The action was also determined not likely to adversely affect any DPS of Atlantic sturgeon, giant manta rays, oceanic white-tip sharks, hawksbill sea turtles (NMFS 2018c). The activities included in the IHA and biological opinion were scheduled to be completed by November 30, 2019.

5.1.8. *Offshore Renewable Energy*

BOEM is responsible for overseeing offshore renewable energy development in federal waters pursuant to the 2009 final regulations for the OCS Renewable Energy Program, which was authorized by the Energy Policy Act of 2005 (EPAAct). These regulations provide a framework for issuing leases, easements, and rights-of-way for OCS activities that support production and transmission of energy from sources other than oil and natural gas (i.e., offshore wind and hydrokinetic projects).

Under the renewable energy regulations (30 CFR § 585), the issuance of leases and subsequent approval of wind energy development on the OCS is a staged decision making process and occurs over several years with each step having varying impacts to marine and/or terrestrial resources. The process follows these general steps: lease issuance, site assessment plan approval, construction and operation plan (COP) review/approval including permitting with cooperating agencies. NMFS has carried out programmatic consultations with BOEM to address the effects of issuance of leases and site assessment activities associated with offshore wind energy. These consultations consider effects from of a suite of activities on listed sturgeon, sea turtles, and marine mammals. The expected effects of the actions considered result from temporary exposure to acoustic sources (e.g., geophysical survey equipment) that may result in behavioral disturbance of individuals. No take in the form of injury or mortality is anticipated.

As of June 2020, BOEM has issued 15 leases for commercial offshore wind energy development along the U.S. Atlantic coast (North Carolina to Massachusetts) and 1 lease for a research site (off the coast of Virginia) where two turbines were installed, the first in federal waters (see <https://www.boem.gov/Lease-and-Grant-Information/>). A variety of site assessment activities have been completed or are ongoing within the lease blocks, including geophysical and geotechnical surveys and the installation of meteorological buoys or towers at some sites. The effects of these activities on ESA-listed species were considered in the programmatic consultation above. No injury or mortality of any ESA-listed species have been reported to date.

In order for an offshore wind facility on the OCS to be built, BOEM must approve a COP; proposed approval of the COP is the federal action that triggers review under NEPA and ESA section 7 consultation. Generically, effects to be considered include (but are not limited to) noise (pile driving, vessels, surveys), vessel strikes, habitat disturbance/loss, avoidance/displacement from the area, and electromagnetic fields.

In 2014, NMFS conducted a formal consultation on the effects of Deepwater Wind Block Island, LLC's and Deepwater Wind Block Transmission, LLC's proposals to construct and operate the Block Island Wind Farm. No injury or mortality of sea turtles was anticipated. Behavioral disturbance of (harassment) of loggerhead, leatherback, Kemp's ridley, and green sea turtles was anticipated due to exposure to disturbing levels of noise during pile driving. Temporary, short-term behavioral effects due to exposure to underwater noise was also anticipated for Atlantic sturgeon, but NMFS was unable to estimate the number of animals affected. Incidental take of 228 fin and 11 North Atlantic right whales due to harassment was also exempted and an IHA was issued (NMFS 2014a).

In 2020, NMFS concluded a formal consultation on the construction, operation, maintenance, and decommissioning of the Vineyard Wind Offshore Energy Project (NMFS 2020f). Vineyard Wind's proposed activity would occur in the northern portion of the 166,886 acre (675 square km) Vineyard Wind Lease Area, also referred to as the wind development area. Under the maximum impact scenario, pile driving during construction is expected to result in harassment of 20 North Atlantic right, 34 fin, 5 sperm, and 4 sei whales and 3 Northwest Atlantic DPS of loggerhead, 1 North Atlantic DPS of green, 1 Kemp's ridley, and 7 leatherback sea turtles. The pile driving is also expected to result in injury (permanent threshold shift) of 5 fin and 2 sei whales. M/SI of the 17 Northwest Atlantic DPS of loggerhead, 2 North Atlantic DPS of green, 2 Kemp's ridley, and 18 leatherback sea turtles is also anticipated due to vessel strikes. The biological opinion also includes estimated levels of take under other scenarios in which the project installs fewer turbines of larger capacity, if such turbines are available, and fewer electrical service platforms (NMFS 2020f).

5.2. Non-federally Regulated Fisheries

Several fisheries for species not managed by a federal FMP occur in state waters of the action area. In addition, unmanaged fisheries (e.g., hagfish) occur in federal waters. The amount of gear contributed to the environment by these fisheries is currently unknown. In most cases, there is limited observer coverage of these fisheries, and the extent of interactions with ESA-listed species is difficult to estimate. Sea turtles, large whales, Atlantic and shortnose sturgeon, and Atlantic salmon may be vulnerable to capture, injury, and mortality in a number of these fisheries. Captures of loggerhead, Kemp's ridley, green, and leatherback sea turtles (Murray 2007, 2008, 2009a, b, 2013, 2015b, 2018, 2020, Murray and Orphanides 2013, NMFS SEFSC 2001, 2009, Warden 2011a, b) and Atlantic sturgeon (ASSRT 2007, NMFS 2011a) in these fisheries have been reported through state reporting requirements, research studies, VTRs, NMFS NEFSC observer programs, and anecdotal reports.

Interactions with large whales have been documented in fishing gear in state waters. The MMPA List of Fisheries (LOF) evaluates commercial fisheries annually and classifies them by the level of incidental marine mammal death and serious injury. Category I fisheries are those with frequent incidental death or serious injury. Category II are those with occasional incidental death or serious injury. Fisheries in these categories are required to carry observers when requested.

Category III fisheries have a remote likelihood of or no known incidental death or serious injury of marine mammals. Fisheries may be classified in a particular category due to interactions with non-ESA-listed marine mammals.

Large whales are susceptible to entanglement in trap/pot and gillnet gear. Johnson et al. (2005) noted that any part of the gear (buoy line, groundline, floatline, and surface system line) creates a risk for entanglement. As described below, trap/pot and gillnet gear are used in several state and unregulated fisheries. These interactions can occur when and where large whales overlap with commercial or recreational fishing gear, including in state and unregulated fisheries. In the Atlantic, fisheries that have been classified as Category I based on interactions with ESA-listed whales include the Northeast sink gillnet (North Atlantic right whale) and Northeast/mid-Atlantic lobster trap/pot (North Atlantic right whale). Category II fisheries include the Southeastern U.S. Atlantic shark gillnet fishery (North Atlantic right whale) and the Atlantic mixed species trap/pot (fin whale). There are state fishery components of the Northeast sink gillnet, Northeast/mid-Atlantic lobster trap/pot, and the Atlantic mixed species trap/pot. Target species in the Atlantic mixed species trap/pot fishery include both federally regulated and non-federally regulated fisheries. Target species include hagfish, shrimp, conch/whelk, red crab, Jonah crab, rock crab, black sea bass, scup, tautog, cod, haddock, pollock, redfish, white hake, spot, skate, catfish, stone crab, and cunner. In the southeast, gillnet is the primary gear for vessels directing on small coastal sharks. The ALWTRP closes the Southeast U.S. Restricted Area North from November 15-April 15 and the Southeast U.S. Restricted Area South from December 1 – March 31. These areas are off Florida. There is an exemption for shark and Spanish mackerel gillnets in the south area if certain requirements are met and, for mackerel, during certain times. There are also weak link, anchoring, and other gear gillnet requirements in the southeast that apply to both state and federal waters.

Using the analysis presented in section 7.2, we estimate that between 2010 and 2018, an annual average of 7.7 right whales mortalities or serious injury resulted from entanglement in U.S. fishing gear. Additional analysis presented in section 7.2 estimates that an annual average of 4.7 right whale M/SI were the result of entanglement in gear used in the federal component of the U.S. fisheries. By subtracting the estimated M/SI in federal waters (4.7) from the total estimated M/SI in U.S. waters (7.7), we estimate that an annual average of 3 right whale M/SI were the result of entanglement with gear used in state fisheries.

Similarly, sea turtles may interact with fishing gear in state waters. Interactions have been documented with loggerhead, green, Kemp's ridley, and leatherback sea turtles. Gear types used in these fisheries include hook-and-line, gillnet, trawl, pound net and weir, trap/pot, seines, and channel nets. The magnitude and extent of interaction in many of these fisheries is largely unknown. Through the Annual Determination, NMFS identifies U.S. fisheries that are required to take observers upon request. The goals of this coverage is to learn more about interactions in that fishery, evaluate existing measures to prohibit take, and to determine if additional measures may be needed. It is not intended to be a comprehensive list of fisheries with interactions or suspected interactions, but rather those fisheries that NMFS intends to observe over a 5-year period (see Table 56 for current listing).

Table 56: Fisheries currently listed under the Annual Determination

Fishery	Years Eligible to Carry Observers
Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl	2020-2025
Gulf of Mexico mixed species fish trawl	2020-2025
Long Island inshore gillnet	2020-2025
Chesapeake Bay inshore gillnet	2020-2025
Mid-Atlantic gillnet	2018-2022
Gulf of Mexico menhaden purse seine	2018-2022

The available bycatch data for FMP fisheries indicate that sink gillnets and bottom otter trawl gear pose the greatest risk to Atlantic sturgeon (ASMFC 2017); although, Atlantic sturgeon are also caught by hook and line, fyke nets, pound nets, drift gillnets and crab pots (ASMFC 2017). It is likely that this vulnerability to these types of gear is similar to federal fisheries, although there is little data available to support this. Information on the number of Atlantic sturgeon captures and mortalities in non-federal fisheries, which primarily occur in state waters, is extremely limited. An Atlantic sturgeon “reward program” provided commercial fishermen monetary rewards for reporting captures of Atlantic sturgeon in Maryland’s Chesapeake Bay from 1996 to 2012 (Mangold et al. 2007). The data from this program show that Atlantic sturgeon have been caught in a wide variety of gear types, including hook and line, pound nets, gillnets, crab pots, eel pots, hoop nets, trawls, and fyke nets. Pound nets (58.9 percent) and gillnets (40.7 percent) accounted for the vast majority of captures. Of the more than 2,000 Atlantic sturgeon reported in the reward program over 16 years (1996-2012), biologists counted ten individuals that died because of their capture. No information on post-release mortality is available (Mangold et al. 2007).

Efforts are currently underway to obtain more information on the number of Atlantic sturgeon and sea turtle captures and mortalities in fisheries in state waters. Atlantic sturgeon are also vulnerable to capture in fisheries occurring in rivers, such as shad fisheries; however, these riverine areas are outside of the action area considered in this Opinion. Where available, specific information on protected species interactions in non-federal fisheries is provided below.

Atlantic Croaker Fishery

Along the U.S. Atlantic coast, Atlantic croaker are most abundant from the Chesapeake Bay to northern Florida. The Atlantic croaker fishery is managed by the Commission. The fishery is prosecuted with bottom trawl and gillnet gear. In 2018, the majority (97 percent) of commercial landings (in pounds) in came from Virginia (53 percent) and North Carolina (44 percent); the majority of recreational landings (in number of fish) were from Virginia (68 percent) and Florida (13 percent) (ASMFC 2019b). Sea turtle interactions have been documented in this fishery. In previous bycatch estimates where loggerhead bycatch was prorated by managed species landed, croaker was one of the fisheries with a higher number of takes for trawl (Murray 2015a) and gillnet gear (Murray 2018). Atlantic sturgeon interactions have also been observed in the Atlantic croaker fishery, but a quantitative assessment of the number of Atlantic sturgeon captured in the croaker fishery is not available. A mortality rate of Atlantic sturgeon in commercial trawls has been estimated at 5 percent. An earlier review of bycatch rates and landings for the weakfish fishery reported that the weakfish-stripped bass fishery had an Atlantic sturgeon bycatch rate of 16 percent from 1989-2000; the weakfish-Atlantic croaker fishery had an Atlantic sturgeon bycatch

rate of 0.02 percent, and the weakfish fishery had an Atlantic sturgeon bycatch rate of 1.0 percent. Bycatch rates were the ratio of sturgeon catch weight to the catch weight of all species landed (ASSRT 2007, Stein et al. 2004a). The ASSRT notes that the estimates can be heavily biased and the error rate large as observer coverage was not equal between fisheries or months of sampling and error (ASSRT 2007). In addition, fisheries have changed significantly since these estimates and, therefore, they are likely not applicable to contemporary fisheries.

Weakfish Fishery

Weakfish are found from Nova Scotia to southeastern Florida, but are more common from New York to North Carolina. The weakfish fishery occurs in both state and federal waters. Most commercial landings occur in the fall and winter months (Weakfish Plan Review Team 2019). The dominant commercial gear is gillnets with about 55 percent of commercial landings. There has been a shift in the dominant source of landings from trawls in the 1950s to 1980s to gillnets from the 1990s to present (Weakfish Plan Review Team 2019). Other gears include pound nets, haul seines, and beach seines (ASMFC 2016). North Carolina (34 percent), New York (23 percent), and Virginia (22 percent) had the largest share of the harvest in 2018 (Weakfish Plan Review Team 2019). North Carolina dominates commercial harvest, followed by Virginia and New Jersey. Together, these states have consistently accounted for 70 to 90 percent of the coast-wide commercial harvest since 1950 (ASMFC 2016, Weakfish Plan Review Team 2015, 2016, 2017, 2018, 2019). The recreational fishery catches weakfish using live or cut bait, jigging, trolling, and chumming, and the majority of fish are caught in state waters. The recreational fishery primarily occurs in state waters between New York and North Carolina (Weakfish Plan Review Team 2019).

Sea turtle bycatch in the weakfish fishery has occurred. NMFS originally assessed the impacts of the fishery on sea turtles in a biological opinion issued in 1997 (NMFS 1997). While the most recent gillnet bycatch estimates for 2007-2011 (Murray 2013) and 2012-2016 (Murray 2018) do prorate the bycatch by species landed, they do not include an estimate of loggerhead bycatch in the weakfish gillnet fishery. In an estimate of bycatch from 2002-2006, one loggerhead sea turtle was estimated to have been captured in the weakfish fishery based on a proration by species landed (Murray 2009b). These estimates encompassed both state and federal waters.

A quantitative assessment of the number of Atlantic sturgeon captured in the weakfish fishery is not available. A mortality rate of Atlantic sturgeon in commercial trawls has been estimated at 5 percent. Weakfish has also been identified as the top landed species on observed trips where sturgeon were incidentally captured (NEFSC observer/sea sampling database, unpublished data). In addition, as described above, the weakfish-striped bass fishery was identified as having higher bycatch rates using data from 1989-2000 (ASSRT 2007); however, there are a number of caveats associated with this data.

Whelk/Conch Fishery

A whelk/conch fishery occurs in several parts of the action area, including waters off Maine, Massachusetts, Connecticut, New York, New Jersey, Delaware, Maryland, and Virginia. While pot gear is the predominant gear used, whelk/conch are also harvested by hand and dredge. The fishery is limited entry in Massachusetts, New York, New Jersey and Virginia. Species targeted include waved, Stimpson, channeled, and knobbed whelk. Unlike lobster, there is no uniform, coast-wide management of the whelk fishery. Each state manages the fishery individually. Requirements often include licenses, gear marking, pot limits, and buoy line requirements.

Whelk fisheries overlap in time and space with sea turtles. Loggerhead, leatherback, and green sea turtles are known to become entangled in lines associated with trap/pot gear used in several fisheries including lobster, finfish, whelk, and crab species (Greater Atlantic Region Sea Turtle Disentanglement Network (GAR STDN), unpublished data). Unlike lobster pots, whelk pots in this area are not fully enclosed. This design of whelk pots has been suggested as a potential source of entrapment for loggerhead sea turtles that may be enticed to enter the trap to get the bait or whelks caught in the trap (Mansfield et al. 2001). Whelk fisheries in Massachusetts, New York, Delaware, Maryland, and Virginia were confirmed or probable fisheries involved in 18 sea turtle entanglements from 2010-2019. Thirteen entanglement events involved a leatherback sea turtle and five involved a loggerhead sea turtle. An additional 18 leatherbacks were entangled in either multiple gears (e.g., conch and lobster) or in gear where the fisherman held multiple permits, including conch, and the exact gear could not be identified. Green sea turtles have been documented in whelk/conch gear in previous years (GAR STDN, unpublished data). Atlantic salmon and Atlantic sturgeon interactions with trap/pot gear have never been observed or documented and; therefore, this gear type is not expected to be a source of injury or mortality to these species.

Crab Fisheries

Crab fisheries use a variety of gears including hand, trap/pot, trawl, and dredge. These fisheries occur in federal and state waters and target species such as blue, Jonah, rock and horseshoe crab. While the blue crab fishery occurs throughout the Mid-Atlantic south to the Gulf of Mexico, Maryland, Virginia, and North Carolina harvesters prosecute the majority of the effort. The Chesapeake Bay Program's Blue Crab Management Strategy indicates that there are multiple commercial and recreational gear types, various season lengths and regulations in three management jurisdictions. Fishing practices and the resulting harvest vary because of the complex ways crabs migrate and disperse throughout Chesapeake Bay.

The Jonah and rock crab fisheries may be prosecuted in conjunction with the lobster fishery. In this case, lobster traps are likely to be used. Depending on state regulation, other style traps may be available for use. Jonah crabs are harvested from deeper waters than rock crabs, and presently, are more highly valued. The commercial Jonah crab fishery is centered around Massachusetts and Rhode Island, though landings occur throughout New England and Mid-Atlantic states. The majority of horseshoe crab harvest comes from the Delaware Bay Region, followed by the New York, New England, and the Southeast regions. Trawls, hand harvests, and dredges make up the bulk of commercial horseshoe crab landings.

Sea turtles and large whales can become entangled in the vertical lines of trap/pot gear when they overlap with these fisheries. From 2010-2019, records (confirmed and probable) show 6 leatherbacks and 6 loggerhead sea turtles interacted with the vertical lines of blue crab gear in New Jersey and Virginia (GAR STDN, unpublished data). While these are where takes have been reported, interactions could occur wherever crab gear and sea turtles overlap. Interactions are primarily associated with entanglement in vertical lines, although sea turtles can also become entangled in groundline or surface systems. In 2007, a leatherback sea turtle was entangled in the lines connecting whelk pots (GAR STDN, unpublished data). In 2012, a leatherback was entangled in the surface system of a mooring buoy (GAR STDN, unpublished data), indicating that interactions with surface systems are possible.

Horseshoe crab has also been identified as the top species landed on trips that have incidentally taken sea turtles (NEFSC observer/sea sampling database, unpublished data). These takes were documented in trawl gear. Based on a proration of landings, two loggerheads on average annually were estimated to have been taken in the horseshoe crab trawl fishery from 2009-2013 (Murray 2015b).

The crab fisheries may have other detrimental impacts on sea turtles beyond entanglement in the fishing gear itself. Loggerheads are known to prey on crab species, including horseshoe and blue crabs. In a study of the diet of loggerhead sea turtles in Virginia waters from 1983 to 2002, Seney and Musick (2007) found a shift in the diet of loggerheads in the area from horseshoe and blue crabs to fish, particularly menhaden and Atlantic croaker. The authors suggested that this shift in loggerhead diet may be due to a decline in the crab species (Seney and Musick 2007). The physiological impacts of this shift are uncertain, although, Mansfield (2006) suggested it as a possible explanation for the declines in loggerhead abundance. Maier et al. (2005) detected Seasonal declines in loggerhead abundance coincident with seasonal declines of horseshoe and blue crabs were detected in the same area (Maier et al. 2005). While there is no evidence of a decline in horseshoe crab abundance in the Southeast during the period 1995-2003, declines were evident in some parts of the Mid-Atlantic (ASMFC 2004, Eyler et al. 2007). Given the variety of loggerheads prey items (Bjorndal 1997, Burke et al. 1993, Dodd 1988, Morreale and Standora 1998) and the differences in regional abundance of horseshoe crabs and other prey items (ASMFC 2004, Eyler et al. 2007), a direct correlation between loggerhead sea turtle abundance and horseshoe crab and blue crab availability cannot be made at this time. Nevertheless, the decline in loggerhead abundance in Virginia waters (Mansfield 2006) and possibly Long Island waters (Morreale and Standora 2005) coincident with noted declines in the abundance of horseshoe crab and other crab species raised concerns that crab fisheries may be impacting the forage base for loggerheads in portions of their range.

Atlantic sturgeon are known to be caught in state water horseshoe crab fisheries using trawl gear (Stein et al. 2004a). With the exception of New Jersey state waters, the horseshoe crab fishery operates in all state waters that occur in the action area. Along the U.S. East Coast, hand, bottom trawl, and dredge fisheries account for the majority (86 percent in the 2017 fishery) of commercial horseshoe crab landings in the bait fishery. Other methods used to land horseshoe crab are gillnets, fixed nets, rakes, hoes, and tongs (ASMFC 2019a, Horseshoe Crab Plan Review Team 2019). For most states, the bait fishery is open year round. However, the fishery operates at different times due to movement of the horseshoe crab. New Jersey has prohibited commercial harvest of horseshoe crabs in state waters (N.J.S.A. 23:2B-20-21) since 2006 (Horseshoe Crab Plan Review Team 2019). State waters of Delaware are closed to horseshoe crab harvest and landing from January 1 through June 7 each year (7 Del Admin. C § 3200). Other states also regulate various seasonal and area closures and other state horseshoe crab fisheries are regulated with various seasonal/area closures (Horseshoe Crab Plan Review Team 2019). The majority of horseshoe crab landings from the bait fishery from 2014-2018 came from Maryland, Delaware, New York, Virginia, and Massachusetts. Florida, Georgia, South Carolina had de minimus status in 2018 (Horseshoe Crab Plan Review Team 2019). There is also a smaller fishery for biomedical uses.

An evaluation of bycatch of Atlantic sturgeon using the NEFSC observer/sea sampling database (1989-2000) found that the bycatch rate for horseshoe crabs was low at 0.05 percent (Stein et al. 2004a). An Atlantic sturgeon “reward program,” where commercial fishermen were provided

monetary rewards for reporting captures of Atlantic sturgeon in the Maryland waters of Chesapeake Bay (Mangold et al. 2007), operated from 1996 to 2012.¹⁹ From 1996-2006, the data showed that one of 1,395 wild Atlantic sturgeon was found caught in a crab pot (Mangold et al. 2007).

Fish Trap, Seine, and Channel Net Fisheries

Incidental captures of sea turtles in fish traps have been reported from several states along the U.S. Atlantic coast (GAR STDN, unpublished data). From 2010-2019, records (confirmed and probable) documented 24 leatherback, 2 Kemp's ridley, 10 loggerheads, and 1 unknown sea turtle in pound nets/weirs from Maine through Virginia. Of the 37 interactions, six animals were documented free swimming (GAR STDN, unpublished data). In this gear, sea turtles may become entangled in the gear or be free swimming in the pound/weir.

The Virginia pound net fishery is contiguous to the action area at the mouth of Chesapeake Bay. Sea turtle interactions with the Virginia pound net fishery have been documented, and interactions reported to the GAR STDN are included above. NMFS has taken regulatory action to address sea turtle bycatch in the Virginia pound net fishery. The most recent biological opinion on the federal rulemaking on Virginia pound nets anticipated the take of up to 805 (1 lethal) loggerhead, 161 Kemp's ridley (1 lethal), 16 green (1 lethal), and 11 Atlantic sturgeon (none lethal) in the pound and heart portions of the gear. The leaders may also capture sea turtles and Atlantic sturgeon. NMFS anticipated that up to 1 (1 lethal), loggerhead, 1 (1 lethal) Kemp's ridley, (up to 1 lethal) green, 8 (4 lethal) leatherback, and 2 Atlantic sturgeon (1 lethal) could occur annually (NMFS 2018e).

Long haul seines, beach seines, purse seines, and channel nets are also known to incidentally capture sea turtles in sounds and other inshore waters along the U.S. Atlantic coast, although no lethal interactions have been reported (NMFS SEFSC 2001). No information on interactions between Atlantic sturgeon and fish traps, long haul seines, or channel nets is currently available; however, depending on where this gear is set and the mesh size, the potential exists for Atlantic sturgeon to be entangled or captured in net gear. Interactions between marine mammals considered in this Opinion and these gears are not known to occur.

American Lobster Trap Fishery

An American lobster trap fishery occurs in state waters of New England and the Mid-Atlantic and is managed under the Commission's Interstate Fishery Management Plan (ISFMP). Like the federal waters component of the fishery, the state waters fishery uses trap/pot gear to land lobster. Trap/pot gear is known to entangle sea turtles and large whales. Often for these entanglements, the gear cannot be documented to a specific fishery. There have been documented takes of North Atlantic right whales in inshore and state lobster gear (Morin et al. 2019) (NMFS, unpublished data; see link to 2000-2018 Marine Animal Incident Data 03/19/2019 at https://archive.fisheries.noaa.gov/garfo/protected/whaletrp/trt/meetings/April%202019/19_april_2019_trt_meeting.html).

¹⁹ The program was terminated in February 2012, with the listing of Atlantic sturgeon under the ESA.

Leatherback, loggerhead, green and Kemp's ridley sea turtles are known to interact with trap/pot gear. As described above, interactions are primarily associated with entanglement in vertical lines. Records of stranded or entangled sea turtles indicate that fishing gear can wrap around the neck, flipper, or body of the sea turtle and severely restrict swimming or feeding (GAR STDN, unpublished data; NMFS STSSN, unpublished data). As a result, these interactions often result in the injury or mortality to sea turtles.

Using the criteria defined in section 7.3.1.3, there were 81 leatherback entanglements from 2010-2019 in state confirmed to the lobster fishery. Four of the cases were confirmed to recreational pot gear. All entanglements involved the vertical line of the gear. These verified/confirmed entanglements occurred in waters off Maine, Massachusetts, and New York from May through October. The majority were documented in waters off Massachusetts (GAR STDN, unpublished data).

Atlantic salmon and Atlantic sturgeon interactions with trap/pot gear have never been observed (NEFSC observer/sea sampling database, unpublished data) or documented; therefore, this gear type is not expected to be a source of injury or mortality to these species.

American Shad Fishery

An American shad fishery occurs in state waters of New England and the Mid-Atlantic and is managed under the Commission's ISFMP. Amendment 3 to the ISFMP requires states and jurisdictions to develop sustainable FMPs, which are reviewed and approved by the Commission's Technical Committee, in order to maintain recreational and commercial shad fisheries (ASMFC 2010). Eight entities in the action area have developed these FMPs. The fishery occurs in rivers and coastal ocean waters. In 2005, the directed at-sea fishery was closed and subsequent landings from the ocean are only from the bycatch fishery. Given this, the fishery is not expected to interact with Atlantic large whales or sea turtles.

In the past, approximately 40-500 Atlantic sturgeon were reportedly captured in the spring shad fishery in Delaware. In recent years, this fishery has turned more to striped bass. Most of the Atlantic sturgeon were captured in the Delaware Bay, with only 2 percent caught in the Delaware river. The fishery uses five-inch mesh gillnets that are left to soak overnight; based on the available information, there is little bycatch mortality (NMFS 2011a). Recreational hook and line shad fisheries are known to capture Atlantic sturgeon, particularly in southern Maine (NMFS 2011a).

Striped Bass Fishery

Since 1981, the Commission has managed striped bass, from Maine to North Carolina through an ISFMP. The striped bass fishery occurs only in state waters. With the exception of a defined area around Block Island, Rhode Island for possession, federal waters have been closed to the harvest and possession of striped bass since 1990. All states are required to have recreational and commercial size limits, recreational creel limits, and commercial quotas. The commercial striped bass fishery is closed in Maine, New Hampshire, and Connecticut, but open in Massachusetts (hook and line only), Rhode Island, New Jersey (hook and line only), Delaware, Maryland, and Virginia. Recreational striped bass fishing occurs all along the U.S. East Coast.

The striped bass fishery uses gears known to interact with sea turtles, including trap, pound nets, gillnets, trawl, and hook-and-line (ASMFC 2020b). When prorated by species landed, striped bass was one of the trawl and gillnet fisheries in which sea turtles were estimated (Murray

2015b, 2018). Several states have reported incidental catch of Atlantic sturgeon during striped bass fishing activities (NMFS 2011a). In southern Maine and New Hampshire, the recreational striped bass fishery is known to catch Atlantic sturgeon, although numbers are not available. There are also numerous reports of Atlantic sturgeon bycatch in recreational striped bass fishery along the south shore of Long Island, particularly around Fire Island and Far Rockaway. Unreported mortality is likely occurring.

Data from the Atlantic Coast Sturgeon Tagging Database showed that from 2000-2004, the striped bass fishery accounted for 43 percent of Atlantic sturgeon recaptures (ASSRT 2007). The striped bass-weakfish fishery also had one of the highest bycatch rates of 30 directed fisheries according to NMFS Observer Program data from 1989-2000 (ASSRT 2007).

State gillnet fisheries

State gillnet fisheries occur in many portions of the action area. However, limited information is available on interactions between these fisheries and protected species. Large and small mesh gillnet fisheries occur in state waters. For example, the black drum shark gillnet fisheries in Virginia state waters fisheries uses large mesh (10- to 14-inch) gillnets. Meshes smaller than 10 inches are used in the croaker and dogfish fisheries. Entanglements of sea turtles in large mesh gillnet sets targeting and/or landing black drum have been recorded (NEFSC observer/sea sampling database, unpublished data). Similarly, sea turtles are vulnerable to capture in small mesh gillnet fisheries occurring in state waters. Observer coverage in state gillnet fisheries has been limited. For example, 31 trips were observed in the Long Island Sound gillnet fishery from 2014 through 2018. There has also been limited coverage on coastal gillnet fisheries in the mid-Atlantic on vessels with federal permits and, to a lesser extent, vessels with state only permit. Through this limited coverage, interactions have been recorded with Kemp's ridley, loggerhead, green, and leatherback sea turtles in gillnets operating in state waters (NEFSC observer/sea sampling database, unpublished data). As gillnet gear is known to pose an interaction risk to listed species of sea turtles, sturgeon, and large whales, these fisheries have the potential to interact with these species when the fisheries overlap with them

High levels of strandings in North Carolina in 1999 were determined to likely result from incidental capture in the large mesh gillnet fishery in Pamlico Sound. Since 2000, NMFS has issued five ESA section 10(a)(1)(B) Incidental Take Permits (65 FR 65840, November 2, 2000; 66 FR 51023, October 5, 2001; 67 FR 67150, November 4, 2002; 70 FR 52984, September 6, 2005; 78 FR 57132, September 17, 2013) to the North Carolina Division of Marine Fisheries authorizing the incidental take of sea turtles in certain components of the gillnet fishery. The most recent permit (78 FR 57132, September 17, 2013) authorizes the take through August 2023. Required measures under the permit include restricted soak times, restricted net lengths, attendance requirements, time-area closures, and adaptive management (78 FR 57132, September 17, 2013). North Carolina DMF also has a permit for the incidental take of Atlantic sturgeon DPSs associated with the inshore gillnet fishery. The conservation plan requires specific monitoring for Atlantic sturgeon. If allowable thresholds are approached, North Carolina DMF will place additional restrictions (e.g., closures, attendance requirements) on the fishery. In addition, the observer coverage will identify and adaptively respond to "hotspots" (79 FR 43716, July 28, 2014). The level of take specified in these permits is detailed in section 5.1.4.

The 2017 Benchmark Assessment (ASMFC 2017) used data from the Northeast Fisheries Observer Program, the North Carolina gillnet fisheries, and the South Carolina American shad

gillnet fishery to assess Atlantic sturgeon bycatch. For the North Carolina gillnet fisheries predicted bycatch for 2004-2005 ranged from 1,286 Atlantic sturgeon in 2011 to 13,668 Atlantic sturgeon in 2008. The Atlantic sturgeon caught in this fishery were primarily juveniles. The percent observed sturgeon that dies ranged from 0-20 percent with an overall mean of 6 percent. Estimates of dead discards ranged from 0-424 fish (ASMFC 2017).

In 2017, 167 Atlantic sturgeon were reported as bycatch from state water fisheries (0-3 miles offshore, including rivers and estuaries). This included 51 fish in the North Carolina gillnet fishery and 66 fish in the South Carolina American shad fishery. Connecticut (15), Maryland (1), Virginia (11), and Georgia (23) also reported bycatch in 2017 (ASMFC 2019d).

State Trawl Fisheries

Trawl fisheries also occurs in state waters in the action area. Virginia (VA Code Ann. § 28.2-315), New Hampshire (N.H. Stat. Ann. §21149), and Delaware (Del. Code tit. 7, §927) prohibit trawling in state waters. Other states such as Maryland prohibit its use in certain areas.

A Northern shrimp fishery has occurred in waters off Maine, New Hampshire, and Massachusetts, and is managed under the Commission's ISFMP. Due to recruitment failure and a collapsed stock, fishing moratoria were instituted by the Commission for the 2014-2018 fishing seasons. In November 2018, the Commission's Northern Shrimp Section extended the moratorium on commercial fishing through 2021. The majority of northern shrimp are caught with otter trawls, which must be equipped with Nordmore grates (ASMFC 2011). When the fishery is open, it is a winter fishery with the season occurring anytime between December 1 and May 31 (ASMFC 2017).

Bottom otter trawls in the Northern shrimp fishery are known to interact with Atlantic sturgeon, but exact numbers are not available (NMFS 2011a). A majority (84 percent) of Atlantic sturgeon bycatch in otter trawls occurs at depths less than 66 ft (20 m), with 90 percent occurring at depths of less than 98 ft (30 m) (ASMFC 2007). During the NEFSC's spring and fall inshore northern shrimp trawl surveys, northern shrimp are most commonly found in tows with depths of greater than 210 ft (64 m) (ASMFC 2011), which is well below the depths at which most Atlantic sturgeon bycatch occurs.

Given that the Northern shrimp trawl fishery is a winter fishery, it is not expected to overlap with sea turtles in the action area. Given the gear type used in the fishery, it is also not expected to interact with large whales.

Other trawl fisheries occur in state waters, but information is limited. In these fisheries, the gear may operate along or off the bottom. From 2009-2018, observers have documented the take of Kemp's ridley, loggerhead, green, and leatherback sea turtles in state waters (NEFSC observer/sea sampling database, unpublished data). The top landed species on trips that captured turtles included scup, summer flounder, longfin squid, horseshoe crab, and butterfish. Atlantic sturgeon have also been observed captured on state trawl fisheries from 2009-2018. Top landed species on these trips included, among others, summer flounder, little skate, scup, butterfish, longfin squid, spiny dogfish, smooth dogfish, and bluefish. During this period, there were no Atlantic salmon documented captured in state waters. Information available on interactions between ESA-listed species and these fisheries is incomplete.

State Recreational Fisheries

Observations of state hook and line recreational fisheries have shown that loggerhead, Kemp's ridley, leatherback, and green sea turtles can interact with recreational fishing gear. When swimming near rod and reel fishing gear, sea turtles can be "foul-hooked" on the flipper or entangled in the fishing line. Sea turtles are also known to bite the bait and become hooked in the mouth or esophagus, or swallow the hook. Most of the reports of interactions come from fishing piers, but there are also reports of offshore captures (NMFS and USFWS 2008). A summary of known impacts of hook and line captures on loggerhead, Kemp's ridley, and leatherback sea turtles can be found in the TEWG reports (TEWG 1998, 2000, 2007, 2009).

Stranding data also provide evidence of interactions between recreational hook and line gear and sea turtles. While data from stranded animals contain certain biases and cannot be used to quantify the magnitude of a particular threat, it does provide some information on interactions with recreational gear. From Maine through Virginia, there were 186 cases reported from 2016-2018 in the STSSN database in which recreational fishing gear was present (NMFS STSSN, unpublished data). This included 36 loggerhead, 122 Kemp's ridley, 2 green, 1 leatherback, and 25 unknown turtles. NMFS conducts outreach on what to do if you hook or entangle a sea turtle while fishing. In addition, Virginia Aquarium's Stranding Response Program has developed a pier partner program that provides signage for the pier and training to the pier operator on what to do if a sea turtle is hooked. Since the program began in 2014, there have been 253 reports received with 172 animals admitted. In 2018, the Aquarium received a record number of hooked turtle reports. Of the 66 reported cases, they admitted 45 turtles for exam. Almost 87 percent of these turtles were Kemp's ridleys. Turtle captures on recreational hook and line gear are not uncommon, but the overall level of take and post-release mortality are unknown.

Bycatch in recreational fisheries in Maine may result in direct mortality or cause stress, thus reducing reproductive success and survival of Atlantic salmon (USFWS and NMFS 2019). Recreational angling is for freshwater species throughout the range of the GOM DPS. This is outside the area where the fisheries undergoing consultation operate.

Atlantic sturgeon have also been observed captured in hook and line gear, yet the total number of interactions that occur annually is unknown. There have been no post-release survival studies for this species. However, we anticipate that Atlantic sturgeon will likely be released alive, due to the overall hardiness of the species. NMFS also engages in educational outreach efforts on disentanglement, release, and handling and resuscitation of Atlantic sturgeon.

5.3. Other Activities

5.3.1. Maritime Industry

Private and commercial vessels, including fishing vessels, operating in the action area of this consultation also have the potential to interact with ESA-listed species. The effects of fishing vessels, recreational vessels, or other types of commercial vessels on listed species may involve disturbance or injury/mortality due to collisions or entanglement in anchor lines. Commercial traffic and recreational pursuits can also adversely affect ESA-listed species through propeller- and boat strikes. Vessel interactions have been documented with large whales, sea turtles, Atlantic sturgeon, and giant manta rays. The extent of the problem is difficult to assess because the interactions occur at sea and are often only detected when the animal strands. It is also often not known if the animal was struck pre- or post-mortem. It is important to note that although

minor vessel collisions may not result in a direct mortality, they may weaken or otherwise affect an animal, which may make it more vulnerable to other threats.

5.3.2. **Pollution**

Anthropogenic sources of marine pollution, while difficult to attribute to a specific federal, state, local, or private action, may affect ESA-listed species in the action area. Sources of pollutants in the action area include atmospheric loading of pollutants (e.g., PCBs); storm water runoff from coastal towns, cities, and villages; runoff into rivers emptying into bays; groundwater discharges; sewage treatment plant effluents; and oil spills. Oil spills may affect ESA-listed species either directly or through the food chain (see section 5.1.7).

Degraded water quality from point and non-point sources can impact protected species. Run-off can introduce pesticides, herbicides, and other contaminants into the system on which these species depend. Contaminants could degrade habitat if pollution and other factors reduce the food available to marine animals. In 2017, NMFS completed a biological opinion on EPA's registration of certain pesticides. Effects ranged from mortalities to reductions in prey, and impaired growth. Species likely to be affected include, among others, Atlantic salmon, Atlantic sturgeon (all five DPSs), and sea turtles. In specifying the ITS, NMFS identified surrogates for anadromous fish and sea turtles (NMFS 2017).

Oil spills, resulting from anthropogenic activities (e.g., commercial vessel traffic/shipping), directly and indirectly affect all components of the marine ecosystem. Larger oil spills may result from severe accidents, although these events would be rare. The pathological effects of oil spills on sea turtles specifically have been documented in several laboratory studies (Vargo et al. 1986). There have been a number of documented smaller oil spills in the northeastern United States.

As many ESA-listed species ranges extend beyond that of the action area, oil spills that occur outside the action area, but within the range of the species, also have the potential to affect ESA-listed species that occur within the action area. For instance, on April 20, 2010, the Deepwater Horizon oil spill occurred off the coast of Louisiana, in the Gulf of Mexico. The effects of this spill on ESA-listed species is discussed in the *Status of the Species* section.

Marine debris (e.g., discarded fishing line, boat lines, plastics) can directly or indirectly affect listed species. Discarded line (fishing or boat) can entangle large whales, Atlantic sturgeon, or sea turtles, causing injury or mortality. Large whales and sea turtles ingest plastic. In the case of sea turtles, they may mistake debris for food. For instance, jellyfish are a preferred prey for leatherbacks, and plastic bags, which may look like jellyfish to the turtles, are often found in the turtles' stomach contents (Mrosovsky et al. 2009, Nelms et al. 2015, NRC 1990, Schuyler et al. 2014). While marine debris is known to affect these species, the effects have not been quantified and impacts at the population level are not well understood.

5.3.3. **Coastal development**

Beachfront development, lighting, and beach erosion control are ongoing activities along the coastlines of the United States and within the action area. In the southeast and mid-Atlantic, these activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Human activities along nesting beaches at night may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more and more coastal counties are adopting

stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

Coastal development may also impact Atlantic sturgeon if it disturbs or degrades foraging habitats or otherwise affects the ability of sturgeon to use coastal habitats.

5.4. Reducing Threats to ESA-listed Species

5.4.1. *Education and Outreach Activities*

Education and outreach activities are some of the primary tools to effectively reduce the threats to all protected species. For example, NMFS has been active in public outreach to educate fishermen about sea turtle handling and resuscitation techniques and educate recreational fishermen and boaters on how to avoid interactions with marine mammals, sea turtles, and sturgeon. NMFS is engaged in a number of education and outreach activities aimed specifically at increasing mariner awareness of the threat of ship strikes to protected species. NMFS also offers educational programs to students. One such program is “SCUTES” (Student Collaborating to Undertake Tracking Efforts for Sturgeon), which offers educational programs and activities about the movements, behaviors, and threats to Atlantic sturgeon. While the effects of these efforts at reducing impacts to protected species cannot be quantified, they are anticipated to reduce impacts through education and promoting stewardship. Outreach occurs through websites, NMFS presence at industry meetings, outreach events and trade shows, publications in industry trade journals and news outlets, and dockside interactions between staff and industry. NMFS intends to continue these outreach efforts in an attempt to reduce interactions and the likelihood of injury to protected species and to potentially improve the condition of the ESA-listed species or its designated critical habitat in the action area.

5.4.2. *Stranding and Salvage Programs*

The STSSN does not directly reduce the threats to sea turtles. However, the extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts not only collects data on dead sea turtles, but also rescues and rehabilitates live stranded turtles, reducing mortality of injured or sick animals. NMFS manages the activities of the STSSN. Data collected by the STSSN are used to monitor stranding levels, to identify areas where unusual or elevated mortality is occurring, and to identify sources of mortality. The data are also used to monitor incidence of disease, study toxicology and contaminants, and conduct genetic studies to determine population structure. All of the states that participate in the STSSN tag live turtles when encountered (either via the stranding network, through incidental takes, or permitted in-water studies). Tagging studies help improve our understanding of sea turtle movements, longevity, and reproductive patterns, all of which contribute to our ability to reach recovery goals for sea turtle species.

NMFS was designated the lead agency to coordinate the Marine Mammal Health and Stranding Response Program (MMHSRP), which was formalized by the 1992 Amendments to the MMPA. The program consists of state volunteer stranding networks, biomonitoring, Analytical Quality Assurance for marine mammal tissue samples, a Working Group on Marine Mammal Unusual Mortality Events (UME) and a National Marine Mammal Tissue Bank. Additionally, a serum bank and long-term storage of histopathology tissue are being developed. The MMHSRP’s permit (permit #18786) includes the incidental take of unidentified sea turtles (10), leatherback sea turtles (2), and Atlantic sturgeon (3).

A salvage program operating under an ESA section 10(a)(a)(A) permit is in place for Atlantic sturgeon. Atlantic sturgeon carcasses can provide pertinent life history data and information on new or evolving threats to Atlantic sturgeon. Their use in scientific research studies can reduce the need to collect live Atlantic sturgeon. The NMFS Sturgeon Salvage Program is a network of individuals qualified to retrieve and/or use Atlantic and shortnose sturgeon carcasses and parts for scientific research and education. All carcasses and parts are retrieved opportunistically and participation in the network is voluntary.

5.4.3. *Disentanglement Networks*

In 2002, in response to the high number of leatherback sea turtles found entangled in pot gear along the U.S. Northeast Atlantic coast, NMFS Northeast Region (now GARFO) established the NMFS Greater Atlantic Region Sea Turtle Disentanglement Network (GAR STDN). The GAR STDN is a component of the larger STSSN program, and operates in all states in the region. The GAR STDN responds to entangled sea turtles, disentangling and releasing live animals, thereby reducing injury and mortality. In addition, the GAR STDN collects data on sea turtle entanglement events, providing valuable information for management purposes. GARFO oversees the GAR STDN program and manages the GAR STDN database.

Any agent/employee of NMFS, the USFWS, the USCG, any other federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his/her official duties, is allowed to take endangered sea turtles encountered in the marine environment if such taking is necessary to: (1) aid a sick, injured, or entangled endangered sea turtle; (2) dispose of a dead endangered sea turtle; or (3) salvage a dead endangered sea turtle for scientific or educational purposes (70 FR 42508, July 25, 2005. NMFS affords the same protection to sea turtles listed as threatened under the ESA (50 CFR 223.206(b)).

In 1984, the Center for Coastal Studies (CCS) in partnership with NMFS, developed techniques for disentangling free-swimming large whales from life threatening entanglements. Over the next decade, CCS and NMFS continued working on the development of the technique to safely disentangle both anchored and free swimming large whales. In 1995, NMFS issued an official permit to CCS to disentangle large whales. This initial partnership led to the establishment of the Atlantic Large Whale Disentanglement Network (ALWDN). This network represents a coordinated effort between NMFS, large whale researchers, state agencies, and other federal partners, to implement and monitor efforts to remove and recover entangling fishing gear from large whales along the entire Atlantic coast. The ALWDN is managed by NMFS and is implemented through a series of permits and Memorandums of Agreement. Due to the success of the disentanglement networks, NMFS believes protected species that may otherwise have succumbed to complications from entangling gear have been freed and have survived.

5.4.4. *Regulatory Measures for Sea Turtles*

Large-Mesh Gillnet Requirements in the Mid-Atlantic

Since 2002, NMFS has regulated the use of large mesh gillnets in federal waters off North Carolina and Virginia (67 FR 13098, March 21, 2002) to reduce the impact of these fisheries on ESA-listed sea turtles. These restrictions were revised in 2006 (73 FR 24776, April 26, 2006). Currently, gillnets with stretched mesh size of 7 inches (17.8 cm) or larger are prohibited in the Exclusive Economic Zone during the following times and in the following areas:

- (1) north of the North Carolina/South Carolina border to Oregon Inlet, North Carolina at all times,
- (2) north of Oregon Inlet, North Carolina to Currituck Beach Light, North Carolina from March 16 through January 14,
- (3) north of Currituck Beach Light, North Carolina to Wachapreague Inlet, Virginia from April 1 through January 14, and
- (4) north of Wachapreague Inlet, Virginia to Chincoteague, Virginia from April 16 through January 14.

NMFS has also issued regulations to address the interaction of sea turtles in gillnet gear fished in Pamlico Sound, North Carolina. Waters of Pamlico Sound are closed to fishing with gillnets with a stretched mesh size larger than 4 ¼ inches (10.8 cm) from September 1 through December 15 each year to protect sea turtles. The closed area includes all inshore waters of Pamlico Sound, and all contiguous tidal waters, south of 35° 46.3' N, north of 35° 00' N, and east of 76° 30' W (50 CFR 223.206). As described above, NMFS has also issued incidental take permits for Atlantic sturgeon and sea turtles in Pamlico Sound gillnet fisheries. The permit includes mandatory measures to reduce take, and impacts from take, in this fishery.

TED Requirements in Trawl Fisheries

Turtle excluder devices (TEDs) are required in the summer flounder and southeast shrimp fisheries. TEDs allow sea turtles to escape the trawl net, reducing injury and mortality resulting from capture in the net. Approved TEDs are required in the shrimp trawl fishery operating in the Atlantic and Gulf Areas (50 CFR 222.102) unless the trawler is fishing under one of the exemptions (e.g., bait shrimper, pusher-head trawl,) and all requirements of the exemption are met (50 CFR 223.206). On February 21, 2003, NMFS issued a final rule to amend the TED regulations to enhance their effectiveness in the Atlantic and Gulf Areas of the southeastern United States by requiring an escape opening designed to exclude leatherbacks as well as large loggerhead and green turtles (68 FR 8456). NMFS published a final rule, effective April 1, 2021, that requires TEDs to exclude small turtles on skimmer trawls vessels 40 ft (12 m) or greater in length (84 FR 70048, December 20, 2019). On March 31, 2021, NMFS delayed the effective date until August 1, 2021 (86 FR 16677).

TEDs are also required for summer flounder trawlers in the summer flounder fishery-sea turtle protection area. This area is bounded on the north by a line extending along 37° 05' N (Cape Charles, VA) and on the south by a line extending out from the North Carolina-South Carolina border. Vessels north of Oregon Inlet, NC are exempt from the TED requirement from January 15 through March 15 each year (50 CFR 223.206). The TED requirements for the summer flounder trawl fishery do not require the use of the larger escape opening.

Pound net requirements in Virginia

NMFS has issued several regulations to help protect sea turtles from entanglement in and impingement on Virginia pound net gear (66 FR 33489, June 22 2001; 67 FR 41196; June 17, 2002; 68 FR 41942, July 16, 2003; 69 FR 24997, May 5, 2004; 71 FR 36024; June 23, 2006; 73 FR 68348, November 18, 2008; 80 FR 6925, February 9, 2015). All offshore pound leaders in Pound Net Regulated Area I (Figure 49) must meet the definition of a modified pound net leader from May 6 through July 15. The modified leader has been found to be effective in reducing sea turtle interactions as compared to the unmodified leader. Under the ESA regulations, nearshore pound net leaders in Pound Net Regulated Area I and all pound net leaders in Pound Net

Regulated Area II must have mesh size less than 12 inches (30.5 cm) stretched mesh and may not employ stringers (50 CFR 223.206) from May 6 through July 15 each year. A pound net leader is exempt from these measures only if it meets the definition of a modified pound net leader. The 2015 regulation (80 FR 6925) modified the definitions of offshore and inshore pound net leaders under the ESA. In addition, there are compliance training, monitoring and reporting requirements in this fishery (50 CFR 223.206).

Under the Bottlenose Dolphin Take Reduction Plan (section 5.4.9), fishermen with offshore pound nets must use a modified pound net leader year-round within the Bottlenose Dolphin Pound Net Regulated Area (Figure 49). Pound nets fished in offshore and inshore areas must be fished with all three continuous sections (i.e., pound, heart, and leader) in the Bottlenose Dolphin Pound Net Regulated Area or Regulated Areas I and II under the ESA sea turtle conservation requirements. An exception is that one or more sections may be missing for up to 10 days for setting, removing, and/or repairing the gear.

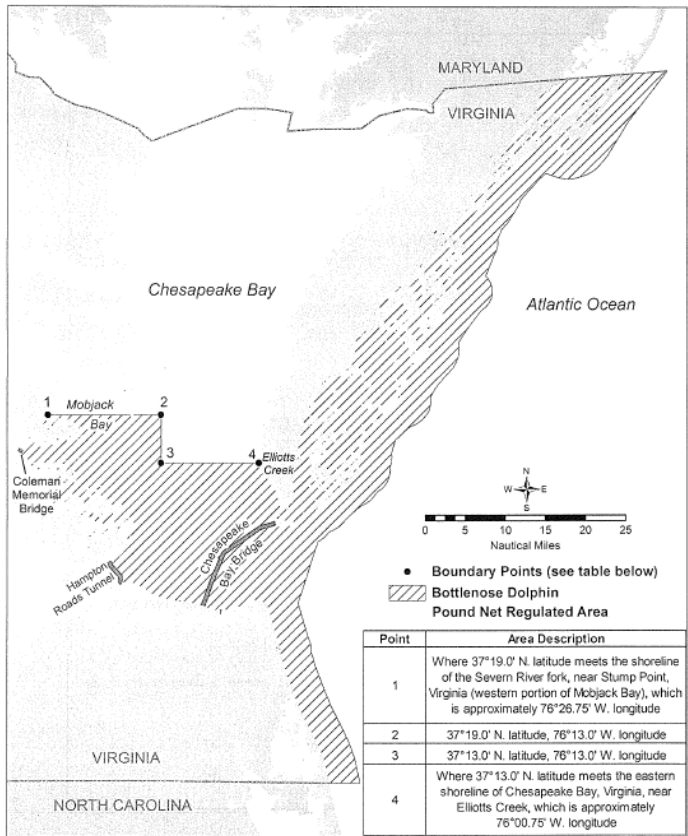


Figure 49: Bottlenose dolphin pound net regulated area

Longline requirements in the HMS fishery

In 2020, NMFS SERO completed two biological opinions on the FMP for the Atlantic HMS fisheries for swordfish, tunas, and sharks (NMFS 2020c, d). These opinions concluded that the actions are not likely to jeopardize the continued existence of any hard-shell or leatherback sea turtle. Sea turtle conservation requirements in the HMS fishery are related to the fishing gear, bait, and disentanglement gear and training (50 CFR 648.21). NMFS requires the use of specific gears and release equipment in the pelagic longline component of the HMS fishery in order to

minimize lethal impacts to sea turtles. NMFS has developed sea turtle handling and release protocols for the HMS fishery (NMFS 2010a). Sea turtle handling and release placards are required to be posted in the wheelhouse of certain commercial fishing vessels. NMFS has also initiated an extensive outreach and education program for commercial fishermen that engage in these fisheries in order to minimize the impacts of this fishery on sea turtles. As part of the program, NMFS has distributed sea turtle identification and resuscitation guidelines to HMS fishermen who may incidentally hook, entangle, or capture sea turtles during their fishing activities and has also conducted hands-on workshops on safe handling, release, and identification of sea turtles.

Modified Dredge Requirements in the Atlantic Sea Scallop Fishery

In response to the observed capture of sea turtles in scallop dredge gear, including injuries and mortality as a result of capture, NMFS required federally-permitted scallop vessels fishing with dredge gear to modify their gear by adding an arrangement of horizontal and vertical chains (hereafter referred to as a “chain mat”) between the sweep and the cutting bar. This modification was required when fishing in Mid-Atlantic waters south of 41° 9’ N from the shoreline to the outer boundary of the EEZ during the period of May 1-November 30 each year (70 FR 30660, May 27, 2005). The requirement was subsequently modified by emergency rule on November 15, 2006 (71 FR 66466) and by final rules published on April 8, 2008 (73 FR 18984) and May 5, 2009 (74 FR 20667). In 2015, NMFS aligned the requirements with the turtle deflector dredge (TDD) requirements as described below. Since 2006, the chain mat modifications have reduced the severity of most sea turtle interactions with scallop dredge gear (Murray 2011, 2015a). However, these modifications are not expected to reduce the overall number of sea turtle interactions with scallop dredge gear.

Beginning May 1, 2013, all limited access scallop vessels, as well as Limited Access General Category vessels with a dredge width of 10.5 ft (3.2 m) or greater, were required to use a TDD in the Mid-Atlantic (west of 71° W) from May 1 through October 31 each year (77 FR 20728, April 6, 2012). The purpose of the TDD requirement is to deflect sea turtles over the dredge frame and bag rather than under the cutting bar, so as to reduce sea turtle injuries due to contact with the dredge frame on the ocean bottom (including being crushed under the dredge frame). When combined with the effects of chain mats, which decrease captures in the dredge bag, the TDD should provide greater sea turtle benefits by reducing injury and mortality due to interactions with the dredge frame, compared to a standard New Bedford dredge.

In 2015, NMFS aligned the TDD and chain mat requirements (80 FR 22119, April 21, 2015). Currently, chain mats are required on any vessel with a sea scallop dredge and required to have a federal Atlantic sea scallop fishery permit, regardless of dredge size or vessel permit category, entering waters west of 71° W from May 1 through November 30. Similarly, any limited access scallop vessel and limited access general category vessel with a dredge width of 10.5 ft (3.2 m) or greater is required to use a TDD west of 71° W from May 1 through November 30.

Handling and Resuscitation Requirements

NMFS has developed and published sea turtle handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities (66 FR 67495, December 31, 2001). Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear.

NMFS has conducted outreach to fishermen participating in fisheries in the Greater Atlantic Region, providing wheelhouse cards detailing the requirements.

5.4.5. *Atlantic Large Whale Take Reduction Plan*

The Plan reduces the risk of serious injury or mortality of North Atlantic right, fin, and humpback whales due to incidental entanglement in U.S. commercial trap/pot and gillnet fishing gear. The Plan is required by the Marine Mammal Protection Act (MMPA) and has been developed through a collaborative Take Reduction Team process implemented by NMFS. The Plan covers the U.S. Atlantic EEZ from Maine through Florida (26°46.5' N). Requirements are year-round in the Northeast, and seasonal in the Mid and South Atlantic. Fisheries in this Opinion that are regulated under the ALWTRP include Northeast multispecies, monkfish, spiny dogfish, skate, bluefish, American lobster, Jonah crab, and red crab. This section describes measures currently in effect (see section 3.2.1 for proposed measures for the lobster and Jonah crab fisheries).

The Atlantic Large Whale Take Reduction Team (ALWTRT) consists of fishing industry representatives, environmentalists, state and federal officials, and other interested parties. The Take Reduction Plan is an evolving plan that changes as NMFS and the Team learn more about why whales become entangled and how fishing practices might be modified to reduce the risk of entanglement. Regulatory actions are directed at reducing serious entanglement injuries and mortalities of right, humpback, and fin whales from fixed gear fisheries (i.e., trap/pot and gillnet fisheries). The non-regulatory component of the Plan is composed of four principal parts: (1) gear research and development, (2) disentanglement, (3) the Right Whale Sighting Advisory System (RWSAS), and (4) education/outreach. These components will be discussed in more detail below. The first regulations stemming from the Plan went into effect in 1997.

Regulatory Measures to Reduce the Threat of Entanglement on Whales

The regulatory component of the Plan includes a combination of broad fishing gear modifications and time-area restrictions supplemented by progressive gear research to reduce the chance that entanglements will occur, or that whales will be seriously injured or die because of an entanglement. The long-term goal, established by the 1994 Amendments to the MMPA, is to reduce entanglement related serious injuries and mortalities of right, humpback and fin whales to insignificant levels approaching zero within five years of Plan implementation. Despite measures of the Plan, entanglements, including serious injuries or mortalities, continued to occur. Data on whale distribution, gear distribution and configuration, and all gear observed on or taken off whales is examined. Revisions are made to the Plan by implementing regulations as new information and technology becomes available.

The Team initially concluded that all parts of gillnet and trap/pot gear can and have caused entanglements. Research and testing has been ongoing to identify risk reduction measures that are feasible. Initial measures included, among others, seasonal closures, gear marking and the introduction of weak links to facilitate a whale's ability to break through the gear (62 FR 39157, July 22, 1997). In 2000, additional or new gear modifications were implemented in the specific areas (65 FR 80368, December 21, 2000). In 2002, further gear modifications (67 FR 1300, January 10, 2002), as well as regulations requiring dynamic (67 FR 1133, January 9, 2002) and seasonal management (67 FR 1142, January 9, 2002) in response to whale occurrence were required. The regulations implemented in 2009, among others, removed the dynamic management requirement due to difficulty effectively implementing rapid requirements and

needing further protection outside these areas, and in place focused broad-based sinking horizontal ground line (line between traps) requirements to remove line from the water column, required expanded gear modifications (e.g., gear marking), and regulated additional trap/pot and gillnet fisheries. The 2014 regulations focused on reducing the number of and associated risk posed by vertical buoy lines, increased the size and the frequency of the required gear marks, and expanded one of the seasonal trap/pot closures (79 FR 36586, June 27, 2014 and 79 FR 73848, December 12, 2014). In 2015, the Team determined that additional unique gear marking was needed in certain areas to better determine where entanglements are actually occurring. Therefore, the newly expanded gear marking scheme was modified further (80 FR 30367, May 28, 2015).

The 2014 regulations implementing the “vertical line strategy” prioritized risk reduction in areas where there is the greatest co-occurrence of vertical lines and large whales using whale and vertical line distribution. These data were overlaid to demonstrate the combined densities by area. A model was developed and was constructed to allow gear configuration alternatives to be manipulated to determine what relative co-occurrence reductions (as a proxy for risk) could be achieved by gear configuration changes and/or effort reductions by area. This co-occurrence analysis was an integral component of the vertical line strategy.

Plan requirements may vary by gear type (gillnet or trap/pot) and area. The major requirements include:

- No buoy line floating at the surface.
- No wet storage of gear (all gear must be hauled out of the water at least once every 30 days. In federal waters in the Southeast trap/pots must be returned to shore at the end of every trip).
- In most waters, surface buoys and buoy line need to be marked to identify the vessel or fishery.
- All buoys, flotation devices, and/or weights must be attached to the buoy line with a weak link. Specific breaking strengths may vary by area. This measure is designed so that if a large whale does become entangled, it should be able to exert enough force to break the weak link and break free of the buoy (lobster gear) or net panels (gillnet), increasing the chance of releasing the gear and reducing the risk of injury or mortality.
- In most waters, groundline must be made of sinking line.
- All buoy lines need to be marked three times (top, middle, bottom) with three marks along a 12 inch (30.5 cm) area. This measure is intended to help managers learn more about where and when entanglements occur.
- Minimum trap per trawl requirements based on area fished and miles from shore.

There are also two seasonal trap/pot closures (Figure 50) under the Plan: the Great South Channel Trap/Pot Closure (50 CFR 229.32(c)4) and the Massachusetts Restricted Area (50 CFR 229.32(c)3). Great South Channel Trap/Pot Closure prohibits fishing with, setting, or possessing trap/pot gear in this area unless stowed in accordance with §229.2 from April 1 through June 30. Cape Cod Bay is also closed to gillnet fishing from January 1 to May 15. These periods coincide with the presence of right whales in these areas. The Massachusetts Restricted Area prohibits fishing with, setting, or possessing trap/pot gear in this area unless stowed in accordance with §229.2 from February 1 to April 30. As described in the *Cumulative Effects*, the Commonwealth

of Massachusetts has implemented additional measures. The current measures include a February 1st through May 15th seasonal closure of all waters under the jurisdiction of the Commonwealth to trap gear fishing. This closure does not apply to waters under the jurisdiction of the Commonwealth within Lobster Management Area 2. There is also a January 1st through May 15th closure of Cape Cod Bay and certain adjacent waters to gillnet gear. These closures can be extended beyond the end date in response to the continued presence of right whales in the waters under the jurisdiction of the Commonwealth (322 CMR 12).

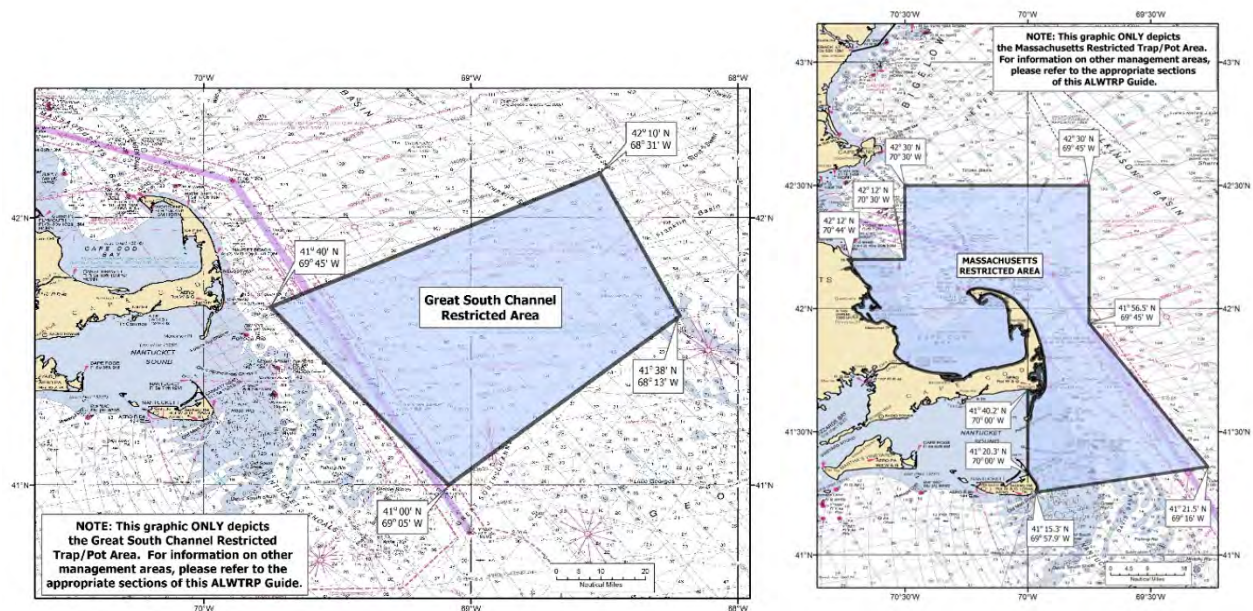


Figure 50: Great South Channel trap/pot closure and the Massachusetts Restricted Area under the ALWTRP

Non-regulatory Components of the ALWTRP

Gear research and development is a critical component of the Plan, with the aim of finding new ways of reducing the number and severity of large-gear interactions while still allowing for fishing activities. Development of gear modifications, including development of a roadmap to a future with ropeless fishing, are ongoing and are primarily used to minimize risk of large whale entanglement.

Outreach activities and products are considered important tools needed to reduce the threats to all protected species from human activities, including fishing activities. Outreach efforts to fishermen under the Plan aim to foster a more cooperative relationship between all parties interested in the conservation of threatened and endangered species. Outreach methods and tools include, but are not limited to, informative websites, NMFS presence at industry meetings, outreach events and trade shows, publications in industry trade journals and news outlets, and dockside interactions between port agents, regional gear liaisons, and industry members. Outreach guides and fact sheets have also been produced to help consolidate Plan requirements for easier access and understanding. Outreach and Plan information is also provided to the NEFSC Observer Program, USCG, and state/federal enforcement agents.

5.4.6. *Measures to Reduce Vessel Strikes to Large Whales*

The Ship Strike Reduction Program is currently focused on protecting the North Atlantic right whale, but the operational measures are expected to reduce the incidence of ship strike on other large whales to some degree. The program consists of five basic elements and includes both regulatory and non-regulatory components. Elements of the program include:

1. operational measures for the shipping industry, including speed restrictions and routing measures.
2. section 7 consultations with federal agencies that maintain vessel fleets.
3. education and outreach programs.
4. a bilateral conservation agreement with Canada.
5. ongoing measures to reduce ship strikes of right whales (e.g., RWSAS, ongoing research into the factors that contribute to ship strikes, and research to identify new technologies that can help mariners and whales avoid each other).

Restricting Vessel Approach to Right Whales

In a right whale recovery action aimed at reducing vessel-related impacts, including disturbance, NMFS published an interim final rule in 1997 restricting vessel approach to right whales to a distance of 500 yards (62 FR 6729, February 13, 1997). The Recovery Plan for the North Atlantic right whale identified anthropogenic disturbance as one of many factors that had some potential to impede right whale recovery (NMFS 2005). With certain exceptions, the rule prohibits both boats and aircraft from approaching any right whale closer than 500 yards.

Exceptions for closer approach are provided for the following situations, when:

1. compliance would create an imminent and serious threat to a person, vessel, or aircraft.
2. a vessel is restricted in its ability to maneuver around the 500-yard perimeter of a whale.
3. a vessel is investigating or involved in the rescue of an entangled or injured right whale.
4. the vessel or aircraft is participating in a permitted activity, such as a research project.

If a vessel operator has unknowingly approached closer than 500 yards, the rule requires that a course be steered away from the whale at slow, safe speed. In addition, all aircraft, except those involved in whale watching activities, are exempted from these approach regulations (50 CFR 224.103). This rule is expected to reduce the potential for vessel collisions and other adverse vessel-related effects in the *Environmental Baseline*.

Mandatory Ship Reporting System (MSR)

In April 1998, the USCG submitted, on behalf of the United States, a proposal to the International Maritime Organization (IMO) requesting approval of a mandatory ship reporting system (MSR) in two areas off the east coast of the United States: the right whale feeding grounds in the Northeast and the right whale calving grounds in the Southeast (Figure 51). The package was submitted to the IMO's Subcommittee on Safety and Navigation, as well as IMO's Marine Safety Committee; the package was approved in December 1998. On June 1, 1999, the USCG published an interim rule implementing the two MSRs (64 FR 29229); on November 20, 2001, the interim rule became final (69 FR 58066). The USCG and NOAA play important roles in helping to operate the MSR system. Ships entering the northeast and southeast MSR boundaries are required to report the vessel identity, date, time, course, speed, destination, and other relevant information. In return, the vessel receives an automated reply with the most recent

right whale sightings, management areas, and information on precautionary measures to take while near right whales.

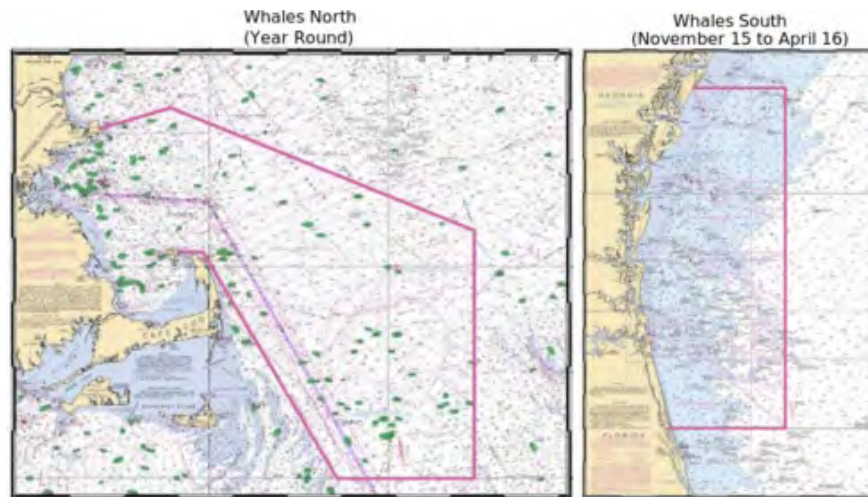


Figure 51: Mandatory ship reporting areas for North Atlantic right whales

Vessel Speed Restrictions

A key component of NOAA's right whale ship strike reduction program is the implementation of speed restrictions for vessels transiting the U.S. Atlantic in areas and seasons where right whales predictably occur in high concentrations. The Northeast Implementation Team (NEIT)-funded report "Recommended Measures to Reduce Ship Strikes of North Atlantic Right Whales" found that seasonal speed and routing measures could be an effective means of reducing the risk of ship strike along the U.S. East Coast (Russell 2001). Based on these recommendations, NMFS published regulations on October 10, 2008 to implement a 10-knot speed restriction for all vessels 65 feet (19.8 meters) or longer in Seasonal Management Areas (SMAs) (Figure 52) along the East Coast of the U.S. Atlantic seaboard at certain times of the year (73 FR 60173; October 10, 2008); on December 9, 2013, NMFS issued a final rule (78 FR 73726) eliminating the sunset provision on speed restrictions outlined in the 2008 rule. The SMAs encompass areas of high risk for whale-vessel collision along the U.S. Atlantic seaboard where right whale sightings predictably and consistently occur each year.

SMAs are supplemented by Dynamic Management Areas (DMAs) that are implemented for 15 days in areas in which right whales are sighted outside of SMA boundaries. When NOAA aerial surveys or other reliable sources report aggregations of three or more right whales in a density that indicates the whales are likely to persist in the area, NOAA calculates a buffer zone around the aggregation (Clapham and Pace 2001). The size of the DMA depends on the number of right whales sighted in the area. Mariners are requested to either avoid the area or travel through it at 10 knots (18.5 km/hr) or less. Compliance with the DMA zones is voluntary. NMFS announces the boundaries of the DMA via various mariner communication outlets, including NOAA

Weather Radio, USCG Broadcast Notice to Mariners, an interactive Google Map website, the Whale Alert app, MSR return messages, and email distribution lists, and the RWSAS.



Figure 52: Seasonal Management Areas (SMAs) to protect North Atlantic right whales

NMFS's 2008 10-knot vessel speed restrictions reduced the risk of lethal strikes of right whales by 38.5 percent in waters off the southeast United States (Lagueux et al. 2011) and 56.7 percent in waters off New England (Wiley et al. 2011). A subsequent analysis using data from 1990-2012 found that, though not directly coincident with SMA implementation, North Atlantic right whale vessel-strike mortalities significantly declined from 2.0 (2000-2006) to 0.33 per year (2017-2012). Large whale vessel-strike mortalities decreased inside active SMAs and increased outside active SMAs (van der Hoop et al. 2015). The research used to initiate vessel speed restrictions and studies subsequent to implementation of the regulations support continued use of the restrictions (Silber and Bettridge 2012).

NOAA recently conducted a review of the rule and assessed its effectiveness, as it pertains to right whale management (NMFS 2020g). The review found that vessel compliance varied by vessel type in active SMAs during 2018-2019. Fishing vessels showed the highest level of compliant transit (93%) while other cargo (44%) and pleasure vessels (31%) had particularly low levels of compliance (NMFS 2020g). This review concluded that since the speed rule was implemented, there has been a decline in the total number of documented right whale mortalities due to vessel strike, but an increase in serious²⁰ and non-serious injuries. The increase in seriously or non-seriously injured right whales by vessel interactions may be due to right whales being better able to avoid fatal vessel collisions due to slower vessel speeds, however, additional

²⁰ Under the MMPA, NMFS defines a serious injury as "any injury that will likely result in mortality (50 CFR 229.2) and further interprets the word "likely" as presenting a "greater than 50 percent chance of death."

analysis is required to fully evaluate this likelihood. Although the review lacked sufficient data to quantitatively assess a connection between the speed rule and the decline in observed right whale mortality due to vessel strikes, the assessment showed the speed rule had a positive effect in contributing to this change. Additionally, the review found that the speed restrictions put in place for right whales are not providing additional protection for other large whale species. The report also concluded that continued speed restrictions are warranted in light of the positive effect at reducing mortalities and also recommended that the regulations be strengthened (NMFS 2020g).

In addition to these federal regulations, the Massachusetts Division of Marine Fisheries has established similar measures to prevent strikes of whales by vessels smaller than 65 ft (20 m) (322 CMR 12.05(2) and (3)). During the period of March 1 through April 30, all vessels measuring less than 65 ft (20 m) overall length and operating within the Cape Cod Bay Restricted Speed Area²¹ shall travel at a speed of 10 knots (18.5 km/hr) or less. Exemptions include inshore areas (waters within Plymouth, Kingston and Duxbury Harbors, Barnstable Harbor and Wellfleet Harbor), as well as enforcement and emergency personnel.

Vessel Routing Measures to Reduce the Co-occurrence of Ships and Whales

Another critical, non-regulatory component of NOAA's right whale ship strike reduction program involves the development and implementation of routing measures that reduce the co-occurrence of vessels and right whales, thus reducing the risk of vessel collisions. Recommended routes were developed for the Cape Cod Bay feeding grounds and Southeast calving grounds by overlaying right whale sightings data on existing vessel tracks, and plotting alternative routes where vessels could expect to encounter fewer right whales. Details of these routes were completed at the end of November 2006. The routes are charted on all NOAA electronic and printed charts, published in U.S. Coast Pilots, and sent to mariners through USCG Notices to Mariners.

Through a joint effort between NOAA and the USCG, the United States also submitted a proposal to the IMO to shift the northern leg of the existing Boston Traffic Separation Scheme (TSS) 12 degrees to the north. Overlaying sightings of right whales and all baleen whales on the existing TSS revealed that the existing TSS directly overlaps with areas of high whale densities, while an area slightly to the north showed a considerable decrease in sightings. Analysis indicated the proposed TSS would overlap with 58 percent fewer right whale sightings and 81 percent fewer sightings of all large whales (Merrick 2005, Silber and Bettridge 2012), thus considerably reducing the risk of collisions between ships and whales. The proposal was submitted to the IMO in April 2006, and was adopted by the Maritime Safety Committee in December 2006 (Silber and Bettridge 2012). The shift took effect on July 1, 2007. In 2009, this TSS was modified by narrowing the width of the north-south portion by one mile to reduce the threat of ship collisions with endangered right whales and other whale species (Silber and Bettridge 2012).

²¹ The Cape Cod bay Restricted Speed Area is defined as all waters of Cape Cod Bay south of 42° 08' north latitude and those waters north and east of Cape Cod west of 70° 10' west longitude.

In 2009, NOAA and the USCG established the Great South Channel as an Area to be Avoided (ATBA). This is a voluntary seasonal ATBA for ships weighing 300 gross tons or more. The ATBA is in effect each year from April 1 to July 31 (Silber and Bettridge 2012), when right whales are known to congregate around the Great South Channel. The ATBA coupled with narrowing the TSS by one nautical mile will reduce the relative risk of right whale ship strikes by an estimated 74 percent during April-July (63 percent from the ATBA and 11 percent from the narrowing of the TSS (Merrick and Cole 2007)).

Right Whale Sighting Advisory System (RWSAS)

The Right Whale Sighting Advisory System (RWSAS) was initiated in early 1997 as a partnership among several federal and state agencies and other organizations to conduct aerial and ship board surveys to locate right whales and to alert mariners to right whale sighting locations in near real time. These right whale sighting reports are obtained from a variety of sources including the USCG, aerial surveys, shipboard surveys, whale watch vessels, and other sources (commercial ships, fishing vessels, and the general public). Right whale sightings Virginia to Maine can also be reported from by calling the NOAA hotline. In order to increase public awareness about the presence of right whales and the need to report sightings to the NOAA, right whale signs have been distributed throughout this region at boat ramps and marinas. In 2009, the Right Whale Sighting Advisory System was reengineered to support the SMA and DMA regulations to reduce the probability of lethal injury to right whales from collisions with ships (73 FR 60173, December 9, 2008).

Fishermen and other vessel operators can obtain RWSAS sighting reports, and make necessary adjustments in operations to decrease the potential for interactions with right whales. The RWSAS has also served as the only form of active entanglement monitoring in the Cape Cod Bay and Great South Channel feeding areas. Some of these sighting efforts have resulted in successful disentanglement of right whales. RWSAS flights have also contributed sightings of dead floating animals that can occasionally be retrieved, and necropsied to increase our knowledge of the biology of the species and effects of human impacts.

WhaleALERT

WhaleALERT is an application designed to augment existing ship navigation tools informing mariners of the safest and most current information to reduce the risk of ship and right whale collisions. Mariners along the U.S. east coast can now download an application that warns them when they enter areas of high risk of collision with North Atlantic right whales. The WhaleALERT app provides one source for information about right whale management measures and the latest data about right whale detections, all overlaid on NOAA digital charts.

5.4.7. North Atlantic Right Whale Recovery Plan Implementation Teams

Two multi-disciplinary teams advise NMFS on issues related to the status of right whales from Maine through Virginia (Northeast Implementation Team (NEIT)) and south of Virginia (Southeast Implementation Team). These teams work collaboratively on coastwide issues and independently on regional issues. They work to coordinate and effect recovery plan implementation through involving stakeholders, promoting creative solutions, monitoring effectiveness of implementation, and identifying and prioritizing information needs. The Recovery Plan Implementation Teams include a population evaluation tool subgroup which is working to develop a population viability analysis or other assessment tool that will help us

better characterize extinction risk, taking into account current and future threats. This analysis is still under development.

5.4.8. *Harbor Porpoise Take Reduction Plan (HPTRP)*

NMFS has implemented the HPTRP to decrease interactions between harbor porpoises and commercial gillnet gear in waters off New England and the Mid-Atlantic. Fisheries in this Opinion that are regulated under the HPTRP include Northeast multispecies, monkfish, spiny dogfish, bluefish, and skate. The HPTRP includes time and area closures and gear modification requirements. Time and area closures implemented by the HPTRP may decrease the chance of interactions between ESA-listed species that are present in the area at the time of the closure and gillnet gear. NMFS published a final rule amending the original plan on February 19, 2010 (75 FR 7383). In New England, amendments included the expansion of seasonal and temporal requirements within some existing HPTRP management areas, incorporation of additional management areas, and establishment of a consequence closure area strategy as an incentive to increase compliance and reduce bycatch levels in areas with historically high levels of harbor porpoise bycatch. In the Mid-Atlantic, amendments included the establishment of an additional management area, and modification to tie-down requirements for large mesh gillnet gear. The final rule also incorporated a research provision and amended some existing regulatory text for minor corrections and clarifications. For more information on the HPTRP including time and area closures, visit: <https://www.fisheries.noaa.gov/action/harbor-porpoise-take-reduction-plan-regulations>.

5.4.9. *Bottlenose Dolphin Take Reduction Plan (BDTRP)*

Under the BDTRP, NMFS has implemented restrictions for small, medium, and large-mesh gillnets along the Atlantic coast from New Jersey to Florida and in the Virginia pound net fishery. Fisheries in this Opinion that are regulated under the BDTRP include monkfish, spiny dogfish, skate, Northeast multispecies, and bluefish. The regulatory requirements seek to reduce soak times and modify fishing practices to limit bycatch of bottlenose dolphins. These regulations may also benefit ESA-listed species that are present in the area during BDTRP regulatory measures. The take reduction team meets periodically to monitor implementation and effectiveness of the plan. For more information on the BDTRP, visit: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/bottlenose-dolphin-take-reduction-plan>.

5.4.10. *Magnuson-Stevens Fishery Conservation and Management Act and Atlantic Coastal Fisheries Cooperative Management Act*

There are numerous regulations mandated by the MSA and ACA that may benefit ESA-listed species. Many fisheries are subject to different time and area closures. These area closures can be seasonal, year-round, and/or gear based. Closure areas may benefit ESA-listed species due to elimination of active gear in areas where ESA-listed species are present. However, if closures shift effort to areas with a comparable or higher density of ESA-listed marine mammals, sea turtles, or fish, and/or the shift in effort results in increases in gear soak or tow time and/or quantity of fishing gear set/towed in the affected area, then risk of interaction could increase. Fishing effort reduction (i.e., landing/possession limits or trap allocations) measures may also benefit ESA-listed species by limiting the amount of time that gear is present in the species environment. Additionally, gear restrictions and modifications required for fishing regulations may also decrease the risk of capture or entanglement with endangered species. National Standard 9 of the MSA specifies conservation and management measures shall, to the extent

practicable, (a) minimize bycatch and (b) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. This includes bycatch of sea turtles and ESA-listed fish. For a complete listing of fishery regulations in the action area visit:

<https://www.fisheries.noaa.gov/content/greater-atlantic-region-regulations>.

5.4.11. *Reducing Threats to Atlantic Sturgeon*

Several conservation actions aimed at reducing threats to Atlantic sturgeon are currently ongoing, including dam removals, moratoria on commercial and recreational fishing, and the implementation of a Sturgeon Salvage Network and educational programs for sturgeon throughout the U.S. Atlantic (e.g., SCUTES). In the near future, NMFS will be convening a recovery team, and drafting a recovery plan that will outline recovery goals, criteria, and steps necessary to recover all Atlantic sturgeon DPSs. To develop population estimates for each DPS, numerous research activities are underway, involving NMFS and other federal, state and academic partners, to obtain more information on the distribution and abundance of Atlantic sturgeon throughout their range. Guidelines developed by sturgeon researchers in cooperation with NMFS staff (Damon-Randall et al. 2010, Kahn and Mohead 2010, Moser et al. 2000) provide standardized research protocols that minimize the risk to sturgeon species from capture, handling and sampling. Efforts are also underway to better understand threats, such as poor water quality and bycatch, faced by the populations and ways to minimize these threats. Gear research is underway to design fishing gear that minimizes interactions with Atlantic sturgeon while maximizing retention of targeted fish species. Several states are in the process of preparing ESA section 10 Habitat Conservation Plans aimed at minimizing the effects of state fisheries on Atlantic sturgeon.

5.4.12. *Reducing Threats to Atlantic Salmon*

NMFS has worked with the Maine Department of Marine Resources (MDMR), USFWS, the Penobscot Indian Nation (PIN), and other partners to pursue a range of management and research activities to mitigate and reduce the most severe threats to Atlantic salmon. We have also worked with such partners to improve our understanding of salmon abundance and population health.

Since Atlantic salmon were listed, NMFS, MDMR, USFWS, PIN, and other partners have taken a number of steps to restore ecosystem function. Numerous dams have been removed and many new fishways have been constructed in Maine (USFWS and NMFS 2019). Among these are dam removals, including the recent removal of the Great Works and Veazie Dams located on the Penobscot River. Removal of these two dams allows Atlantic salmon and other diadromous fish unimpeded access to sections of the Penobscot River that they have not had in 200 years. Several small projects, such as bypasses, fishways, culvert replacements, and barrier (including dams) removal, helped restore physical and biological features necessary to further salmon recovery in the GOM DPS. There have also been efforts on the Kennebec River and the Seasticook River (USFWS and NMFS 2019). Comprehensive efforts encompassed the work of the Penobscot River Restoration Project and NMFS' designation of the Penobscot Habitat Focus Area. In addition, active stocking and fisheries management is supporting recovery of other diadromous species. In addition, the overall threat from aquaculture to the GOM DPS has also decreased substantially over the past decade (USFWS and NMFS 2019). Other recovery activities include: (1) conducting reviews of Species Protection Plans for FERC-licensed hydroelectric projects in the GOM DPS; (2) developing fish passage guidelines; and (3) consulting with federal partners to assure that federal actions minimize harm to Atlantic salmon.

NMFS also supports several annual assessment and monitoring efforts to gain greater understanding of Atlantic salmon movement patterns and community. This information will help inform future management decisions. Among these efforts are: (1) a satellite-tagging project of adult Atlantic salmon off the coast of West Greenland to track ocean movements; (2) a fish community study in the Penobscot River estuary; and (3) telemetry studies measuring Atlantic salmon smolt survival from the Penobscot River to the Gulf of Maine and monitoring fish at Halifax, Nova Scotia.

NMFS participates in the North Atlantic Salmon Conservation Organization (NASCO), the international governing body that jointly manages Atlantic salmon. Participation in NASCO has led to the development of multi-year regulatory measures for high-seas Atlantic salmon fisheries, international guidelines for salmon stocking, mitigation of threats from aquaculture practices, and country specific Action Plans that outline the implementation of all the NASCO guidelines.

We work with international partners to conduct annual sampling of the Atlantic salmon fishery in West Greenland. From this sampling, biological information is used to confirm catch, support international Atlantic salmon stock assessments, and determine salmon continent-of-origin, while providing a platform for research evaluating the ecological health of Atlantic salmon at Greenland.

5.4.13. *Reducing Threats under CITES*

North Atlantic right, fin, sei, and sperm whales and green, Kemp's ridley, loggerhead, and leatherback sea turtles are included on Appendix I of CITES. Appendix I lists species that are the most endangered among CITES-listed species. CITES prohibits international trade in specimens of these species except when the purpose of the import is not commercial, for instances for scientific research. In these cases, import and export permits are required to authorize trade to take place.

Atlantic sturgeon and giant manta rays are listed under Appendix II. This Appendix lists species that are not necessarily now threatened with extinction but may become so unless trade is tightly controlled. It also includes species whose specimens in trade look like those species listed for conservation reasons ("look-alike species"). International trade may be authorized through permits that ensure that the products were legally acquired and that the Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species (after taking into account factors such as its population status and trends, distribution, harvest, and other biological and ecological elements). Restrictions under CITES may help address the threat of overutilization for these species by ensuring that international trade is sustainable.

5.5. Status of the Species within the Action Area

5.5.1. *North Atlantic Right Whale*

North Atlantic right whales occur along the U.S. eastern seaboard of the Northwest Atlantic Ocean. Specifically, North Atlantic right whales occur from calving grounds in the southeastern United States (waters off of Georgia and Florida, with some suggestion that calving grounds may extend as far north as Cape Fear, North Carolina) to feeding grounds in New England waters into Canadian waters (Hayes et al. 2020; W.A. McLellan, Univ. of North Carolina Wilmington, pers. comm. as cited in Hayes et al. 2020). There is also at least one recent case of a calf apparently

being born in the Gulf of Maine (Patrician et al. 2009), and another newborn was detected in Cape Cod Bay in 2013 (CCS, unpublished data, as cited in Hayes et al. 2020).

Right whales predominantly occupy waters of the continental shelf, but are also known to make lengthy excursions into deep waters off the shelf (Baumgartner and Mate 2005, Davis et al. 2017, Hayes et al. 2020, Mate et al. 1997). Offshore of the Maine coast, the likelihood of a North Atlantic right whale being present increases with distance from shore (Roberts et al. 2016). Surveys have demonstrated the existence of several areas where North Atlantic right whales congregate seasonally, including areas in the action area such as the coastal waters of the southeastern U.S.; the Great South Channel; Jordan Basin; Georges Basin along the northeastern edge of Georges Bank; Cape Cod; Massachusetts Bay; and the continental shelf south of New England (Brown et al. 2002, Cole et al. 2013, Hayes et al. 2020, Leiter et al. 2017).

In the late fall months (e.g., October), pregnant female right whales move south to their calving grounds off Georgia and Florida, while the majority of the population likely remains on the feeding grounds or disperses along the eastern seaboard. Recent research indicates our understanding of their movement patterns remains incomplete (Davis et al. 2017). A review of visual and passive acoustic monitoring data in the western North Atlantic demonstrated nearly continuous year-round presence across their entire habitat range (for at least some individuals), including in locations previously thought of as migratory corridors (e.g., waters off New Jersey and Virginia). This suggests that not all of the population undergoes a consistent annual migration (Bort et al. 2015, Cole et al. 2013, Davis et al. 2017, Hayes et al. 2020, Leiter et al. 2017, Morano et al. 2012, Whitt et al. 2013).

New England waters are important feeding habitats for right whales, where they feed primarily on copepods (Hayes et al. 2020). The distribution of right whales is linked to the distribution of their principal zooplankton prey, calanoid copepods (Baumgartner and Mate 2005, NMFS 2005, Waring et al. 2012, Winn et al. 1986). Right whale calls have been detected by autonomous passive acoustic sensors deployed between 2005 and 2010 at three sites (Massachusetts Bay, Stellwagen Bank, and Jeffreys Ledge) in the southern Gulf of Maine (Morano et al. 2012, Mussoline et al. 2012). Comparisons between detections from passive acoustic recorders and observations from aerial surveys in Cape Cod Bay between 2001 and 2005 demonstrated that aerial surveys found whales on approximately two-thirds of the days during which acoustic monitoring detected whales (Clark et al. 2010).

Recent changes in right whale distribution (Kraus et al. 2016) are driven by warming deep waters in the Gulf of Maine (Record et al. 2019). Prior to 2010, right whale movements followed the seasonal occurrence of the late stage, lipid-rich copepod *C. finmarchicus* from the western Gulf of Maine in winter and spring to the eastern Gulf of Maine and Scotian Shelf in the summer and autumn (Beardsley et al. 1996, Mayo and Marx 1990, Murison and Gaskin 1989, Pendleton et al. 2009, Pendleton et al. 2012). Warming in the Gulf of Maine has resulted in changes in the seasonal abundance of late-stage *C. finmarchicus*, with record high abundances in the western Gulf of Maine in spring and significantly lower abundances in the eastern Gulf of Maine in late summer and fall (Record et al. 2019). One of the consequences of this has been a shift of right whales out of habitats such as the Great South Channel and the Bay of Fundy, and into areas such as the Gulf of St. Lawrence in the summer and south of New England and Long Island in the fall and winter (NMFS NEFSC, unpublished data).

In summary, we anticipate individual right whales to occur year round in the action area in both coastal, shallower waters as well as offshore, deeper waters. We expect these individuals to be moving throughout the action area, making seasonal migrations, foraging in northern parts of the action area when copepod patches of sufficient density are present, and calving during the winter months in southern waters of the action area.

5.5.2. *Fin Whale*

Fin whales occurring in the North Atlantic belong to the western North Atlantic stock (Hayes et al. 2020). They are typically found along the 328-ft (100-m) isobath but also in shallower and deeper water, including submarine canyons along the shelf break (Kenney and Winn 1987). Fin whales are migratory, moving seasonally into and out of feeding areas, but the overall migration pattern is complex and specific routes are unknown (Hayes et al. 2018b). The species occur year-round in a wide range of latitudes and longitudes, but the density of individuals in any one area changes seasonally. Thus, their movements overall are patterned and consistent, but distribution of individuals in a given year may vary according to their energetic and reproductive condition, and climatic factors (NMFS 2010c).

The northern Mid-Atlantic Bight represents a major feeding ground for fin whales as the physical and biological oceanographic structure of the area aggregates prey. Fin whales in this area feed on krill (*Meganyctiphanes norvegica* and *Thysanoessa inermis*) and schooling fish such as capelin (*Mallotus villosus*), herring (*Clupea harengus*), and sand lance (*Ammodytes* spp.) (Borobia et al. 1995) by skimming the water or lunge feeding. Several studies suggest that distribution and movements of fin whales along the east coast of the United States is influenced by the availability of sand lance (Kenney and Winn 1986, Payne 1990).

Fin whales are believed to use the North Atlantic water primarily for feeding and more southern waters for calving. Movement of fin whales from the Labrador/Newfoundland region south into the West Indies during the fall have been reported (Clark 1995). However, neonate strandings along the U.S. Mid-Atlantic coast from October through January indicate a possible offshore calving area (Hain et al. 1992).

In summary, we anticipate individual fin whales to occur in the action area year-round, with the highest numbers in the spring and summer. We expect these individuals to be making seasonal coastal migrations, and to be foraging during spring and summer months.

5.5.3. *Sei Whale*

Sei whales occurring in the North Atlantic belong to the Nova Scotia stock (Hayes et al. 2020). They can be found in deeper waters of the continental shelf edge waters of the northeastern United States and northeastward to south of Newfoundland (Hain et al. 1985), and NMFS aerial surveys found substantial numbers of sei whales in this region, in particular south of Nantucket, in the spring of 2001. Sei whales often occur along the shelf edge to feed, but also may come up to shallower shelf waters. Although known to eat fish in other oceans, sei whales off the northeastern U.S. are largely planktivorous, feeding primarily on euphausiids and copepods (Flinn et al. 2002, Hayes et al. 2017a). These aggregations of prey are largely influenced by the dynamic oceanographic processes in the region. The southern portion of the species' range during spring and summer includes the northern portions of the U.S. EEZ; the Gulf of Maine and Georges Bank (Hayes et al. 2017a). Spring is the period of greatest sei whale abundance in New England waters, with sightings concentrated along the eastern margin of Georges Bank and into the Northeast Channel area, and along the southwestern edge of Georges Bank in the area of

Hydrographer Canyon (CETAP 1982). NMFS aerial surveys in 1999, 2000 and 2001 found concentrations of sei and right whales along the northern edge of Georges Bank in the spring. In years of greater abundance of copepod prey sources, sei whales are reported in more inshore locations, such as the Great South Channel (in 1987 and 1989) and Stellwagen Bank (in 1986) (Waring et al. 2014).

During seasonal aerial surveys conducted from 2011-2015 in waters off Massachusetts and Rhode Island, sei whales were observed between March and June every year, with the greatest number of sightings in May (n = 8) and June (n = 13) (Kraus et al. 2016). From 1981 to 2018, sightings data indicate that sei whales may occur in the area in relatively moderate numbers during the spring and in low numbers in the summer (North Atlantic Right Whale Consortium 2018).

In summary, we anticipate individual sei whales to occur in the action area primarily in the spring and summer months. We expect these individuals to be making seasonal migrations, and to be foraging when krill are present. Foraging adult sei whales are most common in the action area but adult sei whales with calves have been observed during spring and summer months (Kraus et al. 2016).

5.5.4. *Sperm Whale*

Sperm whales from the North Atlantic Stock regularly occur in waters of the U.S. EEZ in the Atlantic Ocean. However, the sperm whales that occur in the eastern U.S. Atlantic EEZ likely represent only a fraction of the total stock (Waring et al. 2015). Sperm whales are generally found on the continental shelf edge, over the continental slope, and into mid-ocean regions (Waring et al. 2015). This offshore distribution is more commonly associated with the Gulf Stream edge and other features (Waring et al. 1993, Waring et al. 2001). Based on reviews of many types of stock studies, (i.e., tagging, genetics, catch data, mark-recapture, biochemical markers, etc.), researchers suggested that sperm whale populations have no clear geographic structure (Dufault et al. 1999, Reeves and Whitehead 1997). In the U.S. Atlantic EEZ waters, there appears to be a distinct seasonal cycle (CETAP 1982, Scott and Sadove 1997). In winter, sperm whales are concentrated east and northeast of Cape Hatteras. In spring, the center of distribution shifts northward to east of Delaware and Virginia and is widespread throughout the central portion of the Mid-Atlantic Bight and the southern portion of Georges Bank. In summer, the distribution is similar but now also includes the area east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf (inshore of the 328-ft (100-m) isobath) south of New England. In the fall, sperm whale occurrence south of New England on the continental shelf is at its highest level, and there remains a continental shelf edge occurrence in the Mid-Atlantic Bight.

The average depth of sperm whale sightings observed during the CeTAP surveys was 5,880 ft (1,792 m) (CETAP 1982). Female sperm whales and young males usually inhabit waters deeper than 3,280 ft (1,000 m) and at latitudes less than 40° N (Whitehead 2002). Sperm whales feed on larger organisms that inhabit the deeper ocean regions (Whitehead 2002). Calving for the species occurs in low latitude waters outside of the action area.

In summary, we anticipate adult individual sperm whales to occur infrequently in deeper, offshore waters of the action area primarily in summer and fall months. We expect these individuals to be moving through the project area as they make seasonal migrations, and to be foraging along the shelf break.

5.5.5. *Sea Turtles*

The fishing considered in this Opinion and habitat use by sea turtles overlap in the action area. Adult and/or juvenile loggerhead, leatherback, green, and Kemp's ridley sea turtles may be migrating or foraging in the areas where the fisheries will occur. As described in the *Status of the Species*, the occurrence of loggerhead, Kemp's ridley, green, and leatherback sea turtles along the U.S. Atlantic coast is primarily temperature dependent. In general, sea turtles move up the U.S. Atlantic coast from southern wintering areas to foraging grounds as water temperatures warm in the spring. The trend is reversed in the fall as water temperatures cool. By December, sea turtles have passed Cape Hatteras, returning to more southern waters for the winter (Braun-McNeill and Epperly 2002, Ceriani et al. 2012, Griffin et al. 2013, James et al. 2005b, Mansfield et al. 2009, Morreale and Standora 1998, Morreale and Standora 2005, NEFSC and SEFSC 2011, Shoop and Kenney 1992, TEWG 2009, Winton et al. 2018).

Within the action area, sea turtles are found as far north as the Gulf of Maine seasonally. They occur throughout the bays and estuaries of nearly all southeast and mid-Atlantic states and some Northeast ones as well (e.g., Cape Cod Bay, Massachusetts), from shallow waters along the shoreline and near river mouths to deeper waters of the Atlantic Ocean. They are present in Greater Atlantic Region waters from May to November each year, with the highest number of individuals present from June to October. Sea turtles arrive in waters off Virginia in late April/early May and in the Gulf of Maine in June. (Braun-McNeill and Epperly 2002, Ceriani et al. 2012, Griffin et al. 2013, Morreale and Standora 2005, Palka et al. 2017, Winton et al. 2018). Leatherback sea turtles have a similar seasonal distribution but have a more extensive range compared to the hard-shelled species (Archibald and James 2016, Dodge et al. 2014, James et al. 2005a, James et al. 2005b, Mitchell et al. 2002, Shoop and Kenney 1992).

Sea turtles have been documented in the action area through aerial and vessel surveys and satellite tracking programs and fisheries observers (Archibald and James 2016, Barco et al. 2018, James et al. 2005a, James et al. 2005b, James et al. 2005c, Kraus et al. 2016, NMFS 2015a, 2016a, 2018a, 2019a, Patel et al. 2018, Winton et al. 2018). The Atlantic Marine Assessment Program for Protected Species (AMAPPS) is a comprehensive program to assess abundance, distribution, and ecology of marine mammals, sea turtles, and seabirds throughout the U.S. Atlantic. From 2010-2018, aerial and shipboard surveys (approximately 103,132 nmi (191,000 km) of trackline) from Nova Scotia, Canada through Florida detected more than 8,000 turtles including green, Kemp's ridley, loggerhead, and leatherback turtles (Palka et al. 2017). These sightings occurred throughout most of the action area (see AMAPPS sightings at <http://seamap.env.duke.edu/>). From 2010-2018, the NEFSC and Coonamessett Farm Foundation deployed 180 satellite tags on loggerhead sea turtles. Data from these satellite tags was used to assess the relative density of sea turtles (Palka et al. 2017, Winton et al. 2018). Researchers also continue to tag loggerhead and leatherback sea turtles through this program (NMFS 2015a, 2016a, 2018a, 2019a). The satellite tracks of loggerheads studied as part of the AMAPPS program are at http://www.seaturtle.org/tracking/?project_id=537&dyn=1324309895. Other studies have focused on exploring species distribution relative to prey and physical oceanography.

In the summer of 2010, as part of the AMAPPS project, the NEFSC and SEFSC estimated the abundance of juvenile and adult loggerhead sea turtles in the portion of the northwestern Atlantic continental shelf between Cape Canaveral, Florida and the mouth of the Gulf of St. Lawrence, Canada (NMFS 2011c). The abundance estimates were based on data collected from an aerial

line-transect sighting survey as well as satellite tagged loggerheads. The preliminary regional abundance estimate was about 588,000 individuals (approximate inter-quartile range of 382,000-817,000) based on only the positively identified loggerhead sightings, and about 801,000 individuals (approximate inter-quartile range of 521,000-1,111,000) when based on the positively identified loggerheads and a portion of the unidentified sea turtle sightings (NMFS 2011c).

Barco et al. (2018) estimated loggerhead sea turtle abundance and density in the southern portion of the Mid-Atlantic Bight and Chesapeake Bay using data from 2011-2012. As Chesapeake Bay falls outside the action area, the focus here is on the results for the ocean waters off Virginia and Maryland. During aerial surveys, loggerhead sea turtles were the most common turtle species detected, followed by greens and leatherbacks, with few Kemp's ridleys documented. Density varied both spatially and temporally. Loggerhead abundance and density estimates in the ocean were higher in the spring (May-June) than the summer (July-August) or fall (September-October). Ocean abundance estimates of loggerheads ranged from highs of 27,508-80,503 in the spring months of May-June to lows of 3,005-17,962 in the fall months of September-October (Barco et al. 2018).

AMAPPS data, along with other sources, have been used in recent modelling studies. Winton et al. (2018) modelled the spatial distribution of satellite-tagged loggerhead sea turtles in the Western North Atlantic. The Mid-Atlantic Bight was identified as an important summer foraging area and the results suggest that the area may support a larger proportion of the population, over 50 percent of the predicted relative density of loggerheads north of Cape Hatteras from June to October (NMFS 2019a, Winton et al. 2018). Using satellite telemetry observations from 271 large juvenile and adult sea turtles collected from 2004 to 2016, the models predicted that overall densities were greatest in the shelf waters of the U.S. Atlantic coast from Florida to North Carolina (Figure 53, left side). Tagged loggerheads primarily occupied the continental shelf from Long Island, New York to Florida, with some moving offshore. Monthly variation in the Mid-Atlantic Bight (Figure 53, right side) indicated migration north to the foraging grounds from March to May and migration south from November to December. In late spring and summer, predicted densities were highest in the shelf waters from Maryland to New Jersey. In the cooler months, the predicted densities in the Mid-Atlantic Bight were higher offshore (Winton et al. 2018). South of Cape Hatteras, there was less seasonal variability and predicted densities were high in all months. Many of the individuals tagged in this area remained in the general vicinity of the tagging location. The authors did caution that the model was driven, at least in part, by the weighting scheme chosen, is reflective only of the tagged population, and has biases associated with the non-random tag deployment. Most loggerheads tagged in the Mid-Atlantic Bight were tagged in offshore shelf waters north of Chesapeake Bay in the spring. Thus, loggerheads in the nearshore areas of the Mid-Atlantic Bight may have been under-represented (Winton et al. 2018). Despite these caveats, this data is the best scientific and commercial data on loggerhead density in the action area.

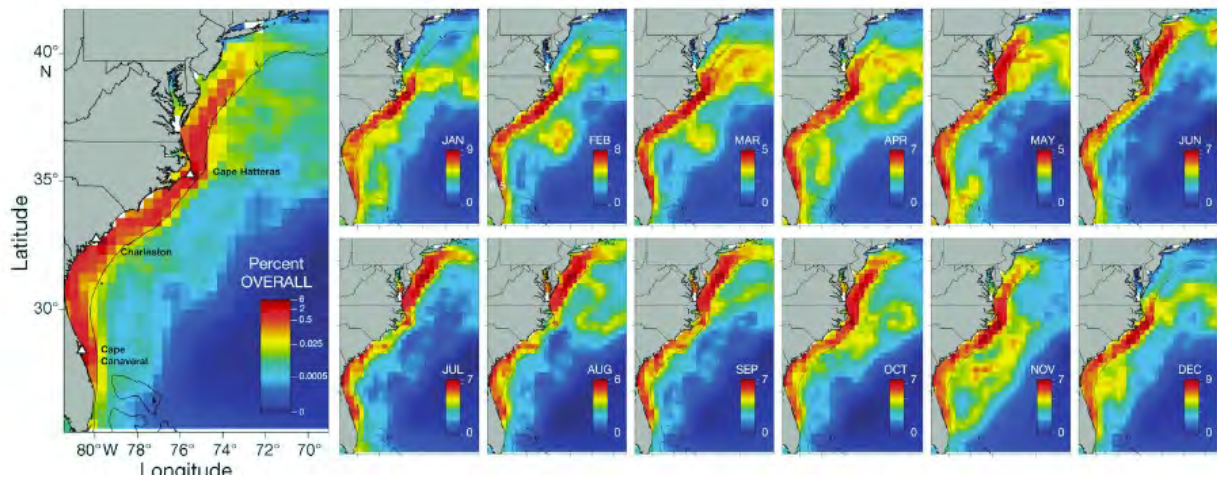


Figure 53: Overall and monthly log density of tagged loggerhead sea turtles predicted from a space-time geostatistical mixed effects model. The proportion of the predicted density in each cell is indicated by the key (Winton et al. 2018).

One of the main factors influencing sea turtle presence in mid-Atlantic waters and north is seasonal temperature patterns (Ruben and Morreale 1999). The distribution of sea turtles is limited geographically and temporally by water temperatures (Braun-McNeill et al. 2008, Epperly 1995, James et al. 2006b, Mansfield et al. 2009), with warmer waters in the late spring, summer, and early fall being the most suitable. Water temperatures too low or too high may affect feeding rates and physiological functioning (Milton and Lutz 2003); metabolic rates may be suppressed when a sea turtle is exposed for a prolonged period to temperatures below 8-10° C (George 1997, Milton and Lutz 2003, Morreale et al. 1992). That said, loggerhead sea turtles have been found in waters as low as 7.1-8 ° C (Braun-McNeill et al. 2008, Smolowitz et al. 2015, Weeks et al. 2010). However, in assessing critical habitat for loggerhead sea turtles, the review team considered the water-temperature habitat range for loggerheads to be above 10° C (NMFS 2013a). Sea turtles are most likely to occur in the action area when water temperatures are above this temperature, although depending on seasonal weather patterns and prey availability, they could be also present in months when water temperatures are cooler (as evidenced by fall and winter cold stunning records as well as year round stranding records).

To better understand loggerhead behavior on the Mid-Atlantic foraging grounds, Patel et al. (2016) used a remotely operated vehicle (ROV) to document the feeding habitats (and prey availability), buoyancy control, and water column use of 73 loggerheads recorded from 2008-2014. When the mouth and face were in view, loggerheads spent 13 percent of the time feeding on non-gelatinous prey and 2 percent feeding on gelatinous prey. Feeding on gelatinous prey occurred near the surface to depths of 52.5 ft (16 m). Non-gelatinous prey were consumed on the bottom. Turtles spent approximately 7 percent of their time on the surface (associated with breathing), 42 percent in the near surface region, 44 percent in the water column, 0.4 percent near bottom, and 6 percent on bottom. When diving to depth, turtles displayed negative buoyancy, making staying at the bottom easier (Patel et al. 2016).

Patel et al. (2018) evaluated temperature-depth data from 162 satellite tags deployed on loggerhead sea turtles from 2009 to 2017 when the water column is highly stratified (June 1 – October 4). Turtles arrived in the Mid-Atlantic Bight in late May as the Cold Pool formed and departed in early October when the Cold Pool started to dissipate. The Cold Pool is an

oceanographic feature that forms annually in late May. During the highly stratified season, tagged turtles were documented throughout the water column from June through September. Fewer bottom dives occurred north of Hudson Canyon early (June) and late (September) in the foraging season (Patel et al. 2018).

Satellite tagging studies have also been used to understand leatherback sea turtle behavior and movement in the action area (Dodge et al. 2014, Dodge et al. 2015, Eckert et al. 2006, James et al. 2005a, James et al. 2005b, James et al. 2006a). These studies show that leatherback sea turtles move throughout most of the North Atlantic from the equator to high latitudes. Key foraging destinations include, among others, the eastern coast of United States (Eckert et al. 2006). Telemetry studies provide information on the use of the water column by leatherback sea turtles. Based on telemetry data for leatherbacks (n=15) off Cape Cod, Massachusetts, leatherback turtles spent over 60 percent of their time in the top 33 ft (10 m) of the water column and over 70 percent in the top 49 ft (15 m) (Dodge et al. 2014). Leatherbacks on the foraging grounds moved with slow, sinuous area-restricted search behaviors. Shorter, shallower dives were taken in productive, shallow waters with strong sea surface temperature gradients. They were highly aggregated in shelf and slope waters in the summer, early fall, and late spring. During the late fall, winter, and early spring, they were more widely dispersed in more southern waters and neritic habitats (Dodge et al. 2014). Leatherbacks (n=24) tagged in Canadian waters primarily used the upper 98 ft (30 m) of the water column and had shallow dives (Wallace et al. 2015).

Dodge et al. (2018) used an autonomous underwater vehicle (AUV) to remotely monitor fine-scale movements and behaviors of nine leatherbacks off Cape Cod, Massachusetts. The “TurtleCam” collected video of tagged leatherback sea turtles and simultaneously sampled the habitat (e.g., chlorophyll, temperature, salinity). Representative data from one turtle was reported in Dodge et al. (2018). During the 5.5 hours of tracking, the turtle dove continuously from the surface to the seafloor (0-66 ft (0-20 m)). Over a two-hour period, the turtle spent 68 percent of its time diving, 16 percent swimming just above the seafloor, 15 percent at the surface and 17 percent just below the surface. The animal frequently surfaced (>100 times in ~2 hours). The turtle used the entire water column, feeding on jellyfish from the seafloor to the surface. The turtle silhouetted prey 36 percent of the time, diving to near/at bottom and looking up to locate prey. The authors note that silhouetting prey may increase entanglement in fixed gear if a buoy of float is mistaken for jellyfish (Dodge et al. 2018).

5.5.6. *Atlantic Sturgeon*

The marine and estuarine range of all five Atlantic sturgeon DPSs overlaps and extends from Canada through Cape Canaveral, Florida. Based on the best available scientific and commercial data, Atlantic sturgeon originating from any of five DPSs could occur in the waters of the action area (Damon-Randall et al. 2013, Wirgin et al. 2015b). Eggs, early life stages, and juveniles (as used here referring to Atlantic sturgeon offspring that have not emigrated from the natal river) are not present in the action area. Sub-adult and adult Atlantic sturgeon occur in waters off the Northeast and Mid-Atlantic year round. Atlantic sturgeon are known to use the action area for migration and foraging. Foraging behaviors typically occur in areas where suitable forage and appropriate habitat conditions are present. These areas include tidally influenced flats and mud, sand, and mixed cobble substrates (Stein et al. 2004b). Within the marine range of Atlantic sturgeon, several marine aggregation areas have been identified adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard. Depths in these areas are generally no greater than 82 ft (25 m) (Dunton et al. 2010, Erickson et al. 2011,

Laney et al. 2007, Stein et al. 2004b). Given the depth range, it is expected that these identified aggregations are primarily in state waters. The fisheries under the ten FMPs and Atlantic sturgeon do overlap, suggesting that if suitable forage and/or habitat features are present, adults and sub-adults from any of the five listed DPSs may be foraging or undertaking migrations in the areas where fishing activities will occur.

5.5.7. *Atlantic Salmon*

Atlantic salmon also use the action area as a migratory route and for foraging. Upon completion of the physiological transition to salt water, the post-smolt Atlantic salmon grows rapidly and has been documented to move in small schools loosely aggregated close to the surface (Dutil and Coutui 1988). After entering into the nearshore waters of Canada, the U.S. post-smolts become part of a mixture of stocks of Atlantic salmon from various North American streams. Their diet includes invertebrates, amphipods, euphausiids, and fish (Fraser 1987, Hislop and Shelton 1993, Hislop and Youngson 1984, Jutila and Toivonen 1985). Results from a 2001-2005 post-smolt trawl survey in Penobscot Bay and the nearshore waters of the Gulf of Maine indicate that Atlantic salmon post-smolts are prevalent in the upper water column (Sheehan et al. 2005).

Most of the GOM DPS-origin salmon spend two winters in the ocean before returning to streams for spawning. Aggregations of Atlantic salmon may still occur after the first winter at sea, but most evidence indicates that they travel individually (Reddin 1985). At this stage, Atlantic salmon primarily eat fish, feeding upon capelin, herring, and sand lance (Hansen and Pethon 1985, Hislop and Shelton 1993, Reddin 1985).

5.5.8. *Giant Manta Ray*

In the Atlantic Ocean, it is unlikely that overutilization as a result of bycatch mortality is a significant threat to giant manta rays (Miller and Klimovich 2017). However, information is severely lacking on both population sizes and distribution of the giant manta ray as well as current catch and fishing effort on the species throughout this portion of its range (Figure 48).

Based on the giant manta ray's distribution, the species may occur in coastal, nearshore, and pelagic waters off the U.S. east coast. Along the U.S. East Coast, giant manta rays are usually found in water temperatures between 19 and 22 °C (Miller and Klimovich 2017) and have been observed as far north as New Jersey. In the action area, very little information on *M. birostris* populations is available. Based on personal observation during aerial surveys conducted off of St. Augustine, Florida, from 2009-2012, F. Young (pers. comm. 2017) noted vast schools of giant manta rays, with over 500 manta rays observed per 6-8 hour day of aerial survey. Given that the species is rarely identified in the fisheries data in the Atlantic, it may be assumed that populations within the Atlantic are small and sparsely distributed (Miller and Klimovich 2017).

5.6. **Impact of the Environmental Baseline on ESA-Listed Species**

Collectively, the stressors described above have had, and likely continue to have, lasting impacts on the ESA-listed species considered in this consultation. Some of these stressors (e.g., vessel strike, entanglement) result in mortality or serious injury to individual animals, whereas others (e.g., a fishery that impacts prey availability) result in more indirect or non-lethal impacts. Assessing the aggregate impacts of these stressors on species is difficult, especially since many of the species in this Opinion are wide ranging and subject to stressors in locations throughout the action area and outside the action area.

We consider the best indicator of the aggregate impact of the *Environmental Baseline* on ESA-listed resources to be the status and trends of those species. As noted in the *Status of the Species*, some of the species considered in this consultation are experiencing increases in population abundance, some are declining, and for others, their status remains unknown. In considering these trends, we must also consider that some are based on a proxy for the overall population. For example, sea turtle trends are primarily based on nesting data that assesses a subset of the population. The trends must be considered in this context. Taken together, this indicates that the *Environmental Baseline* is impacting species in different ways. The species experiencing increasing population abundances are doing so despite the potential negative impacts of the *Environmental Baseline*. Therefore, while the *Environmental Baseline* may slow their recovery, recovery is not being prevented. For the species that may be declining in abundance, it is possible that the suite of conditions described in the *Environmental Baseline* is preventing their recovery. However, it is also possible that their populations are at such low levels (e.g., due to historic commercial whaling) that even when the species' primary threats are removed, the species may not be able to achieve recovery. At small population sizes, species may experience phenomena such as demographic stochasticity, inbreeding depression, and allee effects²², among others, that cause their limited population size to become a threat in and of itself. A thorough review of the status and trends of each species is discussed in the *Status of Species* section of this Opinion.

6. CLIMATE CHANGE

The discussion below presents background information on global climate change, as well as information on past and predicted future effects of global climate change throughout the range of the listed species considered here. Additionally, we present the available information on predicted effects of climate change in the action area and how those predicted environmental changes may affect listed species. Climate change is relevant to the *Status of the Species*, *Environmental Baseline*, and *Cumulative Effects* sections of this Opinion. Therefore, rather than include partial discussions in several sections of this Opinion, we are synthesizing this information into one discussion. Consideration of the effects of the proposed action in light of predicted changes in environmental conditions due to anticipated climate change are included in the *Effects of the Action* below (see section 7).

6.1. Background Information on Global Climate Change

In a special report "Global Warming of 1.5 °C", the Intergovernmental Panel on Climate Change (IPCC) found that human activities are estimated to have caused approximately 1 °C (likely range 0.8 °C to 1.2 °C) of global warming over pre-industrial levels. It is likely to reach 1.5 °C between 2030 and 2050 under current conditions (high confidence) (IPCC 2018). Reflecting this trend, observed global mean sea surface temperature (SST) for 2006-2015 was 0.87 °C likely between 0.1 °C and 0.3 °C higher than the average from 1850-1900 (very high confidence)

²² Demographic stochasticity is caused by random independent events of individual mortality and reproduction which cause random fluctuations in population growth rate. It is most strong in small populations. Inbreeding depression is the reduced biological fitness of a population from breeding of related individuals, inbreeding. As described earlier, allee effects are broadly characterized as a decline in individual fitness in populations with a small size or density.

(IPCC 2018). Ocean temperatures on the Northeast Continental Shelf have risen an average of 0.03 °C each year between 1982–2013, which is three times faster than the global average observed during this time period (Pershing et al. 2015). From 2007–2016, the regional trend increased 0.14 °C per year, four times faster than the national average (Dupigny-Giroux et al. 2018). In the Northwest Atlantic, 2012 was a particularly anomalous year rising a full 2 °C above the average temperature between 1982 and 2011 (Dupigny-Giroux et al. 2018).

Model projections of global mean sea level rise (relative to 1986–2005) suggest an indicative range of 0.85–2.5 ft (0.260–0.77 m) by 2100 for 1.5 °C of global warming which is 0.32 ft (0.1 m) less than for global warming of 2 °C (medium confidence). Sea level rise is expected to continue well beyond 2100 (high confidence) and the magnitude and rate of rise depend on future emission pathways (IPCC 2018). Temperature increase will very likely be associated with more extreme precipitation and faster evaporation of water, leading to greater frequency of both very wet and very dry conditions. Climate warming has also resulted in increased river discharge and glacial and sea-ice melting (Greene et al. 2008).

Ocean temperature in the U.S. Northeast Shelf and surrounding Northwest Atlantic waters have warmed faster than the global average over the last decade (Pershing et al. 2015). New projections for the U.S. Northeast Shelf and Northwest Atlantic Ocean suggest that this region will warm two to three times faster than the global average; given this, existing projections from the IPCC may be too conservative (Saba et al. 2015).

The past few decades have witnessed major changes in ocean circulation patterns in the Arctic, and these were accompanied by climate associated changes as well (Greene et al. 2008). Shifts in atmospheric conditions have altered Arctic Ocean circulation patterns and the export of freshwater to the North Atlantic. Large discharges of freshwater into the North Atlantic subarctic seas can lead to intense stratification of the upper water column and a disruption of North Atlantic Deep Water (NADW) formation (Greene et al. 2008, IPCC 2007). There is evidence that the NADW has already freshened significantly (IPCC 2007). This in turn can lead to a slowing down of the global ocean thermohaline (large-scale circulation in the ocean that transforms low-density upper ocean waters to higher density intermediate and deep waters and returns those waters back to the upper ocean), which can have climatic ramifications for the entire world (Greene et al. 2008). Changes in salinity and temperature are also thought to be the result of changes in the Earth's atmosphere caused by anthropogenic forces (IPCC 2007). Specifically, recent research on the North Atlantic Oscillation (NAO), which impacts climate variability throughout the Northern Hemisphere, has found potential changes in NAO characteristics under future climate change until 2100 (Hanna and Cropper 2017).

Global warming of 1.5 °C is projected to shift the ranges of many marine species to higher latitudes and drive the loss of coastal resources. The risk of irreversible loss of many marine and coastal ecosystems increases with global warming, especially at 2 °C or higher (high confidence) (IPCC 2018). There is a high confidence, based on substantial new evidence, that observed changes in marine systems are associated with rising water temperatures, as well as changes in ice cover, salinity, oxygen levels, and circulation. Changes to the marine ecosystem due to climate change may result in changes in the distribution and abundance of the prey for protected species.

While predictions are available regarding potential effects of climate change globally, it is more difficult to assess the potential effects of climate change on smaller geographic scales, such as

the action area. The effects of future change will vary greatly among coastal regions of the United States. For example, sea level rise is projected to be worse in low-lying coastal areas where land is sinking (e.g., the Gulf of Mexico) than in areas with higher, rising coastlines (e.g., Alaska) (Jay et al. 2018). Climate change can cause or exacerbate direct stress on ecosystems through high temperatures, a reduction in water availability, and altered frequency of extreme events and severe storms. As climate warms, water temperatures in streams and rivers are likely to increase; this will likely result wide-ranging effects to aquatic ecosystems. Changes in temperature will be most evident during low flow periods when the water column in waterways are more likely to warm beyond the physiological tolerance of resident species (NAST 2000). Low flow can impede fish entry into waterways and low flow combined with high temperatures can reduce survival and recruitment in anadromous fishes like Atlantic salmon (Jonsson and Jonsson 2009).

Expected consequences of climate change for river systems are wide ranging. Rivers are already under a great deal of stress due to excessive water withdrawal or land development, and this stress may be exacerbated by changes in climate (Hulme 2005). Rivers could experience a decrease in the amount of dissolved oxygen in surface waters and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing rate (Murdoch et al. 2000). Increased water volume in a warmer-wetter climate could ameliorate poor water quality conditions in places where human-caused concentrations of nutrients and pollutants currently degrade water quality (Murdoch et al. 2000). Increases in water temperature and changes in seasonal patterns of runoff will very likely disturb fish habitat and affect recreational uses of lakes, streams, and wetlands. Surface water resources along the U.S. Atlantic coast are intensively managed with dams and channels and almost all are affected by human activities; in some systems water quality is either below recommended levels or nearly so. Within 50 years, river basins that are impacted by dams or by extensive development will experience greater changes in discharge and water stress than unimpacted, free-flowing rivers (Palmer et al. 2008). Given this, a global analysis of the potential effects of climate change on river basins indicates that large river basins impacted by dams will need a higher level of reactive or proactive management interventions in response to climate change than basins with free-flowing rivers (Palmer et al. 2008). Human-induced disturbances also influence coastal and marine systems, often reducing the ability of the systems to respond and/or adapt to change. Given the above, under a continually changing environment, maintaining healthy riverine ecosystems will likely require adaptive management strategies (Hulme 2005).

6.2. Species Specific Information on Climate Change Effects

6.2.1. *Right, Fin, Sei, and Sperm Whales*

The impact of climate change on cetaceans is likely to be related to habitat degradation and changes in prey availability caused by changes in sea temperatures and circulation, decreased salinity, sea level rise, and ocean acidification (Davis et al. 2020, Simmonds and Elliott 2009). Additional indirect physiological effects include changes in reproductive capacity and susceptibility to diseases (Simmonds and Elliott 2009). Of the main factors affecting distribution of cetaceans, water temperature can have a large influence on geographic ranges of cetacean species (MacLeod 2009). Changes in water temperature due to climate change may affect the distribution of cetaceans (Becker et al. 2018). In general, baleen whales have experienced a northward shift since 2010, matching the shifts in their prey distribution (Davis et al. 2020). MacLeod (2009) found that range changes due increases in water temperature may have a

favorable impact on or may not change the conservation status of 69 percent of baleen whales and three species of sperm whales. However, the findings differ by species. For species considered in this Opinion, MacLeod (2009) found that the conservation implication for sei whales was favorable, while it would be unchanged for fin and sperm whales. For right whales, increases in water temperature may result in longer migration routes, resulting in unfavorable implications for their conservation status. The difference between how climate change affects these species could be due to the difference in the way these species feed, as right whales filter feed through dense patches of prey, other species can gulp feed and target additional prey species (Davis et al. 2020). Macleod (2009) recommended further research to assess whether these predictions are correct. A more recent study evaluated a broader range of factors, applying a qualitative framework to assess the vulnerability of seven cetacean species in the Northeast Atlantic to climate change. Factors considered included population size, geographic distribution, diet diversity, migration, human activities, genetic variability, and IUCN status. Fin and sperm whales were the only large whales evaluated, and they were found to have a higher vulnerability to climate change than the other species in the study. While geographic distribution did not contribute to the vulnerability score for these species, all other factors contributed to varying degrees to the higher risk score (Sousa et al. 2019). A framework for assessing climate change impacts (Lettrich et al. 2019) is currently being applied to assess the vulnerability of marine mammal stocks to climate change in the Northwest Atlantic, Gulf of Mexico, and Caribbean.

In regards to marine mammal prey species, there are many potential effects that global climate change may have on prey abundance and distribution. These effects on prey availability, in turn, pose potential behavioral and physiological effects to marine mammals. Species with more dietary flexibility are expected to be more resilient to fluctuations in prey resources (Gavrilchuk et al. 2014) than specialists and therefore, are less likely to be impacted by changes in prey resources. For example, ocean warming has had a significant impact on the plankton ecology of the Gulf of Maine, including effects on *Calanus finmarchicus*, a primary prey species for North Atlantic right whales (Greene 2016, Record et al. 2019). Decreases in zooplankton (*C. finmarchicus*) prey abundance have been correlated with reduced productivity of North Atlantic right whales (Meyer-Gutbrod et al. 2015). This is an important consideration for right whale recovery. Although warming in the Gulf of Maine has resulted in changes in the seasonal abundance of late-stage *C. finmarchicus*, with record high abundances in the western Gulf of Maine in spring and significantly lower abundances in the eastern Gulf of Maine in late summer and fall (Record et al. 2019), it is projected that *C. finmarchicus* concentrations will decrease within the U.S. Northeast Continental Shelf by the end of the century (Grieve et al. 2017). However, there are still many complex processes that need to be investigated when considering fluctuations of *C. finmarchicus* in the Northwest Atlantic (Runge et al. 2014). Cephalopods such as squid dominate the diet of sperm whales, who would likely re-distribute following changes in the distribution and abundance of their prey. If, however, cephalopod populations collapse or decline dramatically, sperm whales would likely decline as well. Long-term shifts of sperm whale prey in the California Current have been attributed to the redistribution of their prey resulting from climate-based shifts in oceanographic variables (Salvadeo et al. 2011).

More information is needed to determine the potential impacts of global climate change on the timing and extent of population movements, abundance, recruitment, distribution, and species composition of prey (Learmonth et al. 2006). Changes in climate patterns, ocean currents, storm frequency, rainfall, salinity, melting ice, and an increase in river inputs/runoff (nutrients and

pollutants) will all directly affect the distribution, abundance and migration of prey species (Learmonth et al. 2006, Tynan and DeMaster 1997, Waluda et al. 2001). These changes will likely have several indirect effects on marine mammals, which may include changes in distribution; displacement from ideal habitats; decline in individual and population fitness; increased susceptibility to disease and contaminants; and changes in abundance, migration patterns, community structure, and reproductive success (Jenssen 2006, MacLeod 2009, Simmonds and Elliott 2009). Global climate change may also indirectly affect marine mammals via changes to the range and abundance of competitors and predators (Learmonth et al. 2006).

Recent reviews have continued to recommend additional research on the impacts of climate change on protected species (Hare et al. 2016a, NMFS 2012f, 2017e, 2019d). For example, research is needed on understanding climate change effects on North Atlantic right whale foraging, migration, habitat use, reproduction, and distribution (NMFS 2017e). The effects of a changing climate on right whale life history and distribution is one of a number of complex factors limiting their recovery (NMFS 2017e). The future NMFS marine mammal climate vulnerability assessment, expected to publish in 2021, will help provide additional information on which species are most vulnerable to help guide management.

6.2.2. *Sea Turtles*

Sea turtle species have persisted for millions of years. They are ectotherms, meaning that their body temperatures depends on ambient temperatures. Throughout this time they have experienced wide variations in global climate conditions and are thought to have previously adapted to these changes through changes in nesting phenology and behavior (Poloczanska et al. 2009). Given this, climate change at normal rates (thousands of years) is not thought to have historically been a problem for sea turtle species. However, at the current rate of global climate change, future effects to sea turtles are probable. Climate change has been identified as a threat to all species of sea turtles found in the action area (Conant et al. 2009, NMFS and USFWS 2013, NMFS et al. 2011, Seminoff et al. 2015). However, trying to assess the likely effects of climate change on sea turtles is extremely difficult given the uncertainty in all climate change models, the difficulty in determining the likely rate of temperature increases, and the scope and scale of any accompanying habitat or behavior effects. In the Northwest Atlantic, specifically, loggerhead, green, and leatherback sea turtles are predicted to be among the more resilient species to climate change, while Kemp's ridley turtles are among the least resilient (Fuentes et al. 2013). Leatherbacks may be more resilient to climate change in the Northwest Atlantic because of their wide geographic distribution, low nest-site fidelity, and gigantothermy (Dutton et al. 1999, Fuentes et al. 2013, Robinson et al. 2009). Gigantothermy refers to the leatherbacks ability to use their large body size, peripheral tissues as insulation, and circulatory changes in thermoregulation (Paladino et al. 1990). Leatherbacks achieve and maintain substantial differentials between body and ambient temperatures through adaptations for heat production, including adjustments of the metabolic rate, and retention (Wallace and Jones 2008). However, modeling results show that global warming poses a "slight risk" to females nesting in French Guiana and Suriname relative to those in Gabon/Congo and West Papua, Indonesia (Dudley et al. 2016).

Sea turtles are most likely to be affected by climate change due to:

1. changing air/land temperatures and rainfall at nesting beaches that could affect reproductive output including hatching success, hatchling emergence rate, and hatchling sex ratios.

2. sea level rise, which could result in a reduction or shift in available nesting beach habitat, an increased risk of erosion and nest inundation, and reduced nest success.
3. changes in the abundance and distribution of forage species, which could result in changes in the foraging behavior and distribution of sea turtle species as well as changes in sea turtle fitness and growth.
4. changes in water temperature, which could possibly lead to a shift in their range, changes in phenology (timing of nesting seasons, timing of migrations) and different threat exposure.
5. increased frequency and severity of storm events, which could impact nests and nesting habitat, thus reducing nesting and hatching success.

Current approaches have limited power to predict the magnitude of future climate change, associated impacts, whether and to what extent some impacts will offset others, or the adaptive capacity of this species. Within the next decade, sea surface temperatures are expected to rise less than 1 °C. It is unknown if that is enough of a change to contribute to shifts in the range, distribution and recruitment of sea turtles or their prey. Theoretically, we expect that as waters in the action area warm, more sea turtles could be present or present for longer periods.

As climate continues to warm, feminization of sea turtle populations is a concern for many sea turtle species, which undergo temperature-dependent sex determinations. Rapidly increasing global temperatures may result in warmer incubation temperatures and higher female-biased sex ratios (Glen and Mrosovsky 2004, Hawkes et al. 2009). Increases in precipitation might cool beaches (Houghton et al. 2007); thereby, mitigating some impacts relative to increasing sand temperature. Feminization occurs over a small temperature range (1-4 °C) (Wibbels 2003) and several populations in the action area already are female biased (Gledhill 2007, Laloë et al. 2016, Patino-Martinez et al. 2012, Witt et al. 2010). The existing female bias among juvenile loggerhead sea turtles is estimated at approximately three to two females per males (Witt et al. 2010). Feminization is a particular concern in tropical nesting areas where over 95 percent female biased nests are already suspected for green turtles, and leatherbacks are expected to cross this threshold within a decade (Laloë et al. 2014, Laloë et al. 2016, Patino-Martinez et al. 2012). It is possible for populations to persist, and potentially increase with increased egg production, with strong female biases (Broderick et al. 2000, Coyne and Landry 2007, Godfrey et al. 1999, Hays et al. 2003), but population productivity could decline if access to males becomes scarce (Coyne 2000). Low numbers of males could also result in the loss of genetic diversity within a population. Behavioral changes could help mitigate the impacts of climate change, including shifting breeding season and location to avoid warmer temperatures. For example, the start of the nesting season for loggerheads has already shifted as the climate has warmed (Weishampel et al. 2004). Nesting selectivity could also help mitigate the impacts of climate on sex ratios as well (Kamel and Mrosovsky 2004).

At St. Eustatius in the Caribbean, there is an increasing female biased sex ratio of green turtle hatchlings (Laloë et al. 2016). While this is partly attributable to imperfect egg hatchery practices, global climate change is also implicated as a likely cause as warmer sand temperatures at nesting beaches can result in the production of more female embryos. At this time, we do not know how much of this bias is also due to hatchery practices as opposed to temperature. Global warming may exacerbate this female skew. An increase in female bias is predicted in St. Eustatius, with only 2.4 percent male hatchlings expected to be produced by 2030 (Laloë et al. 2016). The study also evaluated leatherback sea turtles on St. Eustatius. The authors found that

the model results project the entire feminization of the green and leatherback sea turtles due to increased air temperature within the next century (Laloë et al. 2016). The extent to which sea turtles may be able to cope with this change, by selecting cooler areas of the beach or shifting their nesting distribution to other beaches with smaller increases in sand temperature, is currently unknown.

Several leatherback nesting areas are already predominantly female, a trend that is expected to continue with some areas expecting at least 95 percent female nests by 2028 (Gledhill 2007, Laloë et al. 2016, Patino-Martinez et al. 2012). Hatchling success has declined in St. Croix (Garner et al. 2017), though there is some evidence that the overall trend is not climate or precipitation related (Rafferty et al. 2017). Excess precipitation is known to negatively impact hatchling success in wet areas but can have a positive effect in dry climates (Santidrián Tomillo et al. 2015). In Grenada, increased rainfall (another effect of climate change) was found to have a cooling influence on leatherback nests, so that more male producing temperatures (less than 29.75 °C) were found within the clutches (Houghton et al. 2007). There is also evidence for very wet conditions inundating nests or increasing fungal and mold growth, reducing hatching success (Patino-Martinez et al. 2014). Very dry conditions may also affect embryonic development and decrease hatchling output. Leatherbacks have a tendency towards individual nest placement preferences, with some clutches deposited in the cooler tide zone of beaches and have relatively weak nesting site fidelity; this may mitigate the effects of long-term changes in climate on sex ratios (Fuentes et al. 2013, Kamel and Mrosovsky 2004).

If nesting can shift over time or space towards cooler sand temperatures, these effects may be partially offset. A shift towards earlier onset of loggerhead nesting was associated with an average warming of 0.8 °C in Florida (Weishampel et al. 2004). Early nesting could also help mitigate some effects of warming, but has also been linked to shorter nesting seasons in this population (Pike et al. 2006), which could have negative effects on hatchling output. Nesting beach characteristics, such as the amount of precipitation and degree of shading, can effectively cool nest temperatures (Lolavar and Wyneken 2015). However, current evidence suggests that the degree of cooling resulting from precipitation and/or shading effects is relatively small and therefore, even under these conditions, the production of predominantly female nests is still possible (Lolavar and Wyneken 2015). However, the impact of precipitation, as well as humidity and air temperature, on loggerhead nests is site specific and data suggest temperate sites may see improvements in hatchling success with predicted increases in precipitation and temperature (Montero et al. 2018, Montero et al. 2019). Conversely, tropical areas already produce 30 percent less output than temperate regions and reproductive output is expected to decline in these regions (Pike 2014).

Warming sea temperatures are likely to result in a shift in the seasonal distribution of sea turtles in the action area. In the northern part of the action area, sea turtles may be present earlier in the year if northward migrations from their southern overwintering grounds begin earlier in the spring. Likewise, if water temperatures are warmer in the fall, sea turtles could remain in the more northern areas later in the year. Potential effects of climate change include range expansion and changes in migration routes as increasing ocean temperatures shift range-limiting isotherms north (Robinson et al. 2009). McMahon and Hays (2006) reported that warming has caused a generally northerly migration of the 15 °C SST isotherm from 1983 to 2006. In response to this, leatherbacks have expanded their range in the Atlantic north by 330 km (McMahon and Hays 2006). An increase in cold stunning of Kemp's ridley sea turtles in New England has also been

linked to climate change and could pose an additional threat to population resilience (Griffin et al. 2019).

In addition, although nesting occurs in the south and mid-Atlantic (i.e., North Carolina and into Virginia), recent observations have caused some speculation that the nesting range of some sea turtle species may shift northward as the climate warms and that nest crowding may increase as sea level rises and available nesting habitat shrinks (Reece et al. 2013). Recent instances include a Kemp's ridley nesting in New York in July 2018 (96 hatchlings), a loggerhead nesting in Delaware in July 2018 (48 hatchlings), and a loggerhead nesting in Maryland in September 2017 (7 live hatchlings). The ability to shift nesting in time and space towards cooler areas could reduce some of the temperature-induced impacts of climate change (e.g., female biased sex ratio). Fuentes et al. (2020) modelled the geographic distribution of climatically suitable nesting habitat for sea turtles in the U.S. Atlantic under future climate scenarios, identified potential range shifts by 2050, determined sea-level rise impacts, and explored changes in exposure to coastal development as a result of range shifts. Overall, the researchers found that, with the exception of the northern nesting boundaries for loggerhead sea turtles, the nesting ranges were not predicted to change. Fuentes et al. (2020) noted that range shifts may be hindered by expanding development. They also found that loggerhead sea turtles would experience a decrease (10 percent) in suitable nesting habitat followed by declines in nesting habitat for green turtles. No significant changes was predicted in the distribution of climatically suitable nesting area for leatherbacks by 2050. Sea level rise is projected to inundate current habitats; however, new beaches will also be formed and suitable habitats could be gained, with leatherback sea turtles potentially experience the biggest gain in suitable habitat (Fuentes et al. 2020).

Despite site-specific vulnerabilities of the Northwest Atlantic Ocean loggerhead DPS, this DPS may be more resilient to changing climate than other management units (Fuentes et al. 2013). Van Houtan and Halley (2011) recently developed climate based models to investigate loggerhead nesting (considering juvenile recruitment and breeding remigration) in the Northwest Atlantic and North Pacific. These models found that climatic conditions and oceanographic influences explain loggerhead nesting variability. Specifically, the climate models alone explained an average 60 percent (range 18 percent-88 percent) of the observed nesting changes in the Northwest Atlantic and North Pacific over the past several decades. In terms of future nesting projections, modeled climate data predict a positive trend for Florida nesting (the Northwest Atlantic Ocean DPS), with increases through 2040 as a result of the Atlantic Multidecadal Oscillation (Van Houtan and Halley 2011). In a separate model, Arendt et al (2013) suggested that the variability represents a lagged perturbation response to historical anthropogenic impacts. The nest count increases since 2008 may reflect a potential recovery response (Arendt et al. 2013).

Climate change may also increase hurricane activity, leading to an increase in debris in nearshore and offshore environments. This, in turn, could increase the occurrence of entanglements, ingestion of pollutants, or drowning. In addition, increased hurricane activity may damage nesting beaches or inundate nests with seawater. Increasing temperatures are expected to result in increased polar melting and changes in precipitation that may lead to rising sea levels (Titus and Narayanan 1995).

Hurricanes and tropical storms occur frequently in the southeastern United States. They impact nesting beaches by increasing erosion and sand loss and depositing large amounts of debris on

the beach. A lower level of leatherback nesting attempts occurred on sites more likely to be impacted by hurricanes (Dewald and Pike 2014). These storm events may ultimately affect the amount of suitable nesting beach habitat, potentially resulting in reduced productivity (TEWG 2007). These storms may also result in egg loss through nest destruction or inundation. Climate change may be increasing the frequency and patterns of hurricanes (IPCC 2014) which may result in more frequent impacts.

These environmental/climatic changes could result in increased erosion rates along nesting beaches, increased inundation of nesting sites, a decrease in available nesting habitat, and an increase in nest crowding (Baker et al. 2006, Daniels et al. 1993, Fish et al. 2005, Reece et al. 2013). Changes in environmental and oceanographic conditions (e.g., increases in the frequency of storms, changes in prevailing currents), as a result of climate change, could accelerate the loss of sea turtle nesting habitat, and thus, loss of eggs (Antonelis et al. 2006, Baker et al. 2006, Conant et al. 2009, Ehrhart et al. 2014).

Tidal inundation and excess precipitation can contribute to reduce hatchling output, particularly in wetter climates (Pike 2014, Pike et al. 2015, Santidrián Tomillo et al. 2015). This is especially problematic in areas with storm events and in highly-developed areas where the beach has nowhere to migrate. Females may deposit eggs seaward of erosion control structures, potentially subjecting nests to repeated tidal inundation. A recent study by the U.S. Geological Survey found that sea levels in a 620-mile (998-km) “hot spot” along the east coast are rising three to four times faster than the global average (Sallenger et al. 2012). In the next 100 years, the study predicted that sea levels will rise an additional 7.9-10.6 inches (20-27 cm) along the Atlantic coast “hot spot” (Sallenger et al. 2012). The disproportionate sea level rise is due to the slowing of Atlantic currents caused by fresh water from the melting of the Greenland Ice Sheet. Sharp rises in sea levels from North Carolina to Massachusetts could threaten wetland and beach habitats, and negatively affect sea turtle nesting along the North Carolina coast. If warming temperatures moved favorable nesting sites northward, it is possible that rises in sea level could constrain the availability of nesting sites on existing beaches (Reece et al. 2013). There is limited evidence of a potential northward range shift of nesting loggerheads in Florida, and it is predicted that this shift, along with sea level rise, could result in more crowded nesting beaches (Reece et al. 2013).

In the case of the Kemp’s ridley, most of their critical nesting beaches are undeveloped and may still be available for nesting despite shifting landward. Unlike much of the Texas coast, the Padre Island National Seashore (PAIS) shoreline in Texas, where increasing numbers of Kemp’s ridley are nesting, is accreting. Given the increase in nesting at the PAIS, as well as increasing and slightly cooler sand temperatures than at other primary nesting sites, PAIS could become an increasingly important source of males for a species, which already has one of the most restricted nesting ranges of all sea turtles. Nesting activity of Kemp’s ridleys in Florida has also increased over the past decade, suggesting the population may have some behavioral flexibility to adapt to a changing climate (Pike 2013). Still, current models predict long-term reductions in sea turtle fertility as a result of climate change; however, these effects may not be seen for 30 to 50 years because of the longevity of sea turtles (Davenport 1997, Hawkes et al. 2007, Hulin and Guillon 2007).

Changes in water temperature may also alter the forage base and, thus, foraging behavior of sea turtles (Conant et al. 2009). Likewise, if changes in water temperature affected the prey base for

green, loggerhead, Kemp's ridley, or leatherback sea turtles, there may be changes in the abundance and distribution of these species in the action area. Depending on whether there was an increase or decrease in the forage base and/or a seasonal shift in water temperature, there could be an increase or decrease in the number of sea turtles in the action area. Seagrass habitats may suffer from decreased productivity and/or increased stress due to sea level rise, as well as changes in salinity, light levels, and temperature (Duarte 2002, Saunders et al. 2013, Short and Neckles 1999). If seagrasses in the action area decline, it is reasonable to expect that the number of foraging green sea turtles would also decline as well. Rising water temperatures, and associated changes in marine physical oceanographic systems (e.g., salinity, oxygen levels, and circulation), may also impact the distribution/abundance of leatherback prey (i.e., jellyfish) and in turn, impact the distribution and foraging behavior of leatherbacks (Attrill et al. 2007, Brodeur et al. 1999, NMFS and USFWS 2013, Purcell 2005, Richardson et al. 2009). Loggerhead sea turtles are thought to be generalists (NMFS and USFWS 2008), and, therefore, may be more resilient to changes in prey availability. As noted above, because we do not know the adaptive capacity of these individuals, or what level of temperature change would cause a shift in distribution, it is not possible to predict changes to the foraging behavior of sea turtles over the next ten years. If sea turtle distribution shifted along with prey distribution, it is likely that there would be minimal, if any, impact to sea turtles due to the availability of food. Similarly, if sea turtles shifted to areas where different forage was available, and sea turtles were able to obtain sufficient nutrition from that new source of forage, any effect would be minimal. However, should climatic changes cause sea turtles to shift to an area or time where insufficient forage is available, impacts to these species would be greater.

Kemp's ridley sea turtles are also the most commonly documented species during cold stun events in the Greater Atlantic Region. With prolonged exposure to low water temperatures, sea turtles become hypothermic and can experience debilitating lethargic conditions. These events occur in the fall at higher latitudes when sea turtles do not migrate south before water temperatures decline. Griffin et al. (2019) suggest that warming sea surface temperatures in the Gulf of Maine are associated with increased strandings of Kemp's ridley sea turtles in Massachusetts. The warmer temperatures may be allowing Kemp's ridley distribution to expand and may act as an ecological bridge between the Gulf Stream and nearshore waters (Griffin et al. 2019).

6.2.3. *Atlantic Sturgeon*

Hare et al. (2016) assessed the vulnerability to climate change of a number of species that occur along the U.S. Atlantic coast. The authors define vulnerability as "the extent to which abundance or productivity of a species in the region could be impacted by climate change and decadal variability." Atlantic sturgeon were given a vulnerability rank of very high (99 percent certainty from bootstrap analysis) and a climate exposure rank of very high. Three exposure factors contributed to this score: sea surface temperature (4.0), ocean acidification (4.0) and air temperature (4.0). The authors concluded that Atlantic sturgeon are relatively invulnerable to distribution shifts. Climate factors such as sea level rise, reduced dissolved oxygen and increased temperatures have the potential to decrease productivity, but the magnitude and interaction of effects is difficult to assess (Hare et al. 2016b). Increasing hypoxia, in combination with increasing temperature, impacts juvenile Atlantic sturgeon metabolism and survival (Secor and Gunderson 1998). A multivariable bioenergetics and survival model predicted that within the Chesapeake Bay, a 1 °C increase in Bay-wide temperature reduced suitable habitat for juvenile

Atlantic sturgeon by 65 percent (Niklitschek and Secor 2005). These studies highlight the importance of the availability of water with suitable temperature, salinity and dissolved oxygen; climate conditions that reduce the amount of available habitat with these conditions would reduce the productivity of Atlantic sturgeon.

Changes in water availability may also impact the productivity of populations of Atlantic sturgeon. In rivers with dams, or other barriers that limit access to upstream freshwater reaches, spawning and rearing habitat may be restricted by increased saltwater intrusion; however, no estimates of the impacts of such change are currently available.

6.2.4. *Atlantic Salmon*

Hare et al. (2016) gave Atlantic salmon a vulnerability rank of very high (100 percent certainty from bootstrap analysis) as well as a climate exposure rank of very high and a distributional vulnerability rank of moderate (87 percent certainty from bootstrap analysis). Due to the effects of warming on freshwater and marine habitats, and the potential to affect the phenology of Atlantic salmon migration, the effect of climate change on Atlantic salmon in the Northeast U.S. Shelf Ecosystem is very likely to be negative (>95 percent certainty in expert scores) (Hare et al. 2016b). Ocean acidification could also affect olfaction, which Atlantic salmon use for natal homing.

As described in Hare et al. (2016), several studies have examined the effects of climate on the abundance and distribution of Atlantic salmon. A review of the likely effects of climate change found that the thermal niche of Atlantic salmon will likely shift northward causing decreased production and possibly extinction at the southern end of the species range (Jonsson and Jonsson 2009). The GOM DPS is the southernmost populations of Atlantic salmon in the Northwest Atlantic Ocean. Declines in post-smolt survival were associated with ocean warming (Friedland et al. 2014). The authors hypothesized that in the Northwest Atlantic, the decline in survival was due to early ocean migration by post-smolts (Friedland et al. 2014). Results of a recent study suggest that poor trophic conditions, likely due to climate-driven environmental factors, and warmer ocean temperatures are constraining the productivity and recovery of Atlantic salmon in the Northwest Atlantic (Mills et al. 2013). Available evidence suggests that climate change and long-term climate variability will reduce the productivity of the GOM DPS of Atlantic salmon.

6.2.5. *Giant Manta Ray*

Given that giant manta rays are migratory and considered ecologically flexible (e.g., low habitat specificity), they may be less vulnerable to the impacts of climate change compared to other sharks and rays (Chin et al. 2010). However, giant manta rays frequently rely on coral reef habitat for important life history functions (e.g., feeding, cleaning), and depend on planktonic food resources for nourishment. As coral reef habitat and planktonic organisms (e.g., zooplankton) are both highly sensitive to environmental changes (Brainard et al. 2011, Guinder and Molinero 2013), climate change is likely to have an impact on the distribution and behavior of the giant manta ray. Coral reef degradation from anthropogenic causes, particularly climate change, is projected to increase through the future (Miller and Klimovich 2017). There is insufficient information to indicate how, and to what extent, changes in the reef community structure will affect the status of the giant manta ray. The projected increase in coral habitat degradation may potentially lead to a decrease in the abundance of manta ray cleaning fish (e.g., *Labroides* spp., *Thalassoma* spp., and *Chaetodon* spp.), as well as an overall reduction in the number of cleaning stations available to manta rays within these habitats. Decreased access to

cleaning stations may negatively impact the fitness of the mantas by hindering their ability to reduce parasitic loads and dead tissue, which in turn, could lead to an increase in diseases and a decline in reproductive fitness and survival.

Changes in climate and oceanographic conditions, such as acidification, are also known to affect zooplankton structure (size, composition, diversity), phenology, and distribution (Guinder and Molinero 2013). As such, the migration paths and locations of both resident and seasonal aggregations of manta rays, which depend on these animals for food, may similarly be altered (Couturier et al. 2012, Government of Australia 2012). It is likely that those manta ray populations that exhibit site-fidelity behavior will be most affected by these changes. As research to understand the exact impacts of climate change on marine phytoplankton and zooplankton communities is still ongoing, the severity of this threat to manta rays has yet to be fully determined.

7. EFFECTS OF THE PROPOSED ACTION

In *Effects of the Action* section, we present the results of our assessment of the probable effects of federal actions that are the subject of this consultation on threatened and endangered species and designated critical habitat. Effects of the action are defined as all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action, and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (50 CFR 402.02)

The analysis in this section forms the foundation for our jeopardy analysis in section 9. The quantitative and qualitative analyses in this section are based upon the best available commercial and scientific data on species biology and the effects of the action. Data are limited, so we are often forced to make assumptions to overcome the limits in our knowledge. Sometimes, the best available information may include a range of values for a particular aspect under consideration or different analytical approaches may be applied to the same data set. When appropriate in those cases, the uncertainty is resolved in favor of the species (see House of Representatives Conference Report No. 697, pg. 1442, 96th Congress, Second Session, 12 (1979)). We generally select the value that would lead to conclusions of higher, rather than lower, risk to endangered or threatened species. This approach provides the “benefit of the doubt” to threatened and endangered species.

7.1. Approach to the Assessment

We began our analysis of the effects of the action by first reviewing what activities (e.g., gear types and techniques, vessel transits) associated with the proposed action are likely to adversely affect whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays in the action area (i.e., the proposed action stressors). We next reviewed the range of responses to an individual’s exposure to that stressor and the factors affecting the likelihood, frequency, and severity of exposure. Afterwards, our focus shifted to evaluating and quantifying exposure. We estimated the number of individuals of each species likely to be exposed and the likely fate of those animals. As described in the *Description of the Proposed Action*, we are also consulting on the implementation of the Habitat Amendment. After assessing the effects of the operations of the fisheries on ESA-listed species, we consider how the Habitat Amendment modifies the

operation of fisheries, and, if changes occur, whether this exposes the species to additional or increased stressors.

The *Integration and Synthesis* section of this Opinion follows the *Effects of the Action*, and integrates information we presented in the *Status of the Species* and *Environmental Baseline* with the results of our exposure and response analyses to estimate the probable risks the proposed action poses to endangered and threatened species. Because we previously concluded that the proposed action is not likely to adversely affect several listed species and areas designated as critical habitat for listed species (section 4.1), these listed species and critical habitat are not considered in the analyses that follow.

To identify, describe, and assess the effects to listed species considered in this Opinion, we reviewed information on: (1) entanglements of right, fin, sei, and sperm whales; and sea turtles documented in the GAR Marine Animal Incident and STDN databases and from published literature (Hayes 2019, Hayes et al. 2019, Johnson et al. 2005, Waring et al. 2015); (2) bycatch of loggerhead, leatherback, Kemp's ridley, and green sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays in these fisheries from the NEFSC observer/sea sampling database and the published literature (ASMFC 2017, Murray 2018, 2020); (3) vessel interactions with sea turtles documented in the STSSN database; (4) life history of large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays, and (5) the effects of fishing gear interactions on large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays that have been published in a number of documents. These sources include status reviews, stock assessments, and biological reports, recovery plans, and numerous other sources of information from the published literature as cited in this Opinion.

Potential Stressors

We consider all stressors from the proposed action that may adversely affect endangered or threatened species, their ecological interactions, or critical habitat designated for the listed species. At any point in time, a single vessel may be the source of one or more of these potential stressors, and listed individuals may be exposed to one or more of these stressors.

Potential stressors from the proposed action include capture or entanglement in fishing gear and vessel strikes. Effects caused by the authorization of the fisheries on threatened and endangered species stem primarily from interactions with the fishing gear that results in the capture, injury, or death of an individual, listed species. Our analysis, therefore, assesses adverse effects from physical contact with fishing gear. We also assume the potential effects of each gear type are proportional to the number of interactions between the gear and each species. Four basic types of fishing gear are primarily used in the fisheries: sink gillnets, bottom trawls, trap/pots, and hook and line gear. Other potential effects of the proposed action on listed species occur vessel interactions, resulting in injury and/or death of an individual.

Additional consequences caused by or resulting from the proposed action, may occur later in time and are reasonably certain to occur. These may include such effects as habitat degradation and reduction of prey/foraging base. Of all the gears used in the fisheries, bottom trawl is the only gear type that has the potential to adversely affect bottom habitat in the action area. Effects of otter trawl gear may include: (1) scraping or plowing of the doors on the bottom, sometimes creating furrows along their path; (2) sediment suspension resulting from the turbulence caused by the doors and the ground gear on the bottom; (3) removal or damage to benthic or demersal species; and (4) removal or damage to structure forming biota. An assessment of fishing gear

impacts found that, for trawl, mud, sand, and cobble features are more susceptible, while granule-pebble and scattered boulder features are less susceptible. Geological structures generally recovered more quickly from trawling on mud and sand substrates than on cobble and boulder substrates; while biological structures recovered at similar rates across substrates. Susceptibility was defined as the percentage of habitat features encountered by the gear during a hypothetical single pass event that had their functional value reduced, and recovery was defined as the time required for the functional value to be restored (see Appendix D in NEFMC 2016b, NEFMC 2020b). We do not consider gillnet, trap/pot, or hook and line gear to be gear types that would affect either bottom or pelagic habitats in the action area and, therefore, our effects to habitat analysis only considers impacts from trawl gear. As described below, there are no indirect effects associated with the proposed action that are likely to adversely affect large whales, sea turtles, ESA-listed fish, or critical habitat. Therefore, the analyses will focus on direct effects. As described in the *Status of the Species*, prey for ESA-listed species within the action areas varies greatly depending on the predator species. Given this range, impacts from changes in the prey/foraging base are considered under the subsections below.

7.2. Effects to Large Whales

Impacts of entanglement events attributed to gear used in Canadian fisheries are considered in the *Status of the Species*. Impacts of entanglement events attributed to gear used in state fisheries are considered in the *Environmental Baseline* and *Cumulative Effects* sections. State and Canadian entanglement events are not included as part of the effects analysis because they are not the result of the action under consultation. The effects of the proposed action in the context of information presented in the *Status of the Species*, *Environmental Baseline*, *Climate Change*, and *Cumulative Effects* will be examined in the *Integration and Synthesis of Effects*.

7.2.1. Gear Interactions

Certain fishing gears may directly affect whales. These include gillnet, hook and line gear, and the lines of trap/pot gear. There are few records of interactions between trawl gear and large cetaceans, and the interactions that have occurred involved species that are not ESA-listed. From 2010-2019, there was one interaction between a large whale and trawl gear. Prior to this, minke whales have been observed or reported entangled in bottom and mid-water trawl gear, but interactions are rare (since 2000, two interactions in bottom trawl gear and one in midwater trawl gear) (Hayes et al. 2020, Waring et al. 2015, Waring et al. 2013). In 2020, a live, anchored humpback whale was disentangled by trained responders from the ALWDN. The gear was recovered and identified as a trawl net. Due to the weight of the gear, fresh wounds on the animal, and the fact that the animal was a juvenile, it was determined the trawl net was of U.S. origin. There have been no observed or reported interactions of right, fin, sei or sperm whales with bottom otter trawl gear (NEFSC observer/sea sampling database, unpublished data; GAR Marine Animal Incident database, unpublished data). Bottom otter trawl gear is not expected to directly affect right, fin, sei, and sperm whales given that these large cetaceans have the speed and maneuverability to get out of the way of oncoming mobile gear, including bottom trawl gear used in these fisheries. Given that this action does not change the fishing practices of the trawl fisheries and the information above, it is extremely unlikely that ESA-listed large whales will interact with bottom otter trawl gear in these fisheries and, therefore, the effects are discountable. In addition, due to their size, right, fin, sei, and sperm whales cannot get caught in the trap/pot itself since the opening is far smaller than any of these species. We focus the remainder of this section on gears that may directly impact large whales.

7.2.1.1. *Factors Affecting Whale Interactions*

Any line in the water column, including line resting on or floating above, the seafloor has the potential to entangle a whale (Hamilton et al. 2018, Hamilton et al. 2019, Johnson et al. 2005). Entanglements may involve the head, flippers, or fluke; effects range from no apparent injury to death. Of the fisheries in this Opinion, large whales are vulnerable to entanglement in vertical or ground lines associated with fisheries using sink gillnet and trap/pot gear as well as the net panels of gillnet gear. No interactions with hook and line gear have been documented for right, sei, or sperm whales. However, one fin whale interaction with hook and line gear was documented in 2016 that resulted in serious injury. While whale interactions with hook and line gear are expected to be rare, we anticipate that any whale species may become entangled in hook and line gear used in these fisheries.

The general scenario that leads to a whale becoming entangled in gear begins with a whale encountering gear. It may move along the line until it comes up against something such as a buoy or knot. When the animal feels the resistance of the gear, it is likely to thrash, which may cause it to become further entangled in the lines associated with gear. The buoy may become caught in the whale's baleen, against a pectoral fin, or on some other body part.

The probability that a marine mammal will initially survive an entanglement in fishing gear depends on the characteristics of the gear, the species, and the health and age of the marine mammal involved. If the gear attached to the line is too heavy and prevents the whale from surfacing, drowning may result immediately. However, many whales have been observed swimming with portions of the line, with or without additional fishing gear, wrapped around a pectoral fin, the tail stock, the neck or the mouth. Documented cases show that entangled animals may travel for extended periods of time and over long distances before freeing themselves, being disentangled by humans, or dying as a result of the entanglement (Angliss and DeMaster 1998).

Determining which part of gear creates the most entanglement risk for ESA-listed species is difficult due to uncertainties surrounding the nature of the entanglement event, as well as unknown biases associated with reporting effort and the lack of information about the types and amounts of gear being used (Johnson et al. 2005). The vertical and ground lines of several different fisheries have been found to entangle large whales. Netting is also known to pose a risk of entanglement to whales. In many events, the animal was entangled in more than one set of gear. The animal may be entangled in the line of one set, which then becomes tangled with the bottom gear or vertical line of a second or third set of gear.

There are generally three initial attachment points for gear to attach to large whales: (1) the gape of the mouth, (2) around the flippers, and (3) around the tail stock. Knots in the line hinder the ability of the line to pass through the baleen. Anchors on the gear or the weight of the gear itself offers resistance against which the whale may struggle and result in further entanglement of the fishing gear across the mouth and/or body of the whale. Conversely, the extra resistance could increase the effectiveness of weak links to assist in shedding gear from entangled whales. Weak links are breakable components of the gear that will part when subject to a certain tension load.

The overlap of the fisheries and large whales in space and time also influences the likelihood that gear entanglement will occur. Atlantic large whales are at risk of becoming entangled in fishing gear as they feed and travel in the action area. North Atlantic right, fin, and sei whales follow a similar, general pattern of foraging at high latitudes (e.g., southern New England and Canadian

waters) in the spring and summer months and calving in lower latitudes (i.e., off of Florida for right whales) in the winter months (CETAP 1982, Clark 1995, Hain et al. 1992, Horwood 2002, Kenney 2009, Perry et al. 1999). The highest abundances of North Atlantic right, fin, and sei whale populations occur from March through November in New England waters, which is also the peak fishing period for the fisheries in these waters. Sperm whales have a different seasonal distribution as described in more detail below.

For many years, right whales aggregated seasonally in seven known areas: the coastal waters of the southeastern United States; the Great South Channel; Jordan Basin; Georges Basin along the northeastern edge of Georges Bank; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Roseway Basin on the Scotian Shelf. Since 2010, fewer whales have been using some of these established habitats such as the Great South Channel and the Bay of Fundy (Davis et al. 2017, Hayes 2019). Meanwhile, the use of Cape Cod and Massachusetts Bay seems to have increased and a large portion of the right whale population is now using an area south of Nantucket and Martha's Vineyard from winter through early spring (Davis et al. 2017, Hayes 2019). This area is also used in other seasons (Oleson et al. 2020). In addition, right whales also use more of the U.S. eastern seaboard than previously believed and can be present in the Mid-Atlantic year round (Davis et al. 2017, Hodge et al. 2015, Salisbury et al. 2016, Whitt et al. 2013). The frequency with which right whales occur in offshore waters in the southeastern United States remains unclear (Hayes 2019).

New England waters are an important feeding ground for fin whales. They are common year round in the EEZ from Cape Hatteras, North Carolina northward; their density varies seasonally (Hayes 2019). Sei whales are present in the action area during spring and summer. The southern portion of the species' range includes the Gulf of Maine and Georges Bank. Spring is the period of greatest abundance of sei whales in U.S. waters (Hayes et al. 2017b).

Sperm whales appear to have a distinct seasonal cycle (CETAP 1982, Scott and Sadove 1997). They are concentrated east and northeast of Cape Hatteras, North Carolina in winter and shift north to east of Delaware and Virginia in spring when they are widespread through the central portion of the Mid-Atlantic Bight and the southern portion of Georges Bank. In summer, the distribution is similar but also includes the area east and north of Georges Bank and into the Northeast Channel region and the continental shelf south of New England. In the fall, sperm whale occurrence south of New England on the continental shelf is at its highest level, and there remains a continental shelf edge occurrence in the Mid-Atlantic Bight. In the U.S. EEZ, they occur on the continental shelf edge, over the continental slope and into mid-ocean regions (Waring et al. 2015).

Because of substantial interannual and geographic variation in whale occurrence and lack of complete data for seasonal distributions, the potential exists for whales to interact with gear used in the fisheries year-round throughout the entire action area.

7.2.1.2. Existing Information on Interactions with Whales

Information available on interactions with large whales comes from reports documented in the GAR Marine Animal Incident Database. Cases in the database include observed cases resulting from entanglement, vessel strike, or unknown cause. We obtain these reports from aerial surveys and vessels on the water that call into the reporting system. The level of information collected for each case varies, but may include details on the animal, gear, and any other information about

the interaction (e.g., location, description, etc.). Each case is evaluated using defined criteria to assign the case to an injury/information category using all available information and scientific judgement. In this way, the injury severity and cause of injury/death for the event is evaluated (Henry et al. 2019, NMFS 2012e). When a case lacks the details necessary for a more specific category, the injury determination is prorated, resulting in a fractional value. For example, cases with evidence of entanglement but with insufficient information to assign it to one of the other categories with a high degree of confidence are prorated at 0.75 (Henry et al. 2019, NMFS 2012e). Serious injury determinations for large whales commonly include animals carrying gear when these entanglements are constricting or appear to interfere with foraging (Hayes et al. 2019). For the purposes of this analysis, we assume that serious injuries result in mortalities. Additionally, depending on the level of information available for each case, the interaction may be attributed to a particular country or unassigned.

When gear is identified, the identification is based on an analysis of recovered gear, fishermen interviews, or information (e.g., gear markings) documented in the field. Frequently, entangled whales have evidence on other body parts of entanglement trauma without gear present, or subsequent sightings may show that the configuration of entangling gear has changed since the initial observation. In these cases, the physical struggle during the initial entanglement may have broken free portions of the gear, including weak links. For example, if an entanglement case had recovered sinking groundline, it is possible the animal had been entangled in other parts of the gear and shed a significant portion of it, with the sinking line being the only part remaining to be recovered.

Evaluating all of the information available for each interaction to make a final determination takes time and the validated data for each case are often not available for one to two years following an interaction. Available preliminary entanglement reports are considered in estimating interaction rates for each species in the sections below. Preliminary reports often change when cases are evaluated more thoroughly. Changes may include adding/deleting cases and changing the determination or status of a case. Preliminary entanglement reports for each year should be considered a minimum number and not comprehensive.

Other information available to assess interactions with fishing gear include scarring estimates. Because whales often free themselves of gear following an entanglement event, scarring is a useful indicator in monitoring fisheries interactions with large whales. Scarring information is available for right whale interactions using research conducted annually using the North Atlantic Right Whale Catalogue (Hamilton et al. 2019). Scar coding and analyses in Hamilton et al. 2019 used the details and methodology presented in papers by Knowlton et al. (2012, 2016), which describes that for a scar to be attributed to entanglement, it must show evidence of the rope having “wrapped” on a given body part. Scars with any uncertainty of source or cause were not included. Data from the catalogue are analyzed to produce annual entanglement estimates using scarring data. In our assessment, we will evaluate the annual entanglement estimates presented in Hamilton et al. (2019) to estimate the rate of right whale entanglements. This rate of entanglement was obtained by accessing a subset of animals adequately photographed in back-to-back years. The information presented in Hamilton et al. (2019) represents the best available information to estimate an annual right whale entanglement rate. There is currently no dedicated research to analyze the scarring rates of the other ESA-listed large whale species. Additionally, the scarring estimate for right whales is not an acceptable surrogate for the other large whale species given the differences in species behavior, distribution, co-occurrence, and body type that

likely contribute to the susceptibility to entanglement. Therefore, at this time there are not enough scarification data available for the other large whale species to calculate a reasonable and scientifically supportable estimate.

Some whale mortalities may never be observed; thus, the annual observed entanglement-related mortalities are likely less than the actual number of entanglement-related mortalities occurring. The methods of Pace et al. (2017) can be used to produce estimates of annual mortality, including both observed and cryptic²³ (unobserved) mortality (Hayes et al. 2019). Subtracting the observed mortality from the estimated annual mortality, we calculated the cryptic mortality. In our assessment, we will evaluate cryptic mortality as well as observed mortality.

A decision support tool (DST) was developed by the NEFSC to aid in the comparison of spatial management measures toward the development of the ALWTRP proposed rule to reach a 60 percent risk reduction target. This model calculates North Atlantic right whale entanglement risk based on three components: (1) line density, (2) whale density, and (3) gear threat per line. The line density component of the DST is based on the peer-reviewed NMFS Vertical Line Model and co-occurrence model developed by IEC. The distribution of whales is from a habitat density model analyzing right whale distribution from 2010-2018.²⁴ The gear threat model was used to determine the potential severity of entanglements of different lines (NMFS 2020b). Together, these components roughly estimate the approximate risk of an entanglement that will result in serious injury or mortality, where a higher density of lines or predicted whales, and/or certain gear characteristics (e.g., high line strength, longer trawls) increase risk. This enables a semi-quantitative comparison of how different management scenarios and gear modifications are predicted to change entanglements that result in serious injury or mortality. For the purpose of this Opinion, the DST was used to assess how much of the risk to right whales is occurring in state vs federal waters. The results show that 60.4 percent of the risk of M/SI to right whales occurs in federal waters. More thorough documentation of the model and its components are available in appendix 3.1 (NMFS 2020b).

To summarize, we are using data from several sources in order to assess the effects of the proposed action on North Atlantic right whales. To evaluate the total number of entanglements, we use the scarification data. To evaluate M/SI, we use the GAR Marine Animal Incident Database to assess observed interactions resulting in M/SI. Annual counts of right whale carcasses do a poor job of indicating the total mortality for that year, and carcass detection rates seem to vary with effective survey effort (Pace et al. 2021). Therefore, we use the total mortality estimate (using methods from Pace et al. 2017) to assess the total mortality. We then subtract the observed interactions (derived from GAR Marine Animal Incident Database) from the total mortality estimates (derived from methods used by Pace et al. (2017) to assess the level of cryptic mortality. The observed M/SI plus cryptic mortality are then apportioned across vessel strikes and entanglements and to the United States and Canada, using the methods described below. This gives an estimate of entanglements resulting in M/SI occurring in U.S. waters. We

²³ Cryptic mortality refers to the death of an animal without resulting in an observed carcass.

²⁴ In the draft Biological Opinion, the distribution of whales was from either a habitat density model analyzing right whale distribution through 2017 or, in Southern New England where distribution has recently shifted, the North Atlantic Right Whale Consortium's Sighting per Unit Effort data from 2014-2018. A new habitat density model is now available and, therefore, we were able to use a single, updated model in the final Biological Opinion..

then use the DST to apportion the entanglements occurring in U.S. waters between state and federal fisheries.

Sublethal Effects of Entanglement

Entanglements may cause sublethal effects that impact an animal's health and reproductive rates (Lysiak et al. 2018, Pettis et al. 2017, Robbins et al. 2015). Sublethal effects of entanglement are difficult to observe or quantify. Therefore, we qualitatively assess the sublethal effects entanglements may have on whales.

When a large whale becomes entangled in fishing gear, they may be partially disentangled or break free of anchor points and carry a portion of the gear with them. Whales carrying gear have a higher energy expenditure due to the increased drag and increased thrust power required to swim (van der Hoop et al. 2017b). Increased drag from carrying gear for long periods can be energetically more costly for a female than the migratory and developmental costs of a pregnancy (van der Hoop et al. 2017a, van der Hoop et al. 2017b, van der Hoop et al. 2017c). Non-lethal entanglements may also reduce or prevent births in the population (Hayes et al. 2018a), cause systemic infection or debilitating tissue damage (Cassoff et al. 2011), or damage the baleen plates preventing efficient filter feeding (Hayes et al. 2018a). Any injury or entanglement that restricts a whale from rotating its jaw while feeding, prevents it from forming a hydrostatic oral seal, compromises the integrity of its baleen, or prevents it from swimming at speeds necessary to capture prey will reduce its foraging capabilities and may lead to starvation (Cassoff et al. 2011, van Der Hoop et al. 2013). As baleen grows slowly, damage to the plates can prevent efficient feeding for years (Hayes et al. 2018a).

While non-lethal entanglement in fishing gear may negatively affect the health or body condition of a whale, multiple stressors (e.g., prey abundance, climate variation, reproductive state, exposure to harmful algal blooms, vessel collisions) co-occur and, individually and cumulatively, can affect the health of animals, and, subsequently, the calving rate of the population. Limited foraging conditions, increases in energetic costs, and stress of entanglements are all likely having an influence on the health and calving rates of whales, however, it is difficult to distinguish the relative effects of each (Hayes et al. 2018a). It is the interplay of these multiple stressors that contributes to the overall health of the animal rather than a single co-variate such as entanglement (Rolland et al. 2016, Schick et al. 2013, van der Hoop et al. 2016). Further, recent literature addressing individual and population level health of right whales are model based, and therefore, the health of whales is based on postulations of the possible impact of multiple stressors, including anthropogenic stressors (e.g., vessel strikes, fishing gear entanglement) (Rolland et al. 2016, Schick et al. 2013). Based on these studies, it is likely that entanglement is a co-variate in the long-term health of right whales. While entanglement results in sublethal effects (van der Hoop et al. 2017a), these effects are often confounded by other factors. Based on the best available scientific and commercial data, we believe at least some of the observed variability in right whale calving rates is due to the sublethal effects of entanglements in U.S. federal fishing gear but cannot quantify the degree to which entanglements are affecting calving rates at this time.

7.2.1.3. *Estimating Interactions with and Serious Injury/Mortality of North Atlantic Right Whales*

Since June 7, 2017, elevated North Atlantic right whale mortalities have been documented, and were declared an Unusual Mortality Event²⁵ (UME). As part of the UME investigation process, additional funding and resources were made available to review the data collected. Therefore, more comprehensive and recent data exists for right whales than the other large whale species. Right whale preliminary entanglement reports are presented below (Table 57). Given that there is comprehensive, validated data available for right whales, preliminary entanglement reports will not be used in the analysis to estimate interactions with right whales. We have reviewed these preliminary reports, and they are consistent with what has been reported in the past so their exclusion from this analysis is not expected to alter any conclusions. For the purpose of this assessment, we are relying on data (e.g., serious injury, country of origin) that have undergone review through the determination process (Henry et al. 2019, NMFS 2012e) described in section 7.2.1.2.

Table 57: Entanglement reports for right whales from January 2019 through March 2021

Date	First seen	Status
4/25/2019	East of Orleans, MA	Partially disentangled; gear shed
6/29/2019	East of Miscou Island, NB	Partially disentangled; gear shed
7/4/2019	East of Perce, QC	Partially disentangled
8/6/2019	Northeast of Iles de la Madeleine, Quebec	Deceased
12/21/2019	South of Nantucket	Entangled
2/24/2020*	South of Nantucket	Entangled
3/16/2020*	Georges Bank	Entangled
10/11/2020*	East of Sea Bright, NJ	Entangled
10/19/2020*	South of Nantucket	Mortality (preliminary cause of death: entanglement)
1/11/2021*	East of Fernandina Beach, FL	Entangled
3/10/2021*	North of Sandwich, MA	Entangled (partially disentangled)

*2020 and 2021 data are preliminary

²⁵ For more information on the UME, see <https://www.fisheries.noaa.gov/marine-life-distress/frequent-questions-2017-north-atlantic-right-whale-unusual-mortality-event>

To estimate future entanglement of right whales resulting in M/SI due to the operation of the federal fisheries, we use data from the GAR Marine Animal Incident Database for the years 2010-2018²⁶. Additionally, to estimate the annual total entanglements resulting from the federal fisheries, we use the most recent scarring estimates for 2010 – 2017 presented in Hamilton et al. (2019). Annual total entanglements includes animals with non-serious entanglements as well as those resulting in serious injury and mortality.

We chose 2010 as the earliest year as this year coincided with a zooplankton regime shift in the Gulf of Maine. The Gulf of Maine has been markedly different in the past decade than in the 2000s. Small bodied zooplankton are now more abundant than large zooplankton such as *C. finmarchicus* (NMFS 2020h). Regime shifts in zooplankton community composition are abrupt changes between contrasting states of a system that persist through time (deYoung et al. 2008). Changes in zooplankton productivity may be one of the most important pathways for climate to impact higher trophic levels of the Northeast continental shelf (Morse et al. 2017). Regime shifts have occurred periodically in the Gulf of Maine (for spring early 1980s, 2002, 2007), on Georges Bank (for spring, early 1990s; for fall, late 1980s), and the Mid-Atlantic Bight (for spring, 1990s; for fall, early 2000s). A regime shift in seasonal sea surface temperature occurred in 2010 in the spring and fall in the Gulf of Maine and Georges Bank, which was followed in 2012 by a shift in the Gulf of Maine zooplankton community (Morse et al. 2017).

The regime shift in 2010 coincided with a noticeable shift in right whale distribution and habitat use (Davies et al. 2019, Davis et al. 2017, Pettis et al. 2018b, Record et al. 2019). Since 2010, right whale habitat use patterns in areas where most of the population has been observed in previous years seems to have changed considerably (Hayes et al. 2019). Climate-driven changes in the Gulf of Maine have shifted the seasonal patterns for essential right whale prey (*C. finmarchicus*), which likely caused right whales to shift their distribution in search of adequate sources of prey (Davis et al. 2017, Morse et al. 2017, Record et al. 2019). There is no information available to suggest when a shift in the zooplankton community may occur again. Given this information, the 2010-2018 data represent the best available information to estimate future right whale interactions with the fisheries.

Between 2010 and 2018, there were 107 confirmed right whale entanglements with 48.5 resulting in M/SI (Table 58). Of these, 16 cases (7.75 M/SI) were confirmed to be entanglement with Canadian fishing gear, and 8 cases (2 M/SI) were confirmed to be entanglement in U.S. fishing gear. The remaining 83 (38.75 M/SI) cases were the result of entanglement with gear from an unknown country of origin. While sightings and acoustic records indicate an extended range (i.e., outside of U.S. or Canadian waters) for at least some individuals (Hayes et al. 2020), all interactions with fishing gear attributed to country were from U.S. or Canadian gear. Therefore, this analysis attributes entanglements to either U.S. or Canadian fishing gear. As

²⁶ Note that the draft Biological Opinion used data from 2010-2019. In developing the final Biological Opinion, we discovered a misalignment in the data. This has been corrected in this final Biological Opinion. Although the 2019 right whale observed interactions data is available, the total mortality estimate for 2019 is not available. Given that we need the total mortality estimate to calculate the cryptic mortality in 2019, we do not include the 2019 data in our average annual estimates below.

described above, injury cases may be prorated resulting in fractional values in the data presented below.

Table 58: Observed entanglements of North Atlantic right whales from 2010 through 2018 by country of origin. Entanglements resulting in M/SI are presented in the parentheses. Source: GAR Marine Animal Incident Database

	Number of Entanglements	Confirmed Canada	Confirmed U.S.	Unknown Country of Origin
2010	6 (4)	0	1	5 (4)
2011	14 (5.5)	0	2	12 (5.5)
2012	12 (4)	0	1 (1)	11 (3)
2013	5 (0.75)	0	0	5 (0.75)
2014	17 (8)	1	1 (1)	15 (7)
2015	9 (3.5)	1	0	8 (3.5)
2016	15 (9.5)	3 (3)	1	11 (6.5)
2017	15 (6)	8 (3)	1	6 (3)
2018	14 (7.25)	3 (1.75)	1	10 (5.5)
Total	107 (48.5)	16 (7.75)	8 (2)	83 (38.75)

Although the observed entanglement data include non-M/SI events, these observed events are considered a minimum estimate, and the actual entanglement rate is likely higher. To account for this underrepresentation of non-M/SI events in the observed entanglement data, our annual entanglement estimate for this Opinion is based on the scarring analysis presented in Hamilton et al. (2019). This approach provides the benefit of the doubt to the species and a more conservative estimate of total right whale entanglements. Therefore, non-M/SI entanglements documented in the GAR Marine Animal Incident Database will not be considered further in this Opinion.

Assignment of an observed entanglement event to a specific fishery or country of origin is rarely possible. Gear is often not retrieved. In cases where gear is retrieved, identification may not be possible because the same gear (e.g., lines and webbing) is used in multiple fisheries. Therefore, we must make assumptions on the origin of the gear for cases where that information is not available. As described below, we use different sources of data to partition M/SI between countries, gear type, cause of M/SI, and state and federal fisheries. Different data are available for each of these categories. In each case, we determined which data source represented the best available data and used that to partition the take. The rationale behind these assumptions is described below and summarized in Table 60.

Unknown Country Apportionment

The estimated M/SI with unknown country of origin was partitioned between the United States and Canada following the approach used by the ALWTRT for their April 2019 meeting; a 50/50 split, to apportion take between countries. In developing the transboundary approach for the ALWTRT, NMFS considered whether there was sufficient information to follow the guidance related to transboundary stocks provided in the NMFS Guidelines for Assessing Marine Mammal Stocks ([GAMMS](#)). Under this guidance, NMFS would assign serious injuries and mortalities that could not be identified to a country of origin based on the percentage of time right whales occur in each country's waters. This likely would have assigned a higher than 50 percent portion of

unknown sources to U.S. fisheries based on historical distribution of the animals. However, given the stock's recent distribution shift, the large portion of the population increasingly occurring in Canadian waters, and the lack of rangewide survey coverage, it was determined that there was insufficient information to quantify the fraction of time right whales now spend on each side of the border. In developing the target for the ALWTRP, NMFS also considered apportioning based on known risk. It is clear from recent documented M/SI incidents where gear has been present that heavier snow crab gear poses a greater mortality risk than buoy lines associated with most nearshore lobster fisheries. However, given the large number of lines in U.S. waters including larger diameter lines and long traps/trawl configurations in offshore U.S. fisheries, significant risk occurs on both sides of the border. Seasonal and dynamic measures have been implemented in Canada, but broadscale measures have been in place in U.S. waters for many years. Given limited distribution information and transboundary fishery attributes, NMFS assessed an equal division of the unassigned serious injuries and mortalities between the United States and Canada. These methods were peer reviewed by the Center for Independent Experts, and while the reviewers did not come to consensus on accuracy, they considered the approach reasonable.²⁷ Therefore, for the purpose of this Opinion, we determined that this 50/50 split represented the best available information.

Unknown Gear Type Apportionment

For entanglements with no gear type identified, we assessed a variety of information to apportion these interactions to trap/pot or gillnet gear. Entanglements are categorized as unknown when there is no gear present or the gear that is present cannot be identified to a particular gear type. When there is net gear present, but it is unknown whether the net gear is gillnet or another net, the gear is categorized generally as net. There were 82 entanglements categorized as unknown and 2 as net (Table 59). Of the 56 non-serious injury entanglement cases from 2010-2018, 43 are categorized as unknown gear, with 23 percent of these unknown gear cases (10 of 43) reported to have gear present. Of the unknown gear M/SI cases (39), 56 percent (22) of the cases were reported with gear present. With the exception of one case, when gear was present and the entanglement case was classified as unknown gear, it was described as lines, sometimes with associated buoys or polyballs. Without identifying marks, we cannot know whether the line is from gillnet gear, trap/pot gear, or another source. In one case, the gear was described as a bridle, configuration unclear. Bridles are used in trap/pot fisheries.

²⁷ See peer review reports for North Atlantic right whale DST review report (2019-2) at <https://www.st.nmfs.noaa.gov/science-quality-assurance/cie-peer-reviews/cie-review-2019>.

Table 59: Number of entanglement interactions and M/SI by gear type from 2010-2018 Source: GAR Marine Animal Incident Database

	Unknown	Gillnet	Net	Pot/Trap	Total
Entanglements	82	6	2	17	107
M/SI	37	1.75	0.75	9	48.5

Based on the information provided in Table 59, M/SI appears to vary by gear type with 53 percent of known trap/pot, 29 percent of gillnet, and 38 percent of net interactions resulting in M/SI. For the cases in unknown gear, 45 percent of the interactions resulted in M/SI. However, this data must be interpreted cautiously given the small number of cases. Net interactions are associated with unidentified nets, which may include gillnets, cast nets, and weirs, among others. For gillnets and vertical lines, there are requirements under the ALWTRP (e.g., weak links in the buoy lines, weak links on the head rope) to reduce the severity of whale interactions with gillnet gear. Similar measures for other net types are not in place. It is possible that the differences in the M/SI between trap/pot and gillnet gear are due to the ability of the animal to break free from gillnet gear.

Interactions that involve gillnet net panels may be more easily detected and identified on large whales; resulting in a higher percentage of these interactions being identified in the database. In addition, 71 percent²⁸ of the interactions in confirmed gillnet gear were categorized as non-serious; while only 47 percent of interactions in confirmed trap/pot gear were categorized as non-serious. As noted above, large whales interacting with gillnet net panels may be able to break free of the gear, and the data indicate that large whales may be able to shed net panel gear.

The other component of the gillnet gear that entangles large whales are the vertical lines. As described above, the records indicate that gear was documented in approximately half of the interactions with unknown gear (which account for 77 percent of all interactions) that resulted in M/SI. With the exception of one, these cases all involved some type of line. Entanglement records in which no gear was present are determined based on wounds and scars. In these cases, it is possible that the interaction was with a different portion of the gear; however, given the data, a portion of these cases likely also involve vertical line gear.

The interaction rate with the gear is based, at least in part, on the co-occurrence of species and the gear. There is no data to indicate that the interaction rate with gillnet vertical lines would differ from the interaction rate with vertical lines associated with trap/pot gear. However, 99.7

²⁸ There were six gillnet entanglement cases, of which 1.75 resulted in M/SI. Although 4 of 6 (67 percent) of the cases were categorized as non-serious, the prorated value results in 71 percent of gillnet entanglements being categorized as non-serious.

percent of vertical lines in the action area are from trap/pot lines²⁹ (2016 IEC, unpublished data). Therefore, we anticipate that the interactions with unknown line gear are much more likely to be from trap/pot gear than gillnet gear.

Based on this information, we determined that it is more reasonable to apportion unknown M/SI to trap/pot gear, rather than simply using the ratio of confirmed gillnet to trap/pot gear to assign unknown M/SI cases given that (1) the records indicate line was the predominant gear involved in cases with unknown gear and the majority of the cases involved unknown gear; (2) interactions with net panels may result in less severe injuries as the animal may be able to break free from the gear; and (3) interactions with vertical lines are more likely to be trap/pot gear given the co-occurrence of the right whales and trap/pot gear. If these assumptions are not correct and gillnet gear is involved in a larger portion of the unknown entanglements, this may be compensated as interactions with unknown net gear were assumed to be from gillnet gear.

U.S. State vs Federal Apportionment

The NEFSC DST was used in this Opinion to compare right whale serious injury and mortality risk in U.S. waters from trap/pot gear in state and federal waters as equitably as possible. To capture how much risk from trap/pot gear is occurring in state versus federal waters, the DST assessed the risk reduction that would occur if all federal waters were closed to all trap/pot fishing gear. The DST showed that showed 60.4 percent of the risk from trap/pot gear to right whales is occurring in federal waters. Given this information, we apportion 60.4 percent of the estimated right whale entanglements occurring in U.S. trap/pot gear to the federal fisheries. The DST was not used to apportion the presumed entanglements in gillnet gear. As described above, all of the presumed gillnet entanglements are attributed to U.S. federal fisheries.

Entanglement vs Vessel Strike Apportionment

For apportioning takes with unknown cause between entanglement and vessel strikes, we used observed cases from the most recent decade (2010-2019) for which information is available.

Other approaches were considered in apportioning take between entanglement and vessel strike. From 2003-2018, a review of 70 mortalities found that of the examined (56) and necropsied (44) carcasses, entanglements accounted for 58 percent and vessel strikes accounted for 43 percent of the mortalities (Sharp et al. 2019). In a separate study, from 1990 to 2017, NMFS reported 62 live right whales as having serious injuries that were defined as life-threatening and subsequently disappeared from the population (Pace et al. 2021). Entanglement accounted for the vast majority (54 of 62, or 87 percent) of these cases (Pace et al. 2021). During this same time period, 41 carcasses were examined, and only 49 percent of the deaths were determined to be entanglement related (Pace et al. 2021). These data suggest that cryptic deaths due to entanglements significantly outnumber cryptic deaths from vessel strikes (Pace et al. 2021).

For this Opinion, we used the observed data from 2010-2019³⁰. Between 2010 and 2019, 15.04 M/SI were confirmed to be due to vessel strikes, and 50.5 M/SI were due to entanglement (GAR

²⁹ This percentage is an average across all months and includes all waters non-exempt and exempted from the ALWTRP.

³⁰ The 2019 observed data was used as it provides the most recent sightings data relevant to this apportionment.

Marine Animal Incident Database, unpublished data). Based on this ratio, we assume 23 percent of the cases in the United States where the cause was unknown were due to vessel strike and 77 percent due to entanglement. While this estimate of mortalities due to entanglement is slightly lower than the estimate included in (Pace et al. 2021) and the authors caution about using detected carcasses when determining cause of death, we believe it represents the best available information as it accounts for serious injury and mortality after the shift in right whale distribution and the exposure to different threats due to this shift. It is also consistent with the findings of Pace et al. (2021) that entanglements significantly outnumber vessel strikes in cryptic mortalities.

There are six categories of entanglement cases considered for attribution to U.S. state and federal fisheries: (1) observed entanglement, confirmed United States; (2) observed entanglement, country unknown; (3) observed, unknown cause, confirmed United States; (4) observed, unknown cause, unknown country; (5) unobserved (cryptic), unknown cause, unknown country; and (6) animals documented with entanglement scars.

Observed Entanglement, Confirmed United States: Entanglements confirmed to be from U.S. trap/pot or gillnet gear were assigned to the U.S. fisheries. Between 2010 and 2018, there were two observed M/SI entanglement cases involving confirmed U.S. fishing gear. One of these was in unknown trap/pot gear, and the other was in unknown gear.

Observed Entanglement, Country Unknown:

There were 38.75 M/SI observed entanglement cases involving gear from an undetermined country of origin from 2010 through 2018 (Table 58). Of these, 1.0 M/SI was identified as trap/pot, 1.75 M/SI as gillnet, 0.75 M/SI as net, and 35.25 M/SI as unknown gear type. As described above, although the net gear entanglements may not have been a result of gillnet gear, to ensure our estimate is conservative to the species, the 0.75 M/SI entanglements involving net gear were assumed to be gillnet gear resulting in a total of 2.5 M/SI entanglements in gillnet gear.

We applied the 50 percent U.S./Canada split to the totals, and presumed 19.375 M/SI entanglements were the result of the U.S. fisheries. Further, 0.5 M/SI entanglements were presumed to be in U.S. trap/pot gear, 1.25 M/SI in U.S. gillnet gear, and 17.625 in U.S. unknown gear.

Phase 1 of the Framework (ALWTRP proposed rule) will reduce risk to large whales from entanglement in lobster and Jonah trap/pot gear. Therefore, in order to properly evaluate the proposed measures, we apportioned the 19.375 M/SIs in unknown U.S. fisheries between gillnet and trap/pot. For entanglements with a gear type identified, the entanglement was assigned to that gear type. As described above, for entanglements with no gear type identified, we are assuming that all of the presumed U.S. entanglements in unknown gear were from trap/pot gear. Therefore, of the 19.375 M/SI entanglements presumed to be a result of the U.S. fisheries, 18.125 M/SI are presumed to be from U.S. trap/pot gear and 1.25 M/SI from gillnet gear.

Observed, Unknown Cause, Confirmed United States. For these cases, we applied the ratio described above (23 percent vessel strike, 77 percent entanglement) of all observed M/SI

resulting from entanglement and vessel strikes from 2010 - 2019³¹. There was one mortality confirmed to the United States with an unknown cause. Applying the apportionment, 0.77 right whales were presumed to be entangled and died in U.S. fishing gear.

Observed, Unknown Cause, Unknown Country: There are also observed cases that are unknown cause and not assigned to country. As above, we assumed that 50 percent of these occurred in the United States, and, of those, 77 percent were assumed to be due to entanglement. When both of these assumptions are applied, it is equivalent to 38.5 percent.

There were 12 M/SI cases observed from 2010 to 2018 where the country and cause were unknown. Of these, 6 M/SI (50 percent of 12) are presumed to have occurred in the United States. Of these entanglements, 4.62 M/SI (77 percent of 6) cases are assumed to be a result of entanglement.

Unobserved (Cryptic), Unknown Cause, Unknown Country: We also used the vessel strike/entanglement ratio and the U.S./Canada split to apportion cryptic mortality. Natural mortality is not included in the apportionment as there is little evidence showing this to be a cause of right whale mortality except at the calf stage (Corkeron et al. 2018).

We estimate cryptic mortality by subtracting the observed mortality in U.S. and Canadian waters from the total mortality. The total right whale mortality estimate generated by the NEFSC from the state space model under status quo for 2010-2018 is 190 (using methods from Pace et al. 2017). From the total mortality estimate (190), we subtracted the observed M/SI due to entanglement (48.5), vessel strike (11.04), and unknown cause (20). We determined that 110.46 mortalities occurred that were not observed and, therefore, considered cryptic mortalities. Of these mortalities, 55.23 (50 percent of 110.46) are presumed to have occurred in the United States. Of these, 42.53 M/SI (77 percent of 55.23) cases are assumed to be a result of entanglement.

Scarring Rates: Research using the North Atlantic Right Whale Catalogue has indicated that between 2010-2017, on average, 30.25 percent of right whales acquired new wounds or scars from fishing gear annually (Hamilton et al. 2019). We used the U.S./Canada split to apportion the total annual entanglement rate. Assuming 50 percent of the 30.25 percent are the result of entanglement with U.S. fishing gear, we determined that an average of 15.125 percent of the right whale population becomes entangled annually in U.S. fishing gear (Table 61).

³¹ The 2019 observed data was used as it provides the most recent sightings data relevant to this apportionment.

Table 60: Summary of the apportionment of M/SI cases between 2010 and 2018 that we assume to be from entanglement in U.S. gear.

Added to the Total	Assumption	Rationale	M/SI Entanglements Attributed to U.S. Fisheries 2010-2018 (Annual Average)
All confirmed U.S. gear entanglement cases	NA	Observed numbers being used	2 (0.22)
50 percent of confirmed entanglement cases from unknown country	Assumes half of cases belong to United States and half to Canada Assumes all entanglement cases not identified to gear type are trap/pot	Observed numbers being split between countries following apportionment from TRT process 99.7 percent of vertical line gear (2016 IEC data) is trap/pot gear ³²	19.375 (2.15)
77 percent of cases with unknown cause confirmed in U.S.	Assumes that ratio of confirmed entanglement and vessel strike case applies to cases with unknown cause. Assumes all entanglements are trap/pot	Observed numbers apportioned based on confirmed cases ratio. Scientific opinion differs on whether an observer bias may occur for these two types of risk; going with observed apportionment is best available.	0.77 (0.086)
38.5 percent of the cases with an unknown cause/unknown country	Assumes 50 percent of cases belong to United States and half to Canada Assumes that ratio of confirmed entanglement and vessel strike case applies to cases with unknown cause (77 percent). Assumes all entanglements are trap/pot	Carrying forward the same assumptions and ratios from observed/confirmed cases, U.S./Canada split, and assigning unknown entanglements to trap/pot.	4.62 (0.513)
38.5 percent of cryptic mortality	Assumes 50 percent of cases belong to United States and half to Canada Assumes that ratio of confirmed entanglement and vessel strike case applies to cryptic mortality (77 percent). Assumes all entanglements are trap/pot	Carrying forward the same assumptions and ratios from observed/confirmed cases, U.S./Canada split, and assigning unknown entanglements to trap/pot.	42.53 (4.725)
Total			69.29 (7.7)

³² When considering U.S. waters that are non-exempt under the ALWTRT, the percentage decreases to 99.4.

Table 61: Summary of the apportionment of the estimated annual entanglement rate based on scarring analysis in Hamilton et al. 2019 between 2010 and 2017 that we assume to be from entanglement in U.S. gear.

50 percent of the annual average entanglement rate based on scarring analysis (Hamilton et al. 2019).	Assumes half of cases belong to United States and half to Canada	Scarring rate split between countries following apportionment from TRT process	15.125 percent of population

Total Entanglements in the U.S. Federal Fisheries

To estimate how much risk from trap/pot gear is occurring in U.S. federal fisheries, we used the results of the DST that showed 60.4 percent of the risk from trap/pot gear to right whales is occurring in federal waters. Given this information, we apportion 60.4 percent of the estimated right whale entanglements occurring in U.S. trap/pot gear to the federal fisheries.

As described above, to estimate the annual rate of total entanglements from the U.S. fisheries, we use the data presented in Hamilton et al. (2019) based on analysis of scarring rates between 2010 and 2017. Based on this information, we determined that the U.S. fisheries will entangle an average of 15.125 percent of the total right whale population annually (Table 61). Of the 15.125 percent of the population entangled annually, we apportioned 60.4 percent of the entanglements to the U.S. federal fisheries analyzed in this Opinion. Given this information, we determined that an average of 9.14 percent of the right whale population is entangled annually in U.S. federal fishing gear.

Total Entanglements in U.S. Federal Fisheries Resulting in M/SI

As described above, our analysis includes data from 2010 to 2018 for observed entanglements, presumed entanglements, and cryptic mortality. The final estimate of right whale M/SI as a result of entanglement in U.S. fishing gear between 2010 and 2018 is 69.29 (annual average 7.7) (Table 60).

The DST showed 60.4 percent of the risk from trap/pot gear to right whales in U.S. waters is occurring in federal waters. All entanglements presumed to be from U.S. gillnet gear (1.25 (annual average 0.125)) were assigned to the federal fisheries in this Opinion. While these entanglements may have occurred in gillnet gear used in fisheries not included in this Opinion, we are giving the “benefit of the doubt” to the species and assuming the interactions were caused by gear used in the federal fisheries in this Opinion.

To estimate the annual average number of entanglements that occurred in U.S. federal fishing gear, we first subtracted the estimated annual average of 0.125 M/SI that occurred in gillnet gear³³ from the total annual average estimated entanglements in U.S. fishing gear (7.7), which

³³ The gillnet estimate is based on the observed data from 2010-2019. The most recent 10-year period represents the best available information for apportioning interactions by gear type. The total mortality estimate is not available for

results in an annual average of 7.57 entanglements in trap/pot gear. We then apportioned 60.4 percent of the estimated entanglements in trap/pot gear (annual average 4.57) to the U.S. federal fisheries and then added back the estimated annual average of 0.125 entanglements in gillnet gear. This results in an estimated annual average of 4.7 M/SI. Given this information, we determined that an annual average of 4.7 right whale M/SI are the result of entanglement from gear used in the U.S. federal fisheries.

Applying the Framework Risk Reduction Percentage

As described in section 3.23.2.1, the Framework will implement four phases designed to reduce entanglement risk to right whales in federal waters. Here, we assess how M/SI in the federal fisheries will be reduced over the implementation of the Framework. The Framework includes:

- Phase 1: The implementation of the 2021 ALWTRP proposed rule measures to reduce the risk of entanglement resulting in M/SI by 58.1 percent³⁴ to right whales in trap/pot gear used in lobster and Jonah crab fisheries.
- Phase 2: In 2023, NMFS implements measures to reduce M/SI by 60 percent to right whales in federal gillnet and other trap/pot (e.g., finfish, red crab) fisheries.
- In 2023-2024, NMFS evaluates measures implemented in the 2023 action as well as new data on the right whale population and threats to assess progress towards achieving the conservation goals of the Framework. At this time, we also expect to be able to assess and incorporate effectively the risk reduction measures taken by Canada to address M/SI in their fisheries.
- Phase 3: In 2025, NMFS implements rulemaking to further reduce the remaining M/SI in federal fixed gear fisheries by 60 percent risk.
- In 2025-2026, NMFS evaluates measures implemented in 2025 action as well as new data on the right whale population and threats to assess progress towards achieving the conservation goals of this Framework. Based on the results of this evaluation, NMFS will determine the degree to which additional measures are needed to ensure the fisheries are not appreciably reducing the likelihood of survival and recovery.
- Phase 4: In 2030, further reduction will be implemented. These reductions will achieve the additional level of risk reduction (expected to be up to an 87% additional reduction) in M/SI of right whales as a result of entanglement with gear used in the federal fisheries that is needed at the time to ensure the likelihood of survival and recovery of the species.

The implementation of the Framework will change how the fisheries considered in this Opinion operate, and as such, these changes are considered in our analysis. While the Framework takes an adaptive management approach, NMFS is committed to achieving the level of reduction needed and specified. Therefore, this analysis considers the implementation of the Framework at the maximum levels specified.

2019, therefore we cannot calculate cryptic mortality and the 2019 data was not considered in estimating M/SI in pot/trap gear.

³⁴ The ALWTRP proposed rule has a risk reduction greater than 60 percent as it accounts for risk reduction previously achieved in Massachusetts state waters. In this Opinion, we analyze only the future risk reduction measures which will achieve a 58.1 percent reduction in risk to right whales.

Phase 1

Phase 1 on the Framework (ALWTRP proposed rule) will incorporate several provisions to reduce the risk of entanglements resulting in M/SI to right whales in the lobster and Jonah crab trap/pot fisheries by at least 58.1 percent. The gear modification requirements include reducing the number of lines in the water (e.g., via increasing the number of traps per trawl, time/area closures to persistent buoy lines) and reducing serious injury and mortality in the remaining lobster and Jonah crab buoy lines by specifying a low (no greater than 1700 lb) maximum breaking strength or weak inserts for vertical line to be used in certain areas depending on gear configurations. Additionally, measures will include gear marking requirements. More detailed information on the measures can be found in the [ALWTRP proposed rule and draft Environmental Impact Statement \(EIS\)](#). The discussion below describes the impact of each of the measures on whale entanglement risks.

- **Line Reduction Requirements:** Measures to reduce the number of vertical lines fished benefit large whales by reducing co-occurrence and associated opportunity for entanglement in buoy lines and associated gear. Measures include requirements to increase the minimum number of traps per trawl in the Northeast to reduce the number of vertical buoy lines in the water. These measures are expected to reduce the total number of entanglements.
- **Seasonal Buoy Line Closures:** Closures protect areas of predictable seasonal aggregations of right whales. The regulatory changes include several restrictions on when and where trap/pot gear can be set with persistent buoy lines. Two existing closures to trap/pot fishing would instead be closed to fishing trap/pot gear with persistent buoy lines; allowing “ropeless” fishing. Ropeless fishing is usually done by storing buoy lines on the bottom and remotely releasing the buoy to retrieve the line when fishermen are on site to haul in their trawl of traps, or other bottom gear. Proposed measures include two new seasonal closure areas. These measures are expected to reduce the total number of entanglements.
- **Weak Line/Insert Requirements:** The regulatory changes include provisions such as requiring that lobster and crab trap/pot gear modify buoy lines to using rope that breaks at 1700 lb. for substantial lengths of the buoy line or for some weak insertions. The specified strength rope or weak inserts is based on a study that indicated that, if a large whale does become entangled, it is more likely to exert enough force to break the rope before a severe entanglement occurs, reducing risk of serious injury or mortality. These measures are expected to reduce the severity of entanglements.
- **Gear marking requirements:** Gear marking requirements will not reduce impacts to large whales but will provide information that will enable us to better understand what fisheries are interacting with these species.

The 2021 ALWTRP proposed rule will reduce the risk of M/SI to right whales from U.S. lobster and Jonah crab trap/pot gear only. However, we are unable to partition the entanglement data above between the different trap/pot fisheries (e.g., lobster pots, fish pots, crab pots). Therefore, our analysis includes all entanglements that are presumed to be in U.S federal gear and will apply the federal portion of the 58.1 percent risk reduction to the estimated number of entanglements resulting in M/SI. Given that some of the risk reduction measures are designed to reduce the severity of entanglements and not the likelihood, as a conservative approach, the risk

reduction was not applied to the estimated total number of right whale entanglements (i.e., non-serious entanglements).

Using results from the DST, we determined the proportion of the 58.1 percent reduction in M/SI due to the ALWTRP measures that would occur in state fisheries vs. federal fisheries. The results showed that 45.78 percent of the total ALWTRP proposed 58.1 percent risk reduction is from federal trap/pot fisheries. This indicates that of the 58.1 percent risk reduction in M/SI due to measures implemented under the ALWTRP, a 26.6 percent (45.78 percent of 58.1 percent) risk reduction of the total U.S. trap/pot entanglements will occur in federal waters. A 26.6 percent reduction of the annual estimate of total U.S. entanglements in trap/pot gear (7.57) results in a reduction of 2.01 M/SI entanglements. We subtract this reduction (2.01) from the total estimated M/SI entanglements in trap/pot gear used in the federal fisheries (4.57) resulting in 2.56 M/SI entanglements in the U.S. federal trap/pot fisheries after the implementation of the ALWTRP rulemaking. We then added in the estimated gillnet M/SI entanglements (0.125) and determined that with the measures implemented in the ALWTRP proposed rule, an annual average of 2.69 M/SI right whale entanglements will occur as a result of gear used in the U.S. federal fisheries (Table 62).

Table 62: Annual average number of right whale M/SI entanglements with measures implemented under the ALWTRP proposed rule, based on apportionments calculated using the DST

	Estimated M/SI in trap/pot gear (60.4% Fed)	Reduction of M/SI with measures implemented under the proposed rule (26.6% Fed)	Remaining M/SI in trap/pot gear with measures implemented under the proposed rule	% Risk reduction in trap/pot gear	Remaining M/SI with measures implemented under the proposed rule (including gillnet)
State	3	2.39	0.61	79.7%	0.61
Federal	4.57	2.01	2.56	44%	2.69
Total	7.57	4.4	3.17	58.1%	3.3

We have determined that, after the implementation of the 2021 ALWTRP proposed rule, the operation of the U.S. federal fisheries will entangle an annual average of 9.14 percent of the right whale population resulting in an annual average of 2.69 M/SI.

Phase 2

Phase 2 of the Framework will implement measures to reduce right whale M/SI in other federal trap/pot fisheries (i.e., red crab, scup, black sea bass) and federal gillnet fisheries by 60 percent. The gear modification requirements for Phase 2 are expected to be similar to those implemented in Phase 1. This includes, but is not limited to, reducing the number of lines in the water (e.g., via increasing the number of traps per trawl, time/area closures to persistent buoy lines) and reducing serious injury and mortality in the remaining buoy lines by specifying a low maximum breaking strength or weak inserts for vertical line to be used in certain areas depending on gear configurations.

As previously described, the 2021 ALWTRP proposed rule will reduce risk in American lobster and Jonah crab fisheries. Although most often we do not know which fishery's gear was

involved in these entanglements, the lobster and Jonah crab fisheries represent the vast majority of the gear in U.S. federal waters, and we expect entanglements in other federal trap/pot gear to be rare. Therefore, we assumed that the 58.1 percent reduction from the ALWTRP proposed rule applied to the total M/SIs in trap/pot fisheries. Although it is possible that the risk reduction we assumed in Phase 1 may apply to entanglements that may be from federal trap/pot gear used in trap/pot fisheries not regulated in Phase 1 (e.g., red crab or finfish fisheries), there is no way to separate these out. If a rare entanglement occurs in federal gear that is not regulated under Phase 1, it is addressed in Phase 2, which will reduce M/SIs occurring in federal gillnet and other trap/pot fisheries (i.e., red crab, scup, black sea bass) by 60 percent. Therefore, as the risk reduction in all trap/pot gear entanglements resulting in M/SI has been analyzed in Phase 1, Phase 2 will analyze a 60 percent risk reduction of right whale M/SI entanglements in gillnet gear.

Phase 2 is expected to reduce right whale M/SI entanglements in gillnet gear in federal waters by 60 percent. As previously described, we anticipate an annual average of 0.125 right whale M/SI as a result of entanglement in gillnet gear. A 60 percent risk reduction is expected to reduce the annual average of right whale M/SI entanglements in gillnet gear by 0.075 to 0.05. This reduction is subtracted from the estimated M/SI occurring after Phase 1 (annual average 2.69), which results in an estimated annual average of 2.61 right whale M/SI entanglements expected to occur in federal waters.

Given that some of the risk reduction measures will be designed to reduce the severity of entanglements and not the likelihood, the risk reduction was not applied to the estimated total number of right whale entanglements (i.e., non-serious entanglements). Therefore, we have determined that after the implementation of Phase 2 of the Framework in 2023, the U.S. federal fisheries will entangle an annual average of 9.14 percent of the right whale population and an annual average of 2.61 right whale M/SI entanglements in federal waters (Table 63).

Phase 3

For the federal fisheries to implement Phases 3 and 4 of the Framework, additional management measures will need to be put in place. Here, the Framework described general measures that could be implemented (independently or in conjunction) to achieve the required risk reduction of these phases, but NMFS will work with its partners to develop the specific measures to reduce M/SI. The measures listed here are not intended to be exhaustive, and any additional strategies to reduce risk to right whales that achieve the conservation goal will be acceptable towards achieving the risk reduction target of Phases 3 and 4 of the Framework.

Buoy Line Closures: Temporary or permanent closures of areas to fishing fixed gear with persistent buoy lines. Vessels would be allowed to fish with fixed gears in these areas without persistent buoy lines. These closures would protect areas of predictable seasonal aggregations of right whales.

Line Reduction Requirements: Reduce the number of vertical lines in the water. This can be achieved by increasing the minimum number of traps per trawl, trap reductions, or implementing line cap allocations of buoy lines in federal waters. Measures to reduce the number of vertical lines fished benefit right whales by reducing co-occurrence and opportunities for entanglement in buoy lines and associated gear.

“Ropeless Fishing”: Ropeless fishing technologies generally store buoy lines on the bottom and remotely releasing the buoy to retrieve the line when fishermen are on site to haul in their gear. Requiring ropeless fishing would remove buoy lines from the water and would benefit right whales by reducing opportunities for entanglement in buoy lines. A number of systems are currently being tested for operational effectiveness in trap/pot fisheries in the Greater Atlantic Region and are expected to be ready for implementation during the implementation of the Framework.

Phase 3 of the Framework will implement measures to reduce right whale M/SI in all federal fisheries by an additional 60 percent. A 60 percent risk reduction will reduce the annual average of 2.61 right whale M/SI entanglements in federal waters by 1.57, resulting in an annual average of 1.04 M/SI in the federal fisheries after the implementation of Phase 3. Although final measures for Phase 3 have not been determined, in order to achieve the risk reduction requirements in Phase 3, the federal fisheries will need to implement measures that will substantially reduce the co-occurrence of right whales and vertical lines. This reduction in co-occurrence is expected to reduce the number of total entanglements of right whales in federal waters. Although we cannot quantify the reduction in the number of entanglements, we expect it to be lower than 9.14 percent of the right whale population. Therefore, we have determined that after the implementation of Phase 3 of the Framework in 2025, the U.S. federal fisheries will entangle an annual average of less than 9.14 percent of the right whale population, and an annual average of 1.04 entanglements are anticipated to result in M/SI (Table 63).

Phase 4

Phase 4 of the Framework will implement measures to reduce right whale M/SI in all federal fisheries by an additional 87 percent. An 87 percent risk reduction will reduce the annual average of 1.04 right whale M/SI entanglements in federal waters by 0.91, resulting in an annual average of 0.136 M/SI in the federal fisheries after the implementation of Phase 4. Although final measures for Phase 4 have not been determined, in order to achieve the risk reduction requirements in Phase 4, the federal fisheries will need to implement measures that will substantially reduce the co-occurrence of right whales and vertical lines. This reduction in co-occurrence is expected to reduce the number of total entanglements of right whales in federal waters. Although we cannot quantify the reduction in the number of entanglements, we expect it to be lower than 9.14 percent of the right whale population. Therefore, we have determined that after the implementation of Phase 4 in 2030, the U.S. federal fisheries will entangle substantially less than 9.14 percent of the right whale population on average annually and will entangle an annual average of 0.136 that are anticipated to result in M/SI (Table 63).

Table 63: Annual average number of right whale M/SI entanglements in federal fisheries before and after measures implemented under the Framework

	Estimated M/SI in federal trap/pot gear	Estimated M/SI in federal gillnet gear	Reduction of M/SI	Remaining M/SI with measures implemented
Phase 1	4.57	0.125	2.01 (in trap/pot)	2.69
Phase 2	2.56	0.125	0.075 (in gillnet)	2.61
Phase 3	2.56	0.05	1.57 (any gear type)	1.04
Phase 4	1.04 (trap/pot and gillnet combined)		0.91 (any gear type)	0.136

As described in the Framework, NMFS will evaluate whether the requirement to reduce M/SI by 87 percent can be lowered, depending on any changes to the population status and environmental baseline (i.e., increased calving rates, risk reductions in vessel strikes and fisheries in Canada, risk reductions in U.S. state fisheries, and/or vessel-strike reductions in U.S. waters). The M/SI reduction may be reduced from the 87 percent target if an action outside the federal fisheries reduces risk to right whales by 0.5 M/SI on average annually (1 whale every two years). Should this occur, the M/SI reduction requirement will be reduced from 87 percent to 39 percent. It is possible that population-wide risk reduction measures will reach a level at which further action in the federal fisheries is not needed. If M/SI from other sources is reduced by greater than one M/SI on average annually, we will evaluate whether further action in the federal fisheries is needed and, if so, at what level.

We have determined that after the implementation of the Framework, the U.S. federal fisheries will entangle substantially less than 9.14 percent of the right whale population on average annually. Depending on if the criterion is met to reduce the risk requirement of the fourth and final phase, entanglements will result in the M/SI specified below (Table 64).

Table 64: Criteria for reductions in the final action of the Framework

Criteria	Reduction Required	Remaining M/SI in federal fisheries with measures implemented
No change in the status	87%	0.136
M/SIs outside the action reduced by 0.5 animals	39%	0.64

Summary of Estimating Right Whale Entanglements

Based on the apportionment information described above, we estimated that, on average, 7.57 North Atlantic right whales were seriously injured or died as a result of entanglement in U.S. trap/pot fishing gear annually from 2010 through 2018. Based on the results from the DST, 60.4 percent (4.57 M/SIs) of these M/SI entanglements occurred in federal trap/pot fisheries. The implementation of the 2020 ALWTRP proposed rule (Phase 1) will reduce the risk of M/SI due to entanglement in U.S. state and federal trap/pot fisheries by 58.1 percent; 26.6 percent of that reduction is expected to occur in federal waters. Therefore, after the implementation of the ALWTRP rule, we anticipate that an annual average of 2.56 right whale entanglements in trap/pot gear used in the U.S. federal fisheries will result in M/SI. In addition, we anticipate the M/SI of 0.125 (annual average) right whales in federal gillnet fisheries. The implementation of the ALWTRP rule will not reduce M/SI due to gillnet entanglements. Therefore, after the implementation of the ALWTRP proposed rule, the U.S. federal fisheries will entangle an annual average of 9.14 percent of the right whale population and an annual average of 2.69 M/SIs.

The implementation of Phase 2 of the Framework will reduce right whale M/SI entanglements in federal gillnet gear by 60 percent. Reducing takes in federal gillnet fisheries (annual average reduction of 0.075 M/SIs) will further reduce the estimated annual average M/SIs expected to occur in federal fixed gear fisheries to 2.61 right whales. Therefore, after the implementation of Phase 2 of the Framework in 2023, the U.S. federal fisheries will entangle an annual average of 9.14 percent of the right whale population and an annual average of 2.61 M/SI.

Phase 3 of the Framework will be implemented within 5 years to reduce the annual average of 2.61 right whale M/SI entanglements in federal waters by an additional 60 percent. Reducing takes in federal fisheries (annual average reduction of 1.56 M/SIs) will further reduce the estimated annual average M/SIs expected to occur in federal fixed gear fisheries to 1.04 right whales. The reduction in co-occurrence from Phase 3 is expected to reduce the number of total entanglements of right whales in federal waters and after the implementation of Phase 3 in 5 years, we expect less than an annual average of 9.14 percent of the right whale population to become entangled in federal waters and an annual average of 1.04 M/SI in federal fixed gear fisheries considered in this Opinion.

Phase 4 of the Framework will be implemented within 10 years to reduce the annual average of 1.04 right whale M/SI entanglements in federal waters by an additional 87 percent. Reducing takes in federal fisheries (annual average reduction of 0.9 M/SIs) will further reduce the estimated annual average M/SIs expected to occur in federal fixed gear fisheries to 0.136 right whales. The reduction in co-occurrence from Phase 4 is expected to further reduce the number of total entanglements of right whales in federal waters. After the implementation of Phase 4 in 10 years, we expect substantially less than 9.14 percent of the right whale population to become entangled in federal waters on average annually and an annual average of 0.136 M/SI in federal fixed gear fisheries considered in this Opinion.

7.2.1.4. *Estimating Interactions with and Serious Injury/Mortality of Fin Whales*

There have been frequent reports of fin whale entanglements over the years that provide adequate information to estimate the number of entanglements and M/SI rates. There have been no preliminary reports of fin whale entanglements from 2018-March 2021. For the purpose of this assessment, we are relying on data that has undergone review through the determination process (e.g., serious injury, country of origin).

To estimate future entanglement of fin whales due to the operation of the federal fisheries, we used the most recent validated data from the GAR Marine Animal Incident Database for the years 2009-2017. These years differ from the right whale assessment because any 2018 fin whale entanglement data has not been reviewed through the determination process (e.g., serious injury, country of origin). Additionally, there is no indication that an ecosystem regime shift caused a distribution shift of fin whales.

Between 2009 and 2017, there were 23 (14.75 M/SI) confirmed fin whale entanglements. Of those, 6 cases (5 M/SI) were confirmed to be the result of entanglement with Canadian fishing gear, 3 cases (1 M/SI) were confirmed to be the result of entanglement with U.S. fishing gear and 14 cases (8.75 M/SI) were the result of entanglement with gear from an unknown country of origin.

For the purpose of this Opinion we focus on entanglement events that are of undetermined origin or confirmed U.S. origin. The 6 Canadian cases (5 M/SI) will not be included in the analysis below. Although it is possible that gear of unknown origin may be from fisheries not considered in this Opinion, we are taking the most conservative approach and assuming the 14 cases (8.75 M/SI) with an unknown country of origin were the result of entanglement with U.S. federal fishing gear. Therefore, between 2009 and 2017, 17 fin whale entanglements (9.75 M/SI) are presumed to have occurred in U.S. federal fishing gear.

Given the small data set of observed interactions for fin whales, our analytical approach is conservative to account for uncertainty in the data and ensure where appropriate we provide the benefit of the doubt to the ESA-listed species. Of the 17 fin whale entanglements (9.75 M/SI), 14 (9 M/SI) involved an unknown gear type, 2 (0 M/SI) involved trap/pot gear, and 1 (0.75 M/SI) involved hook/monofilament gear. Given the limited information available on gear types involved in fin whale entanglements, we assume entanglements could occur as a result of any gear type used in the fisheries.

Based on the observed range of reported entanglements between 2009 and 2017, we anticipate an annual average of 1.89 fin whale entanglements resulting in an annual average of 1.08 M/SI due to the operation of the federal fisheries.

The implementation of the Conservation Framework as part of the proposed action will implement several measures that may reduce the risk of M/SI to fin whales. However, the measures being implemented are focused on reducing risk to right whales from entanglements in trap/pot gear. Given the uncertainty of the benefits that these measures will provide to fin whales, we are taking a conservative approach by not considering any reduction in the risk to the fin whale entanglement estimate. Given this information, we have determined that the operation of the U.S. federal fisheries with the Conservation Framework measures implemented will entangle an annual average of 1.89 fin whales resulting in an annual average of 1.08 M/SI. Although fin whale entanglements could occur as a result of any U.S. fishery (state and/or federal), given that recovered gear is rarely identified to a specific fishery, for the purpose of this Opinion we assume that the fin whale entanglements will occur as a result of the federal fisheries analyzed in this Opinion.

7.2.1.5. *Estimating Interactions with and Serious Injury/Mortality of Sei Whales*

Between 2009-2017, there were two (one M/SI) documented interactions with sei whales in fishing gear from unknown country of origin. Records of observed sei whale entanglements are so limited that a more general approach to estimating the number of entanglements and M/SI is required. For sei whales, we also use preliminary data to assert an assumption on future effects due to entanglement. Sei whale preliminary entanglement reports for 2018-2020 are presented below. These reports include one sei whale entanglement with unknown gear in both 2018 and 2019 (Table 65).

Table 65: Preliminary entanglement reports for sei whales (January 2018-March 2021)

Date	First seen	Status
3/12/18	Marathon Key, FL	Deceased (line documented at initial sighting but not present at necropsy)
4/26/19	Southwest of Cape Sable Island, Nova Scotia	Entangled

The 2018 case that resulted in mortality was found to have been the result of entanglement. The low level of reports may be a reflection of their generally offshore distribution where entanglements are less likely to be observed. Based on these documented entanglements and that the distribution of these species will overlap with the distribution of gear used in the fisheries known to be an entanglement risk, it is likely that sei whales may become entangled in gear used by the fisheries. Although sei whale entanglements are not documented each year, the observed entanglements are likely an underestimate of the actual level of entanglement occurring.

Therefore, we have determined that the federal fisheries will entangle one sei whale on average annually. The low occurrence of these observations does not allow us to make a valid determination on the anticipated levels of M/SI for these entanglements; therefore, we assume that the entanglements will result in M/SI.

The implementation of the Conservation Framework as part of the proposed action will implement several measures that may reduce the risk of M/SI to sei whales. However, the measures being implemented are focused on reducing risk to right whales from entanglements in trap/pot gear. Given the uncertainty of the benefits that these measures will provide to sei whales, we are taking a conservative approach by not considering any reduction in the risk to the sei whale entanglement estimate. Given this information, we have determined that the U.S. federal fisheries with the Conservation Framework measures implemented will entangle an annual average of one sei whale resulting in M/SI.

Although sei whale entanglements could occur as a result of any U.S. fishery (state and/or federal), given that recovered gear is rarely identified to a specific fishery, for the purpose of this Opinion, we assume that the sei whale entanglements will occur as a result of the federal fisheries analyzed in this Opinion.

7.2.1.6. *Estimating Interactions with and Serious Injury/Mortality of Sperm Whales*

There is very limited information on entanglement of sperm whales in fishing gear. Between 2009 and 2017, there have been no documented cases of sperm whales entangled in any gear used in the U.S. fisheries. Additionally, no preliminary sperm whales entanglements were reported in 2018 - March 2021. The most recent SAR confirms that there was one mortality as a result of entanglement in Canadian trap/pot gear in 2009, and one entanglement which resulted in mortality in Canadian pelagic longline in both 2009 and 2010 (Waring et al. 2015). A sperm whale was reported entangled in monkfish net on the Canadian Grand Banks in 2011, but was released alive and gear free (Waring et al. 2015). The lack of observed sperm whale entanglements may be a reflection of their generally offshore distribution where entanglements are less likely to be observed. The distribution of sperm whales overlaps the distribution of gear used in the red crab and lobster fisheries. The gear used in these fisheries is consistent with gear known to be an entanglement risk to large whales causing serious injury and mortality. Therefore, we assume sperm whales entanglements in gear used by the federal fisheries are possible. Given this information, we have determined that the federal fisheries will result in an annual average of one sperm whale entanglement. The lack of observations does not allow us to make a precise determination on the anticipated levels of M/SI for this entanglement; therefore, we assume that it will result in M/SI.

The implementation of the Conservation Framework as part of the proposed action will implement several measures that may reduce the risk of M/SI to sperm whales. However, the measures being implemented are focused on reducing risk to right whale entanglements in trap/pot gear. Given the uncertainty of the level of benefit that these measures will provide to sperm whales, we are taking a conservative approach by not considering any reduction in the risk to the sperm whale entanglement estimate.

7.2.2. *Vessel Strikes*

The proposed action would expose all ESA-listed whale species under NMFS' jurisdiction to the risk of collision with vessels. Vessel collisions with marine mammals can result in death by massive trauma, hemorrhaging, broken bones, and propeller wounds (Campbell-Malone 2007, Knowlton and Kraus 2001). If relatively superficial, some individuals can recover from seemingly serious collisions, as evidenced by photographic time series of deep lacerations healing on individual animals (Silber et al. 2009).

Injuries and mortalities from vessel strikes are a threat to North Atlantic right, fin, sei, and sperm whales. Reports from 2009 to 2018 indicate that right whales experienced four vessel strike mortalities and five serious injuries, two of which were prorated serious injuries, in the United States or in an unknown country of origin. The annual average of vessel strikes between 2012 and 2016 in U.S. waters was 1.4 and 0.8 for fin and sei whale respectively (Hayes et al. 2019). The 2014 SAR for sperm whales indicates one vessel strike resulting in mortality in 2012 (Waring et al. 2015). From 2013-2020, no strandings of sperm whales were classified as human interactions (Hayes et al. 2020). While vessel collisions with marine mammals have been documented, there are few records of interactions between commercial fishing vessels and large cetaceans, and the interactions that have occurred involved species that are not ESA-listed. From 2010-2019, there was only one interaction reported between a large whale and a fishing vessel. In 2015, a self-report from a fishing vessel indicated the vessel interacted with a live, humpback whale. There have been no observed or reported interactions of right, fin, sei or sperm whales with federal fishing vessels. This analysis focuses on whether interactions with fishing vessels participating in the fisheries considered in this Opinion are likely to impact ESA-listed large whales.

Fishing vessels actively fishing either operate at relatively slow speeds, drift, or remain idle, when setting, soaking and hauling gear. Thus, any listed species in the path of a fishing vessel would be more likely to have time to move away before being struck. Fishing vessels transiting to and from port or between fishing areas can travel at greater speeds, particularly recreational vessels, and thus do have more potential to strike a vulnerable species than during active fishing. However, larger vessels are required to comply with seasonal management areas that have speed restrictions to help protect large whales.

Several large scale management efforts to mitigate vessel strikes have proven to be successful (Laist et al. 2014), including the ship speed restriction rule implemented in 2008 (50 CFR 225.105), shifts in traffic separation schemes in the Bay of Fundy and Boston, and the designation of the Roseway Basin and Great South Channel as Areas to be Avoided. In the United States, the Seasonal and Dynamic Management Areas will continue to reduce vessel traffic around aggregations of right whales and lower the risk of any vessel striking a right whale. As described in Section 5.4.6, since the implementation of the speed restriction, there has been a decline in large whale mortalities resulting from vessel strikes.

Given the rarity of vessel strikes when considering (1) the large amount of vessel traffic in the action area, (2) that all fishing vessels (state, federal, and unregulated) represent only a portion of

marine vessel activity³⁵, (3) that fishing vessels considered in this Opinion represent an even smaller portion of marine activity; and (4) regulations in place to reduce the risk of vessel strike to whales, it seems extremely unlikely and discountable that a fishing vessel would strike a whale, even during transiting. Based on this information, we have determined that all listed marine mammals in the action area are not likely to be adversely affected by fishing vessels operating under the proposed action.

7.2.3. *Prey*

We have determined that the operation of the fisheries will not have any adverse effects on the availability of prey for right, fin, sei, and sperm whales. Right whales and sei whales feed on copepods (Perry et al. 1999). Dense aggregations of late stage and diapausing *C. finmarchicus* in the action area will not be affected by the fisheries. As described in section 4.1.10, the fisheries will not affect the availability of copepods for foraging right and sei whales. Copepods are very small organisms that will pass through fishing gear rather than being captured in it. In addition, copepods will not be affected by turbidity created by the gear moving through the water. Fin whales feed on krill and small schooling fish (e.g., sand lance, herring, mackerel) (Aguilar 2002). The fisheries' fishing gear operates on or very near the bottom, while schooling fish such as herring and mackerel occur higher in the water column. Therefore, with the exception of the mackerel/squid/butterfish fishery, the fisheries target and bycatch species are not foraged on or a primary prey species (Perry et al. 1999). Although small schooling fish species (including mackerel) may be caught in net gear targeting mackerel/squid/butterfish, it is one of many prey species rather than a dominant prey species on which they depend. Therefore, because fin whales are less prey selective than some other large whale species and are not expected to be food limited, the fisheries will not affect the availability of prey for fin whales (Perry et al. 1999). Sperm whales feed during summer at high latitudes, where they feed primarily on squid; other prey includes octopus and demersal fish. Sperm whales primarily only overlap with the red crab and lobster fishery, and these fishery are not expected to capture any prey species of sperm whales. We have determined that the operation of the fisheries will not affect the availability of prey for foraging whales.

7.2.4. *Habitat*

As described above, bottom trawl is the only gear type used by the ten fishery management plans considered in this Opinion that has the potential to adversely affect bottom habitat in the action area. Although trawl gear may interact with bottom habitat in the action area, any alterations of bottom habitat are not expected to affect right, fin, sei, and sperm whale's ability to forage, migrate, or breed (Baumgartner et al. 2003, IWC 1992, Pace and Merrick 2008, Perry et al.

³⁵ Fishing vessels accounted for less than 2 percent of the trips made by commercial fishing (all vessels reporting into the VTR system) and recreational vessels in the Greater Atlantic Region vessels in 2012 and 2013. This percentage is likely even lower as it does not include all vessel types (e.g., ferries, tankers). We also reviewed the AIS data from 2016 and 2017 (Memorandum from the Jennifer Anderson to the Record, December 23, 2020 for the caveats associated with this data). AIS is required on vessels that are 65 ft or greater in length. It is not possible to separate fishing vessels participating in the fisheries in this Opinion from other fishing vessels captured in the AIS data. Approximately 15 percent of the vessels permitted in the ten FMPs are greater than or equal to 65 ft in length. A large number of vessels (e.g., recreational and fishing vessels <65 ft) operating in the Greater Atlantic Region are not required to use AIS. Therefore, we do not believe that the AIS provides the most accurate picture of the percentage of trips within the region that are taken by the fisheries considered in this Opinion.

1999). As described above, any disturbance to bottom habitat from trawl gear is expected to be temporary and localized. For these reasons, and the lack of any evidence that fishing practices affect habitats in degrees that harm or harass ESA-listed whales, we find that while the fisheries may potentially interact with benthic habitats, the effects of the habitat interactions will be too small to be meaningfully measured or detected and will therefore will have an insignificant effect on ESA-listed whales.

7.3. Effects to Sea Turtles

7.3.1. Gear Interactions

Certain fishing gears may directly affect sea turtles. Of the gears used by fisheries in this Opinion, sea turtles are known to interact with bottom otter trawls, gillnet, the lines of trap/pot gear, and hook and line gear.

7.3.1.1. Factors Affecting Sea Turtle Interactions

The primary factors affecting sea turtle interactions with the ten fisheries assessed in this Opinion are: (1) overlap in time and space, (2) method of fishing, (3) the behavior of sea turtles in the presence of gear, and (4) oceanographic features. As described in the *Status of the Species*, the occurrence of loggerhead, leatherback, Kemp's ridley, and green sea turtles in Northwest Atlantic waters is primarily temperature dependent. In general, sea turtles move up the U.S. Atlantic coast from southern wintering areas as water temperatures warm in the spring (Braun-McNeill and Epperly 2002, Braun-McNeill et al. 2008, James et al. 2005a, James et al. 2005b, James et al. 2005c, Keinath et al. 1987, Morreale and Standora 1998, Morreale and Standora 2005, Musick and Limpus 1997, Shoop and Kenney 1992). Recreational anglers have reported sightings of sea turtles in inshore waters (bays, inlets, rivers, or sounds) as far north as New York as early as March-April, but in relatively low numbers (Braun-McNeill and Epperly 2002). The trend is reversed in the fall as water temperatures cool. Near Cape Hatteras during late fall and early winter, the narrowness of the continental shelf and influence of the Gulf Stream helps to concentrate sea turtles, making them more susceptible to fishery interactions (Epperly 1995). Greater numbers of loggerheads, Kemp's ridleys, and greens are found in inshore, nearshore, and offshore waters of the southern Mid-Atlantic (Virginia and North Carolina) from May-November (Mansfield et al. 2009) and in inshore, nearshore, and offshore waters of the northern Mid-Atlantic (New York and New Jersey) from June-October (Braun-McNeill and Epperly 2002, Keinath and Musick 1993, Morreale and Standora 1994). Hard-shelled sea turtles are more commonly found in waters south of Cape Cod and Georges Bank, but may also occur in waters farther north (Morreale and Standora 1994). Leatherback sea turtles have a similar seasonal distribution, but have a more extensive range into the Gulf of Maine compared to the hard-shelled sea turtle species (James et al. 2005a, James et al. 2005b, Mitchell et al. 2002, Shoop and Kenney 1992).

Extensive survey effort of the continental shelf from Cape Hatteras to Nova Scotia, Canada in the 1980s revealed that loggerheads were observed at the surface from the beach to bottom depths up to 14,700 ft (4,481 m) (CETAP 1982). However, they were generally found in waters where bottom depths ranged from 72-161 ft (median 120 ft) (22-49 m (median 36.6 m)) (Shoop and Kenney 1992). Leatherbacks were sighted at the surface in waters with bottom depths ranging from 3.3 - 13,620 ft (1-4,151 m) (Shoop and Kenney 1992). However, 84.4 percent of leatherback sightings occurred in waters where the bottom depth was less than 590 ft (180 m); whereas 84.5 percent of loggerhead sightings occurred in waters where the bottom depth was

less than 262 ft (80 m) (Shoop and Kenney 1992). Neither species was commonly found in waters over Georges Bank, regardless of season (Shoop and Kenney 1992). The CeTAP study did not include Kemp's ridley and green sea turtle sightings, given the difficulty of sighting and identifying these sea turtle species (CETAP 1982).

More recently as part of an AMAPPS survey, the NEFSC and SEFSC conducted two shipboard and two aerial line transect surveys covering U.S. Atlantic waters from Florida to Maine, from the coastline to the U.S. EEZ and slightly beyond from June 27 to September 28, 2016 (NMFS 2016a). The aerial abundance surveys targeted sea turtles in Atlantic continental shelf waters from the shore to about the 328-ft (100 m) or 656-ft (200 m) depth contour, depending on the location. The shipboard abundance surveys targeted sea turtles in waters at the shelf break, starting from the offshore edge of the plane's survey area to waters farther offshore to the U.S. EEZ and slightly beyond. The surveys completed about 18,338 nmi (33,963 km) of track lines: 5,796 nmi (10,735 km) from ships and 12,542 nmi (23,228 km) from planes. The most frequently detected sea turtles were loggerheads, with about 1,000 individuals that ranged from 26-41° N, mostly in waters on the continental shelf. Studies conducted in 2016 also investigated methods to estimate spatial and temporal distributions of tagged loggerhead sea turtle densities (NMFS 2016a).

Researchers also conducted aerial surveys in coastal ocean waters of Maryland and Virginia from spring through fall in 2011 and 2012 (Barco et al. 2018). Ocean abundance estimates of loggerheads were highest in the spring months of May-June and lower in the fall months of September-October. Ocean abundance estimates for loggerheads during the summer months of July-August were in between the spring and fall ranges, while no surveys were flown in the winter months from November-March (Barco et al. 2018).

Sea turtle interactions with trawl and gillnet gear used in the ten fisheries can result in entanglements of the head, limbs, or carapace or captures of the animal. Captures of sea turtles in gillnets are a severe type of interaction as they often result in injury and death. Gillnets are so effective at catching sea turtles they were commonly used in the historical sea turtle fishery (Witzell 1994). Drowning may occur due to forced submergence from the weight of the gear or, at a later time, if trailing gear becomes lodged between rocks and ledges below the surface. Although drowning due to forced submergence is the most serious risk to sea turtles in gillnet gear, constriction of a sea turtle's flippers can lead to infection or amputation of limbs, which may result in mortality or impaired foraging or swimming ability. Sea turtles that do escape often retain pieces of gear that can inhibit their foraging or survival. If the turtle is released or escapes with line attached, the flipper may eventually become occluded, infected, and necrotic.

Sea turtles may also drown due to forced submergence in bottom trawl gear. Recent studies have also shown that capture in fishing gear followed by rapid decompression may result in gas bubble formation in the blood stream (embolism) and tissues. This can lead to organ injury, impairment, and mortality in some animals (Crespo-Picazo et al. 2020, Fahlman et al. 2017, García-Párraga et al. 2014, Parga et al. 2020). Gas embolism has been documented in green, loggerhead, olive ridley, and leatherback sea turtles (Crespo-Picazo et al. 2020, García-Párraga et al. 2014, Parga et al. 2020) and in turtles caught in gillnet and trawl gear (Fahlman et al. 2017). The likelihood of fatal decompression increases with increasing depth fished (Fahlman et al. 2017). Size of the gear (e.g., mesh size), duration of sets/tows, and effectiveness of gear modifications (TEDs in trawls) will influence the likelihood of injury and mortality to sea turtles

that are incidentally caught (Epperly et al. 2002, Murray 2007, 2008, 2009a, 2018, 2020, Stacy et al. 2015, Warden 2011a).

Available entanglement data for sea turtles indicate they are also vulnerable to entanglement in trap/pot gear. Aside from hatchling life stages, sea turtles cannot be caught in the pots or traps themselves since the vents/openings leading inside are far smaller than any of these species. Since hatchling sea turtles are pelagic rather than benthic once entering the water from the nesting beach, they are also not susceptible to entering the pot or trap on the ocean bottom. The most commonly documented turtle entanglements are with the vertical lines of fishing gear. However, sea turtles also entangle in groundlines or surface system lines of trap/pot gear. Given data documented in the GAR STDN database, leatherback sea turtles seem to be the most vulnerable turtle to entanglement in vertical lines of fixed fishing gear in the action area. Long pectoral flippers may make leatherback sea turtles more vulnerable to entanglement. Leatherbacks entangled in fixed gear are often restricted with the line wrapped tightly around the flippers multiple times suggesting entangled leatherbacks are typically unable to free themselves from the gear (Hamelin et al. 2017). Hamelin et al. (2017) observed leatherbacks that encountered a vertical line attempt to push the buoy and line away with one or both front flippers or attempt to swim away with broad, raised flipper strokes followed by a struggle with flailing the flippers, diving, and rolling. This behavior repeatedly encircles the flippers and neck, which may result in injuries or suffocation. This behavior can also cause the vertical line of fixed fishing gear to shorten, which can lead to the leatherback being forcibly submerged and can result in drowning (Hamelin et al. 2017). The leatherback's diet is composed predominantly of jellyfish species. Leatherbacks may mistake a surface buoy or submerged float for their jellyfish prey, potentially resulting in an increased risk of entanglement in vertical lines (Dodge et al. 2018). Leatherback entanglements in trap/pot gear may be more prevalent at certain times of the year when they are feeding on jellyfish in nearshore waters (i.e., Cape Cod Bay) where trap/pot fishing gear is concentrated. Hard-shelled turtles also entangle in vertical lines of trap/pot gear. Due to leatherback sea turtles large size, they have the strength to wrap fixed fishing gear lines around themselves, whereas small turtles such as Kemp's ridley or smaller juvenile hard-shelled turtles likely do not (Sampson, pers comm January 16, 2020). The factors influencing entanglements of larger hard-shelled sea turtle in trap/pot fishing gear used by the fisheries in this Opinion are unclear.

Records of stranded or entangled sea turtles show entanglement of trap/pot lines around the neck, flipper, or body of the sea turtle; these entanglements can severely restrict swimming or feeding (Balazs 1985). Drowning may occur quickly if the weight of the gear prevents the turtle from reaching the surface to breathe or, at a later time, if trailing gear becomes lodged between rocks and ledges below the surface. If a sea turtle is entangled when young, the line could become tighter and more constricting as the sea turtle grows, cutting off blood flow and causing deep gashes, some severe enough to remove an appendage (Balazs 1985). A sustained stress response, such as repeated or prolonged entanglement in gear makes these species less able to fight infection or disease, and may make them more prone to boat/ship strikes and predation (Lutcavage and Lutz 1997). Of the entangled sea turtles that do not die from their wounds, some may suffer impaired swimming or foraging abilities, altered migratory behavior, or altered breeding or reproductive patterns due to injuries resulting from the entanglement (Balazs 1985).

Leatherbacks may be more susceptible to drowning compared to other sea turtles due to their unusual physiology and metabolic processes (Lutcavage and Lutz 1997). Leatherbacks lack

calcium, which aids in the neutralizing of lactic acid that builds up by increasing bicarbonate levels. The dive behavior of leatherbacks consists of continuous aerobic activity. When an entanglement occurs, available oxygen decreases allowing anaerobic glycolysis to take over producing high levels of lactic acid in the blood (Lutcavage and Lutz 1997). Therefore, especially when bycaught, the stored oxygen is likely to be quickly used. The softer epidermal tissue of leatherbacks may also make them more susceptible to severe injuries from entangling gear. As with gillnet gear, constriction of a sea turtle's neck or flippers can lead to severe injury or mortality. While drowning is the most serious consequence of entanglement, constriction of a sea turtle's flippers can amputate limbs, also leading to death by infection or to impaired foraging or swimming ability. If the turtle escapes or is released from the gear with line attached, the flipper may eventually become occluded, infected, and necrotic. Entangled sea turtles can also be more vulnerable to collision with boats, particularly if the entanglement occurs at or near the surface (Lutcavage et al. 1997).

In regards to the recreational component of the ten fisheries, stranding data provide some evidence of interactions between recreational hook and line gear and ESA-listed species. Sea turtles are known to ingest baited hooks or have their appendages snagged by hooks, both of which have been recorded in the STSSN database. Loggerheads and Kemp's ridleys are the species caught most often in the Greater Atlantic Region; these turtles frequently ingest the hooks. Deceased sea turtles with hooks in their digestive tract have been reported, although, it is assumed that most sea turtles hooked by recreational fishermen are released alive. Some turtles will break free on their own and escape with embedded/ingested hooks and/or trailing line. Others may be cut free by fishermen and intentionally released. These sea turtles will escape with embedded or swallowed hooks or trailing varying amounts of monofilament fishing line, which may cause post-release injury or death. The ingested hook and/or the trailing, monofilament fishing line may ultimately be swallowed and ingested by the animal, potentially leading to constriction and strangulation of the sea turtle's internal digestive organs; or the line may become entangled around the animal's limbs (which may lead to limb amputations) or around seafloor obstructions, preventing the animal from surfacing (leading to drowning). Thus, some of these hooking/entanglement interactions may eventually be lethal.

NMFS has considered other factors that might affect the likelihood that sea turtles will become entangled in fishing gear. As described above, these other factors include the behavior of sea turtles around fishing gear. Sea turtles have been observed to remain at the bottom or dive to the bottom and hunker down when alarmed by loud noise or gear (Memorandum to the File, L. Lankshear, December 4, 2007, DeAlteris et al. 2010), which could place them in the path of a trawl. Video footage recorded by NMFS SEFSC's Pascagoula Laboratory showed that loggerhead sea turtles will keep swimming in front of an advancing shrimp trawl, rather than deviating to the side, until the turtles become fatigued and are caught by the trawl or the trawl is hauled up (NMFS 2002b). At a workshop on mitigating interactions in trawl fisheries, it was noted that sometimes sea turtles remained on the bottom with bottom disturbance from trawl gear, while others shot to the top (DeAlteris 2010). There was also additional discussion about whether sea turtle behavior in front of approaching trawl gear might be indicative of how long it had been since the turtle had last surfaced for air (DeAlteris 2010). The information on behavior in front of and around trawl gear is inconclusive (DeAlteris 2010).

Benthic immature and adult loggerhead and Kemp's ridley sea turtles feed on benthic organisms such as crabs, whelks, and other invertebrates including bivalves (Burke et al. 1994, Burke et al.

1993, Dodd 1988, Keinath et al. 1987, Lutcavage and Musick 1985, Morreale and Standora 2005, Seney and Musick 2005, Seney and Musick 2007). Green sea turtles also feed on the ocean bottom. Therefore, if loggerhead, Kemp's ridley, and green sea turtles are foraging on the bottom or swimming through the water column in areas where the fisheries operate, they would be at risk.

Research conducted on the use of the water column by sea turtles provides additional information on the co-occurrence of sea turtles and fisheries. Starting in 2007, Coonamessett Farm began a series of research projects to assess and implement the use of an ROV to observe sea turtle behavior in the water column and on the sea floor in the Mid-Atlantic. The ROV studies focused on Atlantic sea scallop fishing grounds with water depths of 131 – 262 ft (40-80 m) during the months of June (2008, 2009), July (2009), August, (2008) and September (2007, 2009) (Smolowitz and Weeks 2010, Weeks et al. 2010). During these studies, over 50 sea turtles were tracked by ROV for periods ranging from two minutes to over eight hours (Smolowitz and Weeks 2010, Weeks et al. 2010). In addition to footage collected from the ROV, visual observations and recordings from the masthead were obtained. A range of loggerhead behaviors were observed, including feeding, diving, swimming, surface, and social behaviors. Loggerheads were observed feeding on jellyfish within the top 33 ft (10 m) of the surface and on crabs and scallops on the ocean bottom (Smolowitz and Weeks 2010, Weeks et al. 2010). A number of sea turtles were recorded on the ocean bottom at depths of 161-230 ft (49-70 m), and water temperatures of 7.5 °C-11.5 °C (Smolowitz and Weeks 2010, Weeks et al. 2010). Bottom times in excess of 30 minutes were recorded (Weeks et al. 2010).

The effect of certain oceanographic features may affect the likelihood of an interaction with sea turtles. A review of the data associated with 11 sea turtles captured by the scallop dredge fishery in 2001 concluded that the captured sea turtles appeared to have been near the shelf/slope front (D. Mountain, pers. comm.). Intensity of biological activity in the Northwest Atlantic has been associated with oceanographic fronts, including nutrient fluxes and biological productivity. Particular oceanographic features and processes that influence biological activity include vertical mixing by tides; seasonal heating and cooling that leads to winter convection and vertical stratification in summer; pressure gradients from density contrasts set up by deep water inflows and lower salinity waters; and influxes of the cold, fresher waters associated with Scotian Shelf Water (Townsend et al. 2006). There may be an increased risk of interactions between sea turtles and fishing gear in areas where these oceanographic features occur simply because there are possibly more sea turtles and more fishing gear present, which increases the potential for interactions. However, at present we are unable to determine if any of these oceanographic features affect the likelihood of interactions between sea turtles and the fisheries in this Opinion. As discussed later on in this section, variables such as latitude, bottom depth, and sea surface temperature have been correlated with sea turtle interaction rates with gillnet and bottom trawl gear in the Mid-Atlantic (Murray 2018, 2020).

Given the seasonal distribution of sea turtles and the times and areas when the ten fisheries operate, green, Kemp's ridley, loggerhead, and leatherback sea turtles are likely to overlap with operation of the fisheries primarily from May through November. Loggerhead interactions are possible year-round in the southern portion of the Mid-Atlantic (Murray and Orphanides 2013). Interactions with other sea turtle species outside these months and in other portions of the action area are certainly possible, albeit at lower frequencies.

7.3.1.2. *Existing Information on Interactions with Sea Turtles*

The discussion of sea turtle interactions that follows will focus on trawl, gillnet, trap/pot, and both commercial and recreational hook and line gear. Sea turtles incidentally captured or entangled in these types of fishing gear must be reported to NMFS on VTRs that are required for all federal fisheries except the American lobster and Jonah crab fisheries. At present, compliance with the requirement for federally-permitted fishermen to report sea turtle interactions on their VTRs is believed to be very low (as evidenced by the lack of reported interactions that have been documented on vessels with observers in recent years). Without reliable VTR reporting of sea turtle interactions, we are using information on bottom trawl, gillnet, and hook and line interactions collected through the observer programs managed by the NEFSC's Fishery Sampling Branch. These programs collect, process, and manage data and biological samples obtained by trained observers during commercial fishing trips throughout the New England and the Mid-Atlantic regions. For trap/pot gear interactions, we also reviewed sea turtle entanglement data that has been collected through and provided by GAR STDN because the observer programs have observed very few trap/pot trips until recently.

Past observed interactions of sea turtles in these four gear types were reviewed in the 2002 Atlantic deep sea red crab, 2013 batched fisheries, and the 2014 American lobster opinions. Updated information is provided herein. The number of reported interactions is a fraction of the total amount occurring, which is unknown for certain species and gears. However, there are model-based bycatch estimates available for sea turtles in both bottom trawl and gillnet fisheries in the Mid-Atlantic and Georges Bank, which provide an estimate of the total number of encounters based on an extrapolation of observed interactions (Murray 2018, 2020). For these gears, only interactions of green sea turtles in gillnet gear were observed too infrequently throughout Georges Bank and the Mid-Atlantic to support model-based bycatch estimates (Murray 2018, 2020). Although included in the study area for the Murray (2018, 2020) bycatch analyses, there are no estimates of sea turtle bycatch in the Gulf of Maine due to a lack of observed bycatch events. There are two records of loggerhead sea turtles observed captured in gillnet gear in the Gulf of Maine, one in 2010 and one in 2018.

The majority of interactions between sea turtles and fisheries considered in this Opinion have occurred south of the Gulf of Maine; this is likely because the distribution of sea turtles correlates with warmer water temperatures, resulting in greater densities of sea turtles south of Cape Cod. The spatial distribution of sea turtles off southern New England and in the Mid-Atlantic is coincident with several fisheries that may target or incidentally land fish species managed under the ten FMPs in this Opinion. As indicated above, the vast majority of sea turtle interactions with the trawl and gillnet components of these fisheries involve loggerheads (Murray 2018, 2020).

From 2014-2018 (the most recent 5-year period that has been statistically analyzed for trawls), NEFOP observers documented 50 loggerhead sea turtle interactions in U.S. Atlantic bottom

trawl gear³⁶, 48 of which occurred in the Mid-Atlantic³⁷. The ASM Program documented no sea turtles over this period. Observers also recorded five Kemp's ridleys, three leatherbacks, and two green sea turtles in bottom trawl gear from 2014-2018 in the Mid-Atlantic and on Georges Bank. The majority (83 percent) of the observed interactions occurred between July and October. Interaction rates were stratified by region, latitude zone, season, and depth. Within each stratum, observed interaction rates were multiplied by total days fished from VTR trips to calculate the estimated number of sea turtle interactions. For VTR trips with TEDs, estimated interactions of hard-shelled sea turtle species were proportioned into observable interactions (those that passed through the TED into the codend), and unobservable/quantifiable interactions (those that escaped out through the TED opening). On TED trips in each stratum, observable interactions were 3 percent of total estimated interactions, and unobservable/quantifiable interactions were 97 percent of total estimated interactions, based on a 97 percent experimental exclusion rate (Watson Jr. 1981 as cited in Murray 2020). Total observable mortalities were estimated by applying the mortality rate (50 percent) for turtles observed in trawl gear interactions from the most recent time series (2013-2017) available at the time (Murray 2020, Upite et al. 2018) to the total estimated observable interactions. The mortality rate for unobservable yet quantifiable interactions was assumed to be 0 percent (Murray 2015b, 2020). As described above, these are animals that escaped through the TED opening and are expected to survive.

The highest loggerhead interaction rate (0.43 turtles/day fished) was in waters south of 37° N (approximately Virginia Beach, Virginia) during November to June in waters greater than 164 ft (50 m) deep (Murray 2020). This is mostly south of the Greater Atlantic Region where the vast majority of the effort in the fisheries in the Opinion occurs. The greatest number of estimated interactions occurred in the Mid-Atlantic region north of 39° N (approximately Cape May, New Jersey), during July to October in waters less than 164 ft (50 m) deep, due to a greater amount of commercial effort in this stratum compared to those farther south. Within each stratum, interaction rates for non-loggerhead species were lower than rates for loggerheads (Murray 2020).

From 2014-2018, 571 loggerheads (CV=0.29, 95% CI=318-997) were estimated to have interacted with bottom trawl gear in the U.S. Mid-Atlantic while 12 loggerheads (CV=0.70, 95% CI=0-31) were estimated to have interacted with bottom trawls on Georges Bank (Murray 2020). The total number of loggerhead sea turtle interactions across both regions was equivalent to 182 adults³⁸. Murray (2020) estimated mortality by applying a mortality rate of 50 percent (from the most recent time series (2013-2017) available at the time of the analysis) to observable interactions and a mortality rate of 0 percent to unobservable but quantifiable interactions. Using these rates, an estimated 272 loggerhead sea turtles (87 adult equivalents) have died from these

³⁶ Takes in the southern Mid-Atlantic shrimp twin trawl fishery were not included in the bycatch analysis or this Opinion because takes in this fishery are estimated by the NMFS Southeast Region and Northeast observers no longer observe this fishery. Additionally, authorization of the Mid-Atlantic shrimp twin trawl fishery is not part of the proposed action under consideration in this consultation.

³⁷ One of these included a sea turtle that could not be identified to species, but for this analysis it was presumed to be a loggerhead based on characteristics described by observers. The observer noted it was "dark brown, tannish with 5 vertebral scutes and an estimated length of [36 inches] 91cm".

³⁸ Explained in more detail on pg. 275 adult equivalence considers a turtle's reproductive value (RV), defined as the contribution of an individual in an age class to current and future reproduction.

interactions. In the Mid-Atlantic, 38 loggerheads were estimated to have been excluded by TEDs (i.e., unobservable but quantifiable interactions).

From 2014-2018, a total of 46 Kemp's ridley (CV=0.45, 95% CI=10-88) and 16 green (CV=0.73, 95% CI=0-44) sea turtles were estimated to have interacted with bottom trawl gear in the Mid-Atlantic, of which 23 and 8 resulted in mortality, respectively. There were no observed interactions between bottom trawl gear and Kemp's ridley sea turtles on Georges Bank. During this period, 20 (CV=0.72, 95% CI = 0-50) and 6 (CV=1.0, 95% CI=0-20) leatherback interactions were estimated to have occurred in the Mid-Atlantic and on Georges Bank, respectively, which resulted in 13 total mortalities. There were 0 Kemp's ridley, green, and leatherback sea turtles estimated to have been excluded by TEDs (i.e., unobservable but quantifiable interactions) (Murray 2020).

Bycatch estimates are also available for sink gillnet gear. From 2012-2016 (the most recent 5-year period that has been statistically analyzed for gillnets), fisheries observers reported a total of 27 loggerhead, 8 Kemp's ridley, 2 green, 2 leatherback, and 9 unidentified hard-shelled sea turtles incidentally caught in U.S. Mid-Atlantic and Georges Bank gillnet gear. Of these, 1 Kemp's ridley, 2 green, and 1 unidentified hard-shelled species were observed inside the sounds in North Carolina. These turtles were excluded from the bycatch rate calculations in Murray (2018) because they were outside the study region. Most (93 percent) of the loggerhead interactions occurred between 40° N and 41.5° N during June through September. In this same region, 5 Kemp's ridley interactions occurred during July through November. In addition, 3 Kemp's ridley interactions occurred around 35° N in April, June, and December. Both green sea turtle interactions occurred inside North Carolina sounds, one in March and the other in September. Both leatherbacks were observed around 40° N in November and December. Unidentified hard-shelled turtle interactions occurred between 35° N and 41.6° N from May to September (Murray 2018).

Murray (2018) estimated that from 2012-2016, sink gillnet fisheries in the mid-Atlantic and Georges Bank bycaught 705 loggerheads (CV=0.29, 95% CI over all years: 335-1116), 145 Kemp's ridleys (CV =0.43, 95% CI over all years: 44-292), 27 leatherbacks (CV =0.71, 95% CI over all years 0-68), and 112 unidentified hard-shelled turtles (CV=0.37, 95% CI over all years (64-321). Of these, mortalities were estimated at 557 loggerheads, 115 Kemp's ridley, 21 leatherbacks, and 88 unidentified hard-shelled sea turtles. Total estimated loggerhead bycatch was equivalent to 19 adults. The highest bycatch rate of loggerheads occurred in the southern Mid-Atlantic stratum in large mesh gear during November to June. Though only one sea turtle was observed in this stratum, observed effort was low, leading to a high bycatch rate. Bycatch rates of all other species were lower relative to loggerheads. Highest estimated loggerhead bycatch occurred in the northern Mid-Atlantic from July to October in large mesh gears due to the higher levels of commercial effort in the stratum. Mean loggerhead bycatch rates were ten times those of Kemp's ridley bycatch rates in large mesh gear in the northern Mid-Atlantic from July to October (Murray 2018).

Documented sea turtle interactions through 2019 with trawl and gillnet gear after the period analyzed in Murray (2018) and Murray (2020), respectively, are presented for additional reference (Table 66, Table 67); however, they are not yet included in any model-based estimates of sea turtle bycatch in the U.S. Mid-Atlantic or Georges Bank. With the exception of green sea turtles in gillnets, the model-based estimates of annual bycatch published in Murray (2018, 2020)

represent the best available information for and analysis of bycatch in the bottom trawl and gillnet components of the ten fisheries assessed in this Opinion. For green sea turtle incidental bycatch in gillnet gear, raw fisheries observer data represents the best available information.

Table 66: Documented bycatch of sea turtles in trawl gear recorded by the NEFOP and ASM Program in 2019 (i.e., since the most recent bycatch estimate (Murray 2020)), along with the most landed commercial species (by hail weight) per trip³⁹ (NMFS NEFSC Observer Program, unpublished data).

	Horseshoe crab	Scup	Sea scallop	Squid, Atlantic longfin	Summer flounder
Loggerhead	1	1	1	2	2
Unidentified				1	

Table 67: Documented bycatch of sea turtles in gillnet gear recorded by the NEFOP and ASM Program from 2017-2019 (i.e., since the most recent bycatch estimate (Murray 2018)), along with the most landed commercial species (by hail weight) per trip³⁹. Gillnet gear includes fixed or anchored sink and drift sink gear (NMFS NEFSC Observer Program, unpublished data).

	Atlantic menhaden	Black drum	Bluefish	King mackerel	Monkfish	Skate, unknown	Smooth dogfish	Spiny dogfish	Spot	Striped bass	Winter skate
Green		1								1	1
Kemp's ridley				1			3	1			
Loggerhead			1		5	1			1		
Leatherback	1										1
Unidentified					1						1

While it may be informative to assess the number of green sea turtles observed captured on gillnet trips when the majority of the landings were any of the species included in the ten FMPs, using this number as the estimated number of interactions would underestimate in two ways. First, green sea turtles could have been captured on trips where these species were part of the catch, but constituted less than the majority of the catch. Second, these captures are an underestimate given that they are only observed captures and we are not currently able to extrapolate this number to generate an estimate of total bycatch. In order to partially compensate for this underestimate and for the purposes of estimating interactions of green sea turtles with gillnet gear authorized under the ten FMPs in this Opinion, we use all observed interactions from 2010-2019, regardless of the most landed commercial species (Table 68). We are using the most

³⁹ For sea turtles brought on board dead, NMFS evaluates whether the mortality is attributed to the current interaction based on the postmortem condition and other evidence, such as entanglement in gear or concurrent abnormalities (NMFS 2017f). Only mortalities attributed to the current interaction are included here.

recent 10 years as we believe this is most reflective of the fisheries operations going forward. We then average the number of interactions per year as shown in Table 69.

Table 68: Documented bycatch of green and unknown sea turtles in gillnet gear recorded by the NEFOP and ASM Program from 2010-2019, along with the most landed commercial species (by hail weight) per trip. Gillnet gear includes fixed or anchored sink and drift sink gear (NMFS NEFSC Observer Program).

	Black drum	Hickory shad	Monkfish	Skate winter	Southern flounder	Striped bass	Summer flounder	Spanish mackerel
Green sea	1	1		1	1	1		
Unidentified			6	3			1	2

Table 69: Documented bycatch and annual average of green and unidentified sea turtles in gillnet gear recorded by the NEFOP from 2010-2019 (NMFS NEFSC Observer Program, unpublished data).

	Documented # of bycatch in gillnet gear	Documented # of bycatch/year in gillnet gear
Green sea turtle	5	0.5
Unidentified sea turtle	12	1.2

As described above, fisheries using trawl and gillnet gear incidentally capture sea turtles, and some of these interactions are lethal. Hard-shelled sea turtles foraging on the bottom or swimming through the water column in areas where the trawl fisheries operate are at risk. Leatherbacks may also be captured in trawl fisheries. Tagging studies have shown that leatherback sea turtles stay primarily within the water column rather than near the bottom (Dodge et al. 2014, James et al. 2005c). Given this and their largely pelagic life history (CETAP 1982, NMFS and USFWS 1992, Rebel 1974), interactions between leatherbacks and bottom trawl gear are expected to occur when the gear is traveling through the water column versus on the bottom.

Potential sea turtle interactions with sink gillnets are most likely to occur with hard-shelled sea turtles since these species are more likely to be found near the bottom where the netting of the gear is found. However, pelagic leatherbacks may also become entangled in the gear. Sea turtles are unlikely to be able to break free of entangling fishing gear and are thus vulnerable to drowning from forced submergence, although some have been recovered alive in sink gillnets.

The American lobster, red crab, Jonah crab, black sea bass, and scup fisheries use trap/pot gear. Sea turtles have been entangled in lobster, finfish, blue crab, and whelk/conch trap/pot gear (GAR STDN, unpublished data). Most of these fisheries use similar gear configurations and fishing methods. There is limited information on entanglements in these gears from the observer and VTR data. While the NEFSC Observer Program documented a leatherback entanglement in lobster gear in 2014, observer coverage in these fisheries has been low. From 2009-2020, one leatherback was also reported entangled via VTR in federal lobster gear and is included in the GAR STDN data below. VTR reported interactions do not accurately indicate the frequency of sea turtle interactions.

Most reports of entanglements in trap/pot gear are documented by the GAR STDN. The GAR STDN operates as an event response network, not as an active observer program. The reports are opportunistic (e.g., from private boaters, fishermen, USCG, state agencies (e.g., Maine Marine Patrol, Massachusetts Environmental Police) and local harbor masters). The level of reporting from the public depends on many factors, including the location and visibility of the turtle and the knowledge of the public regarding who to call when reporting an entanglement. Additionally, since the majority of entanglements are reported by recreational boaters, these data may be skewed to more coastal entanglements in waters that are easily accessible and highly utilized by boaters. Reports may also be skewed towards entanglements at the surface of buoy lines due to those entanglements being visible. Given the limitations on the GAR STDN dataset, it is difficult to correlate the number of entanglements reported to the GAR STDN to the actual number of entanglements that are occurring in coastal and offshore waters. The data presented below are a summary of the GAR STDN entanglement data. Since this dataset is the most complete and best available consolidation of sea turtle entanglement data in the action area, it will be used to estimate sea turtle interactions in the fisheries.

In terms of commercial hook and line gear, only the spiny dogfish and multispecies fisheries have a portion of landings attributed to hook and line gear (namely bottom longlines and handlines). Sea turtle bycatch has been documented in commercial hook and line fisheries, notably the pelagic longline fisheries (Swimmer et al. 2017). Loggerheads and Kemp's ridleys are known to investigate and bite baited hooks according to reports from commercial fishermen fishing for reef fish and sharks with both single rigs and bottom longlines (NMFS SEFSC 2001, TEWG 2000). However, no documented interactions of sea turtles have been recorded in the commercial Northeast bottom longline or handline fisheries from 2002-2019 (NEFSC observer program, unpublished data). Due to the lack of observed interactions in both the spiny dogfish and multispecies hook and line fisheries and because hook and line gear accounts for a small portion of the effort and landings for each fishery (less than 16 percent), we anticipate that interactions with sea turtles are extremely rare and unlikely.

Data on the capture of sea turtles in recreational hook and line fisheries is limited. Hooked sea turtles have been reported by the public fishing recreationally from boats, piers, beaches, banks, and jetties (TEWG 2000). Most sea turtle captures on rod and reel, as reported to the stranding network, have occurred during pier fishing. Fishing piers are suspected to attract sea turtles that learn to forage there for discarded bait and fish carcasses. The amount of persistent debris, including monofilament line, fishing tackle, and other manufactured items, is higher around piers, posing an additional threat to sea turtles in the area. These locations are outside the area where the federal fisheries operate.

Hard-shelled and leatherback sea turtles are known to ingest baited hooks or have their appendages snagged by hooks, both of which have been recorded in the STSSN database. Some will break free on their own and escape, possibly with embedded/ingested hooks and/or trailing line, which may cause post-release injury or death. Others may be cut free by fishermen and intentionally released. Though it is assumed that most sea turtles hooked by recreational fishermen are released alive, deceased sea turtles have been documented with hooks in their digestive tract.

In addition to interactions reported to the STSSN, two sea turtle interactions with handline gear were reported on VTRs by party/charter vessels. Of these, one interaction was reported in federal

waters where the fisheries in this Opinion operate, and the species kept was weakfish. NMFS has also attempted to assess the extent of interactions between recreational anglers and sea turtles through a survey-based pilot study from 2012-2013 that included shore-based, private vessel, and charter/headboat fishing effort in waters off the southeast Atlantic. However, this study was limited to one state.

The recreational bluefish fishery accounts for approximately 70-80 percent of total bluefish landings. Rod and reel, handline, trap/pot, and spear gear are used in the recreational fishery, with rod and reel being the predominant gear type used. Since the recreational fishery receives 80 percent of the annual bluefish quota and charter/recreational boats are commonly found throughout the action area, a significant amount of hook and line fishing occurs for bluefish. However, data from the Marine Recreational Information Program (MRIP, see <https://www.fisheries.noaa.gov/recreational-fishing-data/recreational-fishing-data-and-statistics-queries>) from 2015-2019 indicate that only a small percentage (~2.4 percent of recreational catch and <1 percent of effort where bluefish is the primary or secondary target) of recreational fishing activity for bluefish occurs in federal waters where NMFS directly regulates the fishery. In state waters, the federal FMP sets the overall quota, but authorization and management of the recreational fishery is at the state level.

The bluefish fishery is the fishery with the largest recreational component. As described in section 4.1, bluefish are caught using a technique called jigging. Sea turtles are unlikely to be snagged by jigged gear as it is deployed near the surface and constantly reeled back to the boat. It is possible a sea turtle could become snagged if it comes into contact with the jigged hook, but the chances of that occurring are extremely low. Presently, there are no data sets available to provide estimates of incidental take from hook and line gear used in these federal fisheries when they are operating in federal waters.

The probability of hooking or entanglements in recreational hook and line gear in federal waters is difficult to ascertain and very little data are available for the U.S. Atlantic to analyze impacts from this type of interaction on individual animals. In addition, it may be difficult to tell if the entangling gear is recreational or commercial depending on the gear present. Based on the lack of documented takes by hook and line fisheries in this Opinion and the fishing techniques used by the recreational bluefish fishery, we anticipate that interactions with recreational fisheries in federal waters and in fisheries in this Opinion are extremely rare and unlikely.

7.3.1.3. *Estimating Interactions with and Mortality of Sea Turtles*

Estimating Interactions

As described earlier in this Opinion, Murray (2018, 2020) analyzes fisheries observer data and VTR data from fishermen to estimate the number of sea turtle interactions in bottom trawl and gillnet gear in U.S. Mid-Atlantic and Georges Bank waters that occurred over certain time periods (2014-2018 for trawls, 2012-2016 for gillnets). These reports on interactions represent the most accurate predictor of annual sea turtle interactions in U.S. bottom trawl and gillnet fisheries south of the Gulf of Maine to Cape Hatteras. For green sea turtles in gillnets, however, observer reports from the NEFSC observer/sea sampling database represent the best available information on annual bycatch in these fisheries. For trap/pot gear interactions with sea turtles, entanglement data from the GAR STDN represents the best available information on annual bycatch in the lobster, red crab, Jonah crab, black sea bass, and scup trap/pot fisheries.

Interactions with recreational and commercial hook and line gear in the fisheries in this Opinion are expected to be extremely rare and unlikely and are, thus, not addressed in this section.

The sea turtle bycatch estimate methods for trawls and gillnets (Murray 2018, 2020) estimated interaction rates for each sea turtle species with stratified ratio estimators. This method differs from previous approaches (Murray 2015b, Murray and Orphanides 2013, Warden 2011a), where rates were estimated using generalized additive models (GAMs). Ratio estimators are computationally simple with general application to many sampling designs (Cochran 1977, Murray 2020) and results may be similar to those using GAM or generalized linear models (GLM) if ratio estimators are stratified based on the same explanatory variables in a GAM or GLM model (Murray 2007, Murray and Orphanides 2013, Orphanides 2010).

Observer and commercial data were stratified by Ecological Production Unit (EPU), latitude zone, season, and depth, based on factors associated with loggerhead bycatch rates in previous trawl bycatch analyses (latitude, SST, depth) (Murray 2015b, Murray and Orphanides 2013, Warden 2011a). Within the Mid-Atlantic EPU, latitude zones included: Northern ($\geq 37^\circ$ N to the Mid-Atlantic boundary); Middle ($< 37^\circ$ N and $< 39^\circ$ N) and Southern ($\leq 37^\circ$ N). Season was used as a proxy for SST. Summer was defined as July – October and winter as November – June. Depth groups were defined as shallow (≤ 164 ft (50 m)) or deep (> 164 ft (50 m)). Within the Georges Bank EPU, rates were stratified by season and depth groups. While only a few interactions occurred in the Georges Bank EPU, it was stratified as a separate region for a number of reasons. These include: (1) the EPUs are characterized by distinct patterns in oceanographic properties, fish distributions, and primary production (Ecosystem Assessment Program 2012); (2) previous analyses of turtle interactions delineated the “Mid-Atlantic” with the same boundaries, facilitating comparisons across time series; and (3) observer coverage is allocated separately across fleets operating in the Mid-Atlantic versus Northeast regions, of which Georges Bank is a part.

Previous NEFSC bycatch estimate reports assigned trips and associated bycatch to FMPs or individual species landed based on the distribution of landings for that trip. Trips in a certain time and area using trawls or gillnets were estimated to have a certain bycatch rate of loggerhead sea turtles (based on the observed interactions). In the estimate, the trip and its associated interactions (calculated using the bycatch rate) were assigned to multiple fisheries in a ratio that reflected the catch composition of that trip by weight (Murray 2013, 2015b, Warden 2011b). This method was meant to reflect how many of the fisheries that operate in the action area land several species on any given trip. As we have now batched all federal trawl and gillnet fisheries under GARFO jurisdiction into one Opinion, minus the scallop trawl fishery, we no longer need to partition bycatch by specific FMP except for scallops, which is a small percentage of the total trawl take estimate (Linden 2020).

Bottom Trawls

From 2014-2018, 571 loggerhead (CV=0.29, 95% CI=318-997), 46 Kemp’s ridley (CV=0.45, 95% CI=10-88), 20 leatherback (CV=0.72, 95% CI = 0-50), and 16 green (CV=0.73, 95% CI=0-44) sea turtle interactions were estimated to have occurred in bottom trawl gear in the Mid-Atlantic region over the 5-year period. On Georges Bank, 12 loggerheads (CV=0.70, 95% CI=0-31) and 6 leatherback (CV=1.0, 95% CI=0-20) interactions were estimated to have occurred from 2014-2018. An estimated 272 loggerhead, 23 Kemp’s ridley, 13 leatherback, and 8 green sea turtle interactions resulted in mortality over this period (Murray 2020). With the respective

95 percent CIs, it would be expected that anywhere from the low end to the high end of each sea turtle species could interact with trawl gear annually and that would be within the range of estimated interactions based on past records. For this Opinion, we are using the upper end of the 95 percent CI. In Murray (2020), this is an estimate of 1,028 loggerhead, 88 Kemp's ridley, 70 leatherback, and 44 green sea turtles over a 5-year period is the best available information on the anticipated number of interactions in the bottom trawl component of these fisheries in both state and federal waters.

To estimate the number of interactions in federal waters only, we used estimated interaction rates from Murray (2020) and VTR data from 2014-2018, the years of the Murray (2020) analysis. Using the number of trawl trips in federal waters (excluding Atlantic sea scallop trips), we estimate 954 loggerhead, 53 Kemp's ridley, 40 leatherback, and 32 green sea turtle interactions over a 5-year period is the best available information on bottom trawl interactions with sea turtles in the ten fisheries (Linden 2020). These estimates provide the best available information for determining the anticipated number of sea turtle interactions over future 5-year periods in the bottom trawl components of the ten fisheries. This represents the total number of interactions anticipated in the bottom trawl component of these fisheries and not just the number observed. We further believe that any interactions in bottom trawl gear that occur outside of the Mid-Atlantic and Georges Bank (i.e., in the Gulf of Maine) will be subsumed within this estimate as the upper ends of the 95 percent CIs (rather than the means) are being used. CIs for combined strata within the Mid-Atlantic and Georges Bank regions were obtained in through the summation of stratum-specific bycatch estimates (Murray 2020).

Gillnets

From 2012-2016, estimated bycatch of sea turtles in sink gillnet gear on Georges Bank and in the Mid-Atlantic was 705 loggerheads (of which 557 were mortalities) (CV = 0.29, 95% CI over all years: 335-1116), 145 Kemp's ridleys (115 mortalities) (CV=0.43, 95% CI over all years: 44-292), 27 leatherbacks (21 mortalities) (CV=0.71, 95% CI over all years: 0-68), and 112 unidentified hard-shelled sea turtles (88 mortalities) (CV=0.37, 95% CI over all years: 64-321) (Murray 2018). These estimates of sea turtle interactions with Mid-Atlantic and Georges Bank sink gillnet gear provide the best available information for determining the anticipated bycatch of sea turtles in that gear type in the action area. For this Opinion, we are using the upper ends of the 95 percent CIs and therefore estimate 1,116 loggerhead, 292 Kemp's ridley, 68 leatherback, and 321 unidentified hard-shelled sea turtle interactions over a 5-year period as the best available information on the anticipated number of interactions in the gillnet component of the ten fisheries. This represents the total number of interactions expected over future 5-year periods in the gillnet component of these fisheries and not just the number that may be observed. We further believe that any sea turtle interactions in gillnet gear that occur outside of the Mid-Atlantic and Georges Bank (i.e., in the Gulf of Maine) will be captured within these estimates as the upper ends of the 95 percent CIs (rather than the means) are being used. As with trawl gear, we used VTR effort in federal waters to estimate interactions with the fisheries in this Opinion.

Looking solely at fishing effort in federal waters, we estimate 853 loggerhead, 196 Kemp's ridley, 52 leatherback, and 226 unidentified hard-shelled sea turtle interactions over a 5-year period is the best available information on gillnet interactions with sea turtles in the ten fisheries (Linden 2020). Of the estimated hard-shelled sea turtle interactions identified to species, loggerheads represent 81 percent (853/1,049) of the total interactions and Kemp's ridleys represent 19 percent (196/1,049). Thus, we anticipate that of the 226 unidentified sea turtle

interactions over a 5-year period, 183 will be loggerheads and 43 will be Kemp's ridleys. That brings our federal waters totals to 1,036 loggerhead, 239 Kemp's ridley, and 52 leatherback interactions over a 5-year period for gillnet gear used in the ten fisheries.

There are no total bycatch estimates for green sea turtles in U.S. Mid-Atlantic and Georges Bank gillnet gear. The very low number of observed green sea turtle interactions in gillnet gear suggests that interactions with this species within the action area in the fisheries considered in this Opinion are rare. However, given the fact that observer coverage in these fisheries is much less than 100 percent, it is likely that interactions with green sea turtles have occurred but were not observed or reported. Given effort in the gillnet fisheries as a whole and the seasonal overlap in distribution of this species with the operation of gillnet gear, green sea turtles are likely to occasionally interact with gillnet gear.

From 2010-2019, an annual average of 0.5 green sea turtles and 1.2 unidentified turtles were captured in gillnet gear (Table 69). Rounding up, we anticipate the take of 1 green sea turtle annually. While it is more likely that the unknown sea turtles are loggerheads or Kemp's ridleys, it is possible that, in any given year, a green sea turtle could be captured and not identified to species. Therefore, we are adding 1 unknown turtle to the anticipated capture number to account for this possibility. This gives a total of ten captures (average of two annually) in gillnet gear over a 5-year period.

Trap/Pot Gear

When calculating the sea turtle interaction rates for trap/pot gear used in the ten fisheries in this Opinion, we evaluated GAR STDN vertical line stranding and entanglement records documented during 2010-2019, the most recent 10-year period, in state and federal waters. We believe this approach is reasonable for a number of reasons. The species of sea turtles that occur in the action area are all highly migratory and found in both state and federal waters. Trap construction requirements are very similar in the state and federal fisheries, and effort throughout the seasons is similar. The vast majority of both state and federal trap/pot fishing effort occurs in the depth range where sea turtles are known to occur most frequently (0-120 ft (0-36 meters)); thus, none of the fisheries are known to have a disproportionate rate of sea turtle entanglement based on the distributions of sea turtles and fishing effort. Since the gear, timing, and distribution of effort with respect to sea turtle abundance are essentially the same in both state and federal waters, we believe the number of sea turtle entanglements reported to the GAR STDN is the best available data from which to estimate of sea turtle entanglements.

From 2013-2019, the NEFSC observer/sea sampling database included one reported interaction in pot gear in 2014 (a dead leatherback). Given the low level of observer coverage in these fisheries and the extremely small sample size of observer records for this gear type, these data will not be used to estimate sea turtle interactions with the fisheries.

An annual estimate of sea turtle interactions in fixed gear fisheries in federal waters was determined based on the number of confirmed and probable entanglement cases in the GAR STDN database from 2010-2019. Any of the estimates that produced fractional numbers were rounded up in the final estimates.

Between 2010 and 2019, 272 sea turtle entanglements in vertical line gear in state and federal waters of the Greater Atlantic Region (Maine through Virginia) were reported and classified with a probable or confirmed, high confidence rating. Although the action area of the fisheries

considered in this Opinion extends to Key West, Florida, the trap/pot fisheries considered in this Opinion only operate in the Greater Atlantic Region. One case involved scallop aquaculture gear and another involved gear used by a vessel conducting research. These two cases will not be considered as part of the analysis. Of the 270 cases assessed, 255 involved leatherback sea turtles and 15 involved loggerhead sea turtles. For leatherbacks, there were 238 records in state waters, and 17 in federal waters. This includes four cases where the latitude and longitude were unknown, but the general location description or fishery indicated state waters. These four interactions were assigned to state fisheries based on the location and/or fishery description. For loggerheads, 14 records were in state waters and 1 in federal waters. There has only been one green and no Kemp's ridley sea turtles documented in the STDN database. The green sea turtle was entangled in conch gear in state water in 2007. Small turtles such as Kemp's ridley or smaller juvenile hard-shelled turtles likely do not have the strength to wrap fixed fishing gear lines around themselves (Sampson, pers comm January 16, 2020). Given the lack of documented interactions and the size of Kemp's ridley and green sea turtles in the areas where the trap/pot fisheries considered in this Opinion, interactions with these species in trap/pot gear are extremely rare and, therefore, not estimated below.

Leatherback Sea Turtles

Given differences in information available for the different trap/pot fisheries, we estimate leatherback sea turtle entanglements in federal lobster/Jonah crab traps/pot fisheries separately from fish trap/pot fisheries. Additionally, given the red crab fishery's offshore location and absence of GAR STDN data for sea turtle interactions with gear used in this fishery, we evaluate this fishery separately. We then combine the three estimates to produce an overall estimate of annual sea turtle entanglements, by species, expected in the fisheries in the Opinion.

Lobster and Jonah Crab: The Jonah crab FMP was implemented in federal waters in 2019 and only allows previously permitted lobster traps to target Jonah crab. Therefore, the entanglement estimate for the Jonah crab fishery is contained within the estimate for the lobster fishery. The GAR STDN receives the majority of reports from private boaters and recreational fishermen who encounter entangled turtles in the water. These reports may come directly from the reporting individual or routed through the USCG, state agencies (e.g., Maine Marine Patrol, Massachusetts Environmental Police) or local harbor masters. It is likely that the opportunistic GAR STDN data is biased towards state waters given the high number of recreational vessels in state waters. For this analysis, entanglements are considered to occur at the same rate in the federal and state fisheries. Therefore, we will apply information on entanglement rates from observed state fishery entanglements to the federal portion of the fishery. While the interactions in federal waters are described above, they are not used in this analysis as they are contained within the overall estimate below.

Gear may be verified to fishery through the buoy/gear identification numbers, which can be traced in the various state agency and federal permit systems. The American lobster fishery occurs in state and federal waters by vessels with state and/or federal permits. Of the total effort in state and federal waters, approximately 20 percent of the overall lobster fishery operates their gear in federal waters (ASMFC 2009, NMFS 2014b). The GAR STDN entanglement data involved three different scenarios for gear involved in entanglements: 1) one gear set permitted to one fishery; 2) one gear set permitted in more than one fishery; and 3) two different gear sets permitted to two different fisheries. To ensure our estimate is conservative to the species,

entanglements involving multiple permits or gear types were attributed to target species based on the following criteria:

1. If gear is permitted in one fishery, interactions are assigned to the species for which the permit is held.
2. If gear is permitted in more than one fishery:
 - a. If one species is federally managed (e.g., lobster) and the other (e.g., conch) is not, interaction is assigned to the federally managed species.
 - b. If both species are federally managed, 0.5 interactions are assigned to each species.
3. If two gears sets in two different fisheries are involved:
 - a. If target species known, 0.5 interactions are assigned to each species.
 - b. If one species known and the other is unknown, 0.5 interactions are assigned to the known species and 0.5 to unknown.

Using these criteria, 81 leatherback entanglements from 2010-2019 in state waters were confirmed to the lobster fishery. There were also 119.5 interactions in unknown gear. The 0.5 results from an interaction in which two gear sets were involved; one of these gear sets was unknown. The percentage (68.4 percent) of all cases with identified gear (118.5) in state waters that proved to be lobster trap/pot gear (81) was applied to the unknown gear entanglement total (119.5) to estimate the total unknown gear presumed to be lobster trap/pot gear. Therefore, 81.7 (68.4 percent of 119.5) of the interactions in unknown gear are presumed to be lobster gear. This results in 163 ($=81+81.7$) interactions with lobster gear over the 10 years, with an annual average of 16.3.

As described above, approximately 80 percent of the gear is in state waters. Therefore, the 163 interactions represent 80 percent of all interactions. Applying this, we anticipate the total take in state and federal waters of 203.75 ($=163/0.8$) leatherbacks over ten years. The annual average in state and federal waters is 20.38 takes. Given that 20 percent of the lobster fishing effort is in federal waters, we estimate that 4.08 (20 percent of 20.28) leatherback sea turtles will become entangled in federal lobster gear each year. Since part of a sea turtle cannot be taken, this estimate will be rounded up to five leatherback sea turtle entanglements in the federal lobster and Jonah crab fisheries annually.

Black Sea Bass and Scup: Using the criteria above, 18.5 leatherback entanglements in state waters from 2010-2019 (GAR STDN, unpublished data) were assigned to fish trap/pot gear. The percentage (15.6 percent) of all cases with identified gear (118.5) in state waters that proved to be fish trap/pot gear (18.5) was applied to the unknown gear entanglement total (119.5) to estimate the total unknown gear presumed to be fish trap/pot gear. Therefore, 18.6 (15 percent of 119.5) entanglement events with unknown gear in state waters are presumed to have involved fish trap/pot gear. Adding this (18.6) to the confirmed cases (18.5) results in 37.1 (annual average of 3.71) estimated leatherback entanglements in fish trap/pot gear.

Effort distribution data between state and federal waters in fish trap/pot gear used in the fisheries is not available. The fisheries and leatherbacks overlap in both state and federal waters, and we believe that interactions are equally likely in both areas. Additionally, the opportunistic GAR STDN data are considered biased towards state waters, and entanglements are considered to occur at the same rate in the federal and state fisheries. Therefore, we assume that the same number of interactions (3.71 annually) will occur in federal waters. The actual number of entangled leatherbacks per year may differ from this estimate; however, the actual number of

entanglements cannot be extrapolated from the existing data. Assuming effort in the federal fisheries is equal to effort in the state fisheries and entanglements in the federal fisheries occur at the same rate of the observed entanglements in the state fisheries, we anticipate four leatherback sea turtle interactions annually in the fish trap/pot component of the fisheries.

Red Crab: Leatherback sea turtles may be found in the area where red crab gear is set. Documentation of leatherback sea turtle interactions with red crab trap/pot gear has not occurred. Between 2016 and 2019, there were 263 red crab directed trips. Of those, 57 trips had observers onboard and did not observe any leatherback sea turtle interactions with red crab gear. Observer coverage ranged from 13 percent to 27 percent annually (NOAA Fisheries, unpublished data). Despite the absence of reported interactions of leatherbacks with red crab trap/pot gear, the possibility exists that interactions will occur. Red crab gear is configured and set in a manner comparable to lobster gear; a gear type known to be an entanglement risk to sea turtles. We realize that more leatherbacks might be entangled than are actually reported. However, there is not information available to estimate these; therefore, we anticipate one leatherback sea turtle interaction annually in trap/pot gear used in the red crab fishery.

Combined Estimate: Using the methods above, we estimate that there will be five leatherback interactions in federal lobster pot gear, four in fish pot gear, and one in red crab gear. Over a 5-year period, we anticipate 50 leatherback interactions in trap/pot gear used in the fisheries considered in this Opinion.

Loggerhead Sea Turtles

From 2010-2019, 15 loggerhead sea turtles were reported entangled in trap/pot gear. One of these interactions was confirmed to lobster gear in federal waters. The remainder were in state water fisheries. Six of these were in blue crab gear, 5 in conch gear, and 3 in unknown gear. The interactions with gears that may be used by fisheries in this Opinion occurred in lobster gear in 2017 (1) and in unknown gear in 2013 (1), 2014 (1), and 2019 (1).

To estimate the annual interactions, we used the highest number (1) of annual documented loggerhead entanglements per year from 2010-2019 that may have been trap/pot gear used in the fisheries (lobster and unknown gear). Although the actual number of loggerheads entangled in trap/pot gear per year may be larger, it cannot be extrapolated from the existing GAR STDN data. As a result, we have determined that the maximum number of annual interactions from 2010-2019 represents the best available scientific and commercial data on the number of loggerhead interactions anticipated in the trap/pot component of the federal fisheries annually. We believe that this approach is consistent with NMFS' directive to provide the "benefit of the doubt" to threatened and endangered species. Therefore, we anticipate one loggerhead sea turtle interactions annually in trap/pot gear used in the fisheries.

Estimating Mortalities

Sea turtle interactions with gillnet, bottom trawl, and trap/pot gear likely result in a higher level of sea turtle mortality than is evident due to mortality after a turtle is released alive (post-interaction mortalities). Injuries suffered by sea turtles interacting with these gear types fall into two main categories: (1) submergence injuries characterized by an absence or obvious reduction in breathing and consciousness with no other apparent injury, and (2) contact injuries characterized by entanglement of the head, flippers, and/or other body parts in the gear. The following information is provided as an assessment of the extent of these types of injuries likely to occur to sea turtles affected by the operation of these fisheries. It should be noted that the

severity of sea turtle submergence injuries from trawl gear interactions will likely be less if the turtle is interacting with a trawl equipped with a TED rather than a trawl without one.

Sea turtles forcibly submerged in any type of restrictive gear eventually suffer fatal consequences from prolonged anoxia and/or seawater infiltration of the lung (Lutcavage and Lutz 1997). Studies examining the relationship between tow duration and sea turtle mortality in the shrimp trawl fishery show that mortality was strongly dependent on trawling duration (Epperly et al. 2002, Henwood and Stuntz 1987, NRC 1990, Sasso and Epperly 2006). The results of these studies were comparable. In general, tows of short duration have little effect on the likelihood of mortality for sea turtles caught in the trawl gear. Intermediate tow durations result in a rapid escalation to mortality, and eventually reach a plateau of high mortality, but will not equal 100 percent as a turtle caught within the last hour of a long tow will likely survive (Epperly et al. 2002, Henwood and Stuntz 1987, NRC 1990, Sasso and Epperly 2006). The stress of being captured in a trawl is greater in cold water than in warm water (Epperly et al. 2002, Sasso and Epperly 2006). Epperly et al. (2002) gave the example that a 40 minute tow in the summer time was predicted to have a 3 percent mortality rate whereas a 40 minute tow in the winter time was predicted to have a 5 percent mortality rate. To achieve a negligible mortality rate (defined by NRC as <1 percent), tow duration for both seasons would have to be less than 10 minutes (Epperly et al. 2002, Sasso and Epperly 2006). However, in both seasons, a rapid escalation in the mortality rate did not occur until after 50 minutes (Sasso and Epperly 2006) as had been found by Henwood and Stuntz (1987). Although the data used in the 2006 analysis were specific to bottom otter trawl gear in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries, the authors considered the findings to be applicable to the impacts of forced submergence in general (Sasso and Epperly 2006).

Metabolic changes that can impair a sea turtle's ability to function can occur within minutes of a forced submergence. Most voluntary dives appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status. The story is quite different, however, in forcibly submerged sea turtles, where oxygen stores are rapidly consumed, anaerobic glycolysis is activated, and acid-base balance is disturbed, sometimes to lethal levels (Lutcavage and Lutz 1997). Forced submergence of Kemp's ridley sea turtles in shrimp trawls resulted in an acid-base imbalance after just a few minutes (times that were within the normal dive times for the species) (Stabenau et al. 1991). Conversely, recovery times for acid-base levels to return to normal may be prolonged. Henwood and Stuntz (1987) found that it took as long as 20 hours for the acid-base levels of loggerhead sea turtles to return to normal after capture in shrimp trawls for less than 30 minutes. This effect is expected to be worse for sea turtles that are recaptured before metabolic levels have returned to normal.

Tows by trawl vessels are usually around one to two hours in duration. However, Murray (2008) found that tow durations of bottom otter trawl gear that resulted in sea turtle bycatch ranged from 0.5 to over 5 hours. Shortened tow durations in some fisheries, which have been used to limit large amounts of non-target fish species bycatch, should help to reduce the risk of death from forced submergence for sea turtles caught in trawls, but they do not eliminate the risk. For trawl fisheries, assuming that the mortality rate for sea turtles from forced submergence is comparable to that measured for the shrimp fishery (Epperly et al. 2002, Sasso and Epperly 2006), sea turtles may die as a result of capture and forced submergence in trawl gear, especially if they are caught at the beginning of long tows.

There are far fewer studies on the effects of forced submergence in gillnets than there are for trawls. However, the risk of a sea turtle drowning as a result of entanglement in gillnet gear is assumed to be greater compared to trawl gear, as gillnets are often left to soak for extended periods of time (i.e., days rather than hours) and are usually anchored to the seafloor. If a sea turtle is caught in a gillnet soon after it is set and is unable to surface for air, the likelihood of mortality is high, as a fisherman may not be back to retrieve it for several days. Soak times for gillnets in which sea turtles were captured from 2012-2016 ranged between 0.2 and 264 hours (Murray 2018).

Mortality calculations

Prior to 2013, the best available information on sea turtle mortality was the number of dead sea turtles documented by the NEFOP and ASM programs and/or reported in the NEFSC bycatch estimates (Murray 2008, 2009a, Warden 2011a). Based on the descriptions provided by fisheries observers, it seemed probable that some injured sea turtles observed captured in commercial fishing gear and that were returned to the water alive would have subsequently died as a result of those injuries. We recognized the need to expand guidance originally developed for the scallop dredge fishery to attempt to encompass other Greater Atlantic Region gear types (e.g., gillnet, trawl) and a wide range of sea turtle injuries and to use a consistent approach for assessing post-release survival.

In November 2009, NMFS GARFO and the NEFSC hosted a workshop to discuss sea turtle injuries in regional fishing gear and associated post-interaction mortality. The workshop convened various experts in sea turtle veterinary medicine, health assessment, anatomy, and/or rehabilitation. The information gathered by individual participants at this workshop was then used by NMFS to develop technical guidelines for assessing sea turtle injuries in Northeast fishing gear (Upite 2011). In 2015, to promote national consistency when assessing post-interaction mortality in trawl, net, and trap/pot gear, NMFS convened an expert working group of veterinarians, sea turtle biologists, observer program experts, and resources managers to inform the development of national criteria (Stacy et al. 2015). Subsequent to the workshop, NMFS developed national guidance on assessing post-interaction mortality (NMFS 2017f). Each year, NMFS reviews records of incidental capture in trawl, net, and trap/pot to determine the post-interaction mortality in these gears (Upite et al. 2019). Based upon the best available scientific and commercial data, we believe that these guidelines are reasonable measures of what to expect for sea turtles captured by fishing gear and associated post-interaction mortality.

Workgroup members annually review each observer record and first determine if the injury was a result of the fishery interaction (haul/set/tow), interpreted as a “fresh” injury, using the guidance and expert opinion. If fresh, then the members use the national criteria to place the turtle into one of the three categories with the identified post-release mortality rates or provide justification for a 100 percent mortality determination. After the determinations are finalized, the records are separated by gear type. Based upon the percent probability of mortality and numbers of turtles in each category, turtle mortalities are calculated for each category by gear type. The number of dead turtles is then combined to obtain an overall mortality number by gear type, and the mortality percentage (number of dead turtles/number of total observations) is calculated (Upite et al. 2019). The associated mortality rates (10 percent or 20 percent (depending on depth of the fishing operation), 50 percent, 80 percent) for the three categories factor in any potential variations in species differences. As the criteria apply to all sea turtle species and life phases

(NMFS 2017f), all species are combined in the mortality rate estimates for each gear type Upite, 2019 #3097}. Therefore, the resulting mortality percentages apply to all sea turtle species.

Mortality percentages are calculated over a rolling 5-year period. The mortality percentages for the four most recent 5-year periods (Upite et al. 2019; Memorandums from Carrie Upite, Sea Turtle Recovery Coordinator, to Jennifer Anderson, ARA for Protected Resources, February 26, 2020 and April 26, 2021), which overlap with the bycatch estimates, are presented in Table 70. These post-interaction mortality rates are consistent with those calculated over the past several 5-year periods dating back to 2006-2010.

Table 70: Rolling 5-year mortality percentages by gear type

	Trawl	Gillnet	Vertical Line
2012-2016	47%	78%	53-59%
2013-2017	48%	73%	55-61%
2014-2018	46%	71%	60-64%
2015-2019	43%	64%	57-62%

The ten fisheries assessed in this Opinion primarily use sink gillnet, bottom otter trawl, and trap/pot gear. For this Opinion, we are using the highest percentage over these periods to account for variability in mortality rates and to be conservative to the species. Therefore, we assume that 78 percent of gillnet interactions and 64 percent of vertical line interactions will result in mortality. For trawl gear, Murray (2020) estimated 50 percent mortality based on the most recent time series (2013-2017) available at that time. While the methodology was the same (Upite et al. 2019), this rate is slightly higher than the mean mortality rate in trawl gear reported for 2013-2017 (Table 70) because takes in shrimp twin trawl gear were excluded from the data considered by Murray (2020). The fisheries considered in this Opinion do not use shrimp twin trawl gear; therefore, it is reasonable to use the mortality estimate from Murray (2020). In addition, using the highest percentage is the most conservative to the species. Murray (2020) also assumed that the mortality rate for unobservable yet quantifiable interactions (i.e., the turtle passed through a TED) was 0 percent. To be conservative, we are assuming that all sea turtle takes in trawls will be in non-TED equipped gear and that the mortality rate of 50 percent is the worst case scenario experienced by each species. This is a reasonable assumption given that only 5.7 percent of the estimated interactions in bottom trawls from 2014-2018 involved sea turtles escaping out of a TED opening, all of which were loggerheads (Murray 2020).

As described above, we are using the upper end of the confidence intervals in the bycatch estimates for trawl and gillnet gear to estimate interactions with sea turtles. We then apply the post-interaction mortality rates by gear type to estimate the number of interactions that are expected to result in mortalities (Table 71). Based on bottom trawl interaction rates from 2014-2018 (Murray 2020) and using the number of bottom trawl trips in federal waters (excluding Atlantic sea scallop trips) during that period, we estimate 954 loggerhead, 53 Kemp's ridley, 40 leatherback, and 32 green sea turtle interactions over a 5-year period (Linden 2020). Using a mortality rate of 50 percent and rounding up, we estimate 477 loggerhead, 27 Kemp's ridley, 20 leatherback, and 16 green sea turtle mortalities in trawl gear used in the fisheries considered in this Opinion.

Based on interaction rates from 2012-2016 (Murray 2018) and using the number of gillnet trips in federal waters during that period, we estimate 853 loggerhead, 196 Kemp's ridley, 52

leatherback, and 226 unidentified hard-shelled sea turtle interactions over a 5-year period (Linden 2020) interactions. As described above (see 7.3.1.3, gillnets), we anticipate that of the 226 unidentified sea turtle interactions, 183 will be loggerheads and 43 will be Kemp's ridleys. Therefore, 1,036 loggerhead, 239 Kemp's ridley, and 52 leatherback interactions over a 5-year period will occur in gillnet gear used in the ten fisheries. Using a mortality rate of 78 percent and rounding up, 808 loggerhead, 187 Kemp's ridley, and 41 leatherback interactions will result in mortality. For green sea turtles, we anticipate the take of two interactions with gillnet gear annually or 10 interactions over a 5-year period. Using the 78 percent mortality, we anticipate that 8 (rounded up from 7.8) interactions will be lethal over the five year period.

We anticipate 50 leatherback sea turtle interactions over a 5-year period in all trap/pot gear used in the ten fisheries. To estimate total mortality, the Northeast Sea Turtle Injury Workgroup reviewed sea turtle entanglement cases in the GAR STDN database that were identified as involving vertical fishing line (Memorandum from Carrie Upite, Sea Turtle Recovery Coordinator, to Jennifer Anderson, ARA for Protected Resources, February 26, 2020). While most vertical line entanglements involve trap/pot gear, this cannot always be conclusively determined, so mortality rates were presented for "vertical fishing line." To incorporate all of the entanglement-related mortality data, estimated mortality rates included cases that assumed the sea turtles were deceased. To be conservative towards the species, we used the highest mortality rate (64 percent) from the four most recent 5-year periods (Memorandums from Carrie Upite, Sea Turtle Recovery Coordinator, to Jennifer Anderson, ARA for Protected Resources, February 26, 2020 and April 26, 2021). Using a mortality percentage of 64 and rounding up, we anticipate that 32 leatherback interactions in trap/pot gear used in the 10 fisheries will result in mortality over a 5-year period. We also anticipate five loggerhead sea turtle interactions over a 5-year period in trap/pot gear used in the ten fisheries. As described above, the mortality percentages apply to all species; therefore, using the 64 percent mortality percentage and rounding up, we anticipate that 4 loggerhead interactions could be lethal.

Age Class of Sea Turtles Interacting with Fishing Gear

Leatherback sea turtles

The TEWG specifies that sub-adults range from 39.4-57.1 inches (100-145 cm) and adults are >57.1 inches (145 cm) CCL (TEWG 2007). Stranding, sighting, and tracking records suggest that both adult and immature leatherback sea turtles occur within the action area where the fisheries operate (James et al. 2005a, James et al. 2005c, NMFS and USFWS 1992, NMFS SEFSC 2001). Immature and sexually mature leatherback sea turtles are known to be captured in trap/pot gear. Using the formula in Avens et al. (2009) to convert SCL to CCL, leatherbacks entangled in trap/pot gear from 2010-2019 ranged from 48.6-68.7 inches (123.5-174.6 cm CCL) (GAR STDN, unpublished data). Although there were no measurements recorded for leatherbacks captured in Mid-Atlantic and Georges Bank gillnet gear from 2012-2016 (Murray 2018), there were two leatherbacks captured in trawl gear in the region from 2014-2018 that were 55.9 inches (142 cm) and 87.8 inches (223 cm) CCL, respectively (Murray 2020). Therefore, either immature or sexually mature leatherback sea turtles could interact in gillnet, trawl, or trap/pot gear since both age classes occur in areas where the ten fisheries operate.

Loggerhead sea turtles

The 2008 recovery plan identifies five life stages for loggerhead sea turtles: (1) hatchling: 4 centimeters CCL, 1-5 days; (2) post-hatchling: 1.6-2.4 inches (4-6 cm) CCL, <6 months; (3) oceanic juvenile: 3.3-25.2 inches (8.5-64 cm) CCL, 7-11.5 years; (4) neritic juvenile: 18.1-34.3 inches (46-87 cm) CCL, 13-20 years; and (5) adult male/female: 32.7 inches (>83 cm) CCL and >34.4 inches (>87 cm) CCL (respectively), >25 years for females (NMFS and USFWS 2008). From 1995-2016, loggerhead sea turtles captured in gillnets and measured (n=25) ranged from 20.5-39.8 inches (52-101 cm) CCL (Murray 2009a, 2013, 2018). From 2009-2018 in bottom trawl gears, loggerhead ranged from 19.3-46.8 inches (49-119 cm) CCL (n=126 turtles) (Murray 2015b, 2020). Measurements may not be collected when an animal was not brought on board for sampling (e.g., fell out of net), when an observer was off-watch, or when the interaction was observed by an at-sea monitor, who is not required to collect biological information from observed bycatch. Data is also available from the STDN on the size of loggerheads entangled in vertical lines. Loggerheads entangled in blue crab, conch, and unknown gear from 2010-2019 ranged from 26.7-48.0 inches (67.8 cm-121.9 cm) SCL. Converting SCL to CCL (Teas 1993), the CCLs ranged from 28.7-51.2 inches (73-130 cm). Measurements are not available for animal entangled in lobster trap/pot gear. Both neritic juveniles (sexually immature) and adults are captured in trawl, gillnet, and trap/pot gear.

Estimates of adult equivalents are also informative in assessing impacts to populations. Adult equivalence considers a turtle's reproductive value (RV), defined as the contribution of an individual in an age class to current and future reproduction. It translates the loss of individual turtles into the number of adults expected based on the likelihood the individual will survive to adulthood and reproduce. Compared to individual losses, monitoring adult-equivalent losses from fisheries interactions can be a more informative metric to assess population-level impacts (Haas 2010).

The most recent estimates of bycatch in gillnet (Murray 2018) and trawl (Murray 2020) includes turtle sizes and adult equivalents for loggerheads. From 2012-2016, observed loggerheads caught in Mid-Atlantic and Georges Bank gillnet gear, for which measurements could be taken, were neritic juveniles, and ranged between 21.3-27.2 inches (54.0-69.0 cm) CCL (n=11 turtles). Estimated interactions across Georges Bank and the Mid-Atlantic in gillnet gear were equivalent to 19 adults (Murray 2018). Due to the low sample of measured turtles in the analysis, limited information was available to calculate adult equivalent bycatch, and a larger sample of measured turtles including turtles from other strata would have helped provide a more accurate measure of adult equivalents (Murray 2018). Size classes of loggerheads observed captured in Mid-Atlantic and Georges Bank trawl gear from 2014-2018 spanned both juvenile and adult life stages, ranging from 20.1-46.8 inches (51.0-119.0 cm) CCL (n=38 turtles). From 2014-2018, the total number of loggerhead sea turtle interactions across Georges Bank and the Mid-Atlantic in bottom trawl gear was equivalent to 182 adults (Murray 2020). Based on these observer measurements and the known distribution of loggerhead sea turtles captured in other U.S. Atlantic coastal fisheries, we expect that both juvenile and adult loggerheads may be captured in gear used by these ten fisheries because both life stages are present within the action area.

Kemp's sea turtles

The post-hatchling stage for Kemp's ridley sea turtles was defined by the TEWG as Kemp's ridleys of 2-7.9 inches (5-20 cm) SCL, while turtles 7.9-23.6 inches (20-60 cm) SCL were considered to be benthic immature (TEWG 2000). Converting SCL to CCL (Teas 1993), post-

hatchling Kemp's ridley sea turtles range from 2.1-8.3 inches (5.3-21.2 cm) and benthic immature turtles range from 8.3-25.0 inches (21.2-63.5 cm) CCL. Length at sexual maturity was more recently reported to vary considerably, ranging from 18.5-24.0 inches (47.0 to 61.0 cm) CCL (Bjorndal et al. 2014). Benthic immature turtles are those animals that have recruited to coastal benthic habitat. Mid-Atlantic and coastal New England waters are known to be developmental foraging habitat for immature Kemp's ridley sea turtles, while adults have been documented from waters and nesting beaches along the South Atlantic coast of the U.S. and in the Gulf of Mexico (Morreale and Standora 2005, Musick and Limpus 1997, TEWG 2000). Kemp's ridley turtles captured in Mid-Atlantic and Georges Bank gillnet gear from 2012-2016 ranged from 11.6-14.6 inches (29.5 to 37.0 cm) CCL (n=5 turtles), sizes considered to be juveniles (Bjorndal et al. 2014, TEWG 2000). Size classes of Kemp's ridleys observed captured in Mid-Atlantic and Georges Bank trawl gear from 2014-2018 ranged from 8.93-11.7 (22.7-29.7 cm) CCL (n=3 turtles), also in the size range of juvenile turtles. Given the life history of the species and the above bycatch records in recent years, we expect that only juvenile Kemp's ridley sea turtles are likely to interact with gear used in these fisheries.

Green sea turtles

Hirth (1997) defined a juvenile green sea turtle as a post-hatchling up to 15.7 inches (40 cm) SCL. A sub-adult was defined as green sea turtles from 16.1 inches (41 cm) through the onset of sexual maturity, and sexual maturity was defined as green sea turtles greater than 27.6-39.4 inches (70-100 cm) SCL (Hirth 1997). As they are for Kemp's ridleys, Mid-Atlantic waters are recognized as developmental habitat for juvenile green sea turtles after they enter the benthic environment (Morreale and Standora 2005, Musick and Limpus 1997). Green sea turtles observed captured in Mid-Atlantic and Georges Bank gillnet gear from 2012-2016 measured 10.2 and 11.8 inches (26.0 and 30.0 cm) CCL, which are considered juveniles. Two additional green sea turtles were captured in Mid-Atlantic and Georges Bank trawl gear from 2014-2018 and measured 10.1 and 12.2 inches (25.6 and 31.0 cm) CCL, respectively, also within the juvenile size range. However, nesting individuals are known to occur and feed in the Mid-Atlantic on occasion. A green sea turtle nest was documented in Delaware in 2011 and nests have also been recorded previously in North Carolina and Virginia (Hawkes et al. 2005), <https://dwr.virginia.gov/blog/sea-turtles-in-virginia/>, <https://www.delawareonline.com/story/news/2018/10/26/rare-delaware-sea-turtle-nest-could-sign-climate-changed/1759869002/>). Thus, we expect that both juvenile and adult green sea turtles are likely to interact with gear used in these fisheries.

7.3.2. Vessel Strikes

Vessels participating in the fisheries in the Opinion pose a potential threat to sea turtles when transiting to and from fishing areas and when moving during fishing activity. The degree of threat varies by vessel type (planing vs. displacement hull), vessel speed (Hazel et al. 2007, Work et al. 2010), sea turtle distribution and density in relation to vessel traffic (co-occurrence), sea turtle behavior, and environmental conditions (e.g., sea state, visibility). When sustaining injuries from vessels, sea turtles may be struck by the hull or by some portion of the steering or propulsion system. In fact, the most commonly recognized injuries are from propellers (Foley et al. 2019). Records from the Sea Turtle Stranding and Salvage Network (STSSN) show that both juvenile and adult sea turtles are subject to vessel strikes (NMFS STSSN database, unpublished data). Any of the sea turtle species can occur at or near the surface in open-ocean and coastal areas, whether resting, feeding or periodically surfacing to breathe. Therefore, green, Kemp's

ridley, loggerhead, and leatherback sea turtles may all be struck by vessels operating in the fisheries in the Opinion, with any strike resulting in possible injury or mortality to the animal.

The proportion of vessel-struck sea turtles that survive is unknown. In some cases, it is not possible to determine whether documented injuries on stranded animals resulted in death or were post-mortem injuries. However, the available data indicate that post-mortem vessel strike injuries are uncommon in stranded sea turtles. Based on data from off the coast of Florida, there is good evidence that when vessel strike injuries are observed as the principle finding for a stranded turtle, the injuries were both ante-mortem and the cause of death (Foley et al. 2019). Foley et al. (2019) found that the cause of death was vessel strike or probable vessel strike in approximately 93 percent of stranded turtles with vessel strike injuries. Sea turtles found alive with concussive or propeller injuries are frequently brought to rehabilitation facilities; some are later released and others are deemed unfit to return to the wild and remain in captivity. Sea turtles in the wild have been documented with healed injuries so at least some sea turtles survive without human intervention.

To analyze the effects of vessels operating in the fisheries in this Opinion on sea turtles, we evaluated the best available scientific and commercial data on vessel traffic and sea turtle strandings. Here, we summarize the analysis we conducted (see Memorandum from Jennifer Anderson, ARA for Protected Resources to The File, December 23, 2020 for the detailed analysis). Vessel types that occur in the action area include fishing, recreational, and commercial (e.g., cargo, military, passenger, tankers, tug-tow) vessels. However, data is limited on the use of the area by commercial vessels other than fishing vessels and, therefore, this information was not used in the analysis. Review of the fishing footprints data⁴⁰, Northeast Ocean data portal⁴¹, Mid-Atlantic Ocean data portal⁴², and VTR data shows that the large majority of vessel traffic for the fisheries in this Opinion occurs from Virginia north. Therefore, our analysis focuses on the GAR. In addition, recreational boating surveys are available for 2012 and 2013 (Monmouth University 2016, Starbuck and Lipsky 2012). These and VTR data are the best available data on vessel use of the area. Based on the data provided in the recreational surveys (Monmouth University 2016, Starbuck and Lipsky 2012), we estimate that 13,082,108 recreational trips were taken from Maine to Virginia during May through October in each year from 2012 to 2013. To better understand the overall vessel traffic in the GAR in 2012 and 2013, VTR data for commercial fishing trips (for fisheries in the Opinion and outside it) were also queried over this time frame. This resulted in an average of 240,365 trips reported on VTRs from May through October in 2012 and 2013. Combining these estimates, a minimum of 13,322,473 trips were taken each year from 2012 to 2013. This provides us with an estimated minimum number of trips taken from May through October in these years. While turtles are generally present in the GAR from May through November, data on vessel trips in November was, with the exception of VTR data, not available.

Taking into consideration the information above, data provided by recreational boating surveys in 2012 and 2013, as well as VTR data, provide the best available scientific and commercial data to estimate the rate of sea turtles struck annually by vessels operating from Maine to Virginia.

⁴⁰ <https://nefsc.noaa.gov/read/socialsci/fishing-footprints.php>

⁴¹ <https://www.northeastoceandata.org/>

⁴² <https://portal.midatlanticocean.org/>

Therefore, we used STSSN stranding data from 2012 and 2013 to estimate the number of sea turtles struck annually. There were 173 stranded sea turtles with propeller marks or evidence of watercraft injury during this period.⁴³ This includes animals that are alive and dead. For dead turtles, injuries can occur ante- or post-mortem. As described above, Foley et al. (2019) found that in 93 percent of stranded turtles with evidence of vessel strike, the injury occurred ante-mortem and was the cause of death. Using this, we presume that 7 percent of the animals that stranded dead may have received the injuries post-mortem; therefore, the number of that stranded dead was adjusted down. This resulted in 162 strandings due to vessel strikes in 2012 and 2013. Not all sea turtles that are injured or die at sea will strand; studies estimate that up to 7-27 percent of at-sea mortalities will strand (Epperly et al. 1996, Murphy and Hopkins-Murphy 1989). To account for vessel-struck animals that do not strand, we corrected the number of reported strandings with the detection value of 17 percent (the mid-point between the estimates provided in Murphy and Hopkins-Murphy (1989) and Epperly et al. (1996)). This results in an estimate of 476 sea turtles stranding due to vessel strikes from Maine through Virginia from May through November each year (2012 and 2013).⁴⁴

Using the minimum number of trips taken by recreational and commercial fishing vessels in 2012 and 2013 (i.e., 13,322,473 trips) and the estimated number of sea turtles stranding due to vessel strikes (i.e., 476 sea turtles), we estimate that one turtle is struck every 27,988 ($= 13,322,473/476$) trips⁴⁵. Applying this rate to the trips taken by vessels in the fisheries in the Opinion, we estimated the number of sea turtles struck by these vessels. From 2015-2019, commercial fishing vessels operating in the fisheries considered in the Opinion reported trips on their VTRs. We believe that this most recent period provides the best estimate of trips that will be taken in future years over the course of the Opinion. In these years, an annual average of 65,330 trips were taken from May through November each year north of Virginia. While the rate calculated here (i.e., 1 turtle/27,988 trips) is based on vessel data from May through October, we are applying the interaction rate to fishing trip data from May through November to assess interactions during the time sea turtles are present in the GAR. This is appropriate given that we do not have information to suggest that the rates would be different in November, the data being used is intended to give a gross estimate of interactions, and the data from May through October represents the best available data since November data are not available. Applying the rate above, we estimate that 2.3 ($= 65,330/27,988$) sea turtles of any species would be struck annually by vessels operating in the fisheries considered in the Opinion. Given that a partial turtle cannot be taken, we estimate that 3 interactions (lethal or non-lethal) may occur annually due to the operation of the fisheries or 15 interactions (lethal or non-lethal) in a 5-year period (Table 71). These vessel strikes could involve any of the four sea turtle species.

⁴³ Of the 173 stranded sea turtles with propeller marks, 22 were leatherbacks, 3 were green, 23 were Kemp's ridley, 124 loggerhead, and one was an unknown turtle species.

⁴⁴ The estimated number of turtles struck each year in 2012 and 2013 applies to all vessels (i.e., fishing, recreational, cargo, ferries, etc.) operating in the area.

⁴⁵ This is a conservative estimate of the number of turtles struck by fishing vessel in federal waters because (1) the total number of trips for all vessels used to estimate turtle struck per trip is an underestimate and (2) the number of trips by federally-permitted vessels includes trips those vessels took in state waters.

Table 71: Anticipated sea turtle interactions (mortalities) with gillnet, trawl, and trap/pot gear and vessels operating in the fisheries over a 5-year period

Species	Gillnet Interactions (Mortality)	Trawl Interactions (Mortality)	Pot/Trap Interactions (Mortality)	Vessel Interactions (Mortality)
Green	10 (8)	32 (16)		15 (15) any combination of species
Kemp's ridley	239 (187)	53 (27)		
Loggerhead	1,036 (808)	954 (477)	5 (4)	
Leatherback	52 (41)	40 (20)	50 (32)	

7.3.3. *Prey*

Sea turtle prey items such as horseshoe crabs, other crabs, whelks, and fish are removed from the marine environment as fisheries bycatch in one or more of the ten fisheries under consultation. None of these are typical prey species of leatherback sea turtles or of neritic juvenile or adult green sea turtles (the age classes anticipated to occur in continental shelf waters where the fisheries operate) (Bjorndal 1985, 1997, Mortimer 1982, NMFS and USFWS 1992, Rebel 1974). Therefore, the ten fisheries will not affect the availability of prey for leatherback and green sea turtles in the action area.

Neritic juveniles and adults of both loggerhead and Kemp's ridley sea turtles are known to feed on species (Burke et al. 1994, Burke et al. 1993, Dodd 1988, Keinath et al. 1987, Lutcavage and Musick 1985, Morreale and Standora 2005, Seney and Musick 2005, Seney and Musick 2007) that are caught as bycatch in numerous fisheries. In a study of the diet of loggerhead sea turtles in Virginia waters from 1983-2002, Seney and Musick (2007) found a shift in the diet of loggerheads in the area from horseshoe and blue crabs to fish, particularly menhaden and Atlantic croaker. The authors suggested that a decline in the crab species have resulted in the shift and loggerheads are likely foraging on fish captured in fishing nets or on discarded fishery bycatch (Seney and Musick 2007). The physiological impacts of this shift are uncertain; although, it was suggested as a possible explanation for the declines in loggerhead abundance noted by Mansfield (2006). Preliminary data from stranded loggerheads in Virginia from 2008-2012 suggests a return to a more traditional diet, with large whelks, decapod crustaceans, and horseshoe crabs constituting approximately 80 percent of the prey items. While differences in turtle size and geographic distribution compared to the earlier studies appear to be a factor, the authors suggest that reductions in blue and horseshoe crab harvest limits since the early 2000s may have increased the availability of these prey species to loggerhead sea turtles (Barco et al. 2015). A preliminary analysis of the GI contents of stranded Kemp's ridley sea turtles from 2010-2013 showed their diet was similar to the 1983-2002 diet. However, insects were recorded for the first time and horseshoe crabs and mud snails were consumed more frequently compared to the earlier years. Fish, first recorded in the Kemp's ridley diet in 2000, remained an important component (Barco et al. 2015, Seney et al. 2015). In addition, while the fisheries that target crab species may be impacting loggerheads and Kemp's ridleys by reducing available prey, the crabs caught as bycatch are expected to be returned to the water alive, dead, or injured to the extent that the organisms will shortly die. Injured or deceased bycatch would still be available as prey for sea turtles, particularly loggerheads, which are known to eat a variety of live prey as well as scavenge dead organisms. Given this information, it is extremely unlikely the fisheries will have an effect on sea turtle prey and, therefore, effects are discountable.

7.3.4. *Habitat*

As described above, geologic structures generally recover more quickly from bottom trawling on mud and sand substrates than on cobble and boulder substrates; while biological structures recovered at similar rates across substrates (see Appendix D in NEFMC 2016b, 2020b). The foraging distribution of Kemp's ridley, loggerhead, and green sea turtles in Mid-Atlantic and New England waters as far north as approximately Cape Cod and Georges Bank, do not typically occur in gravel habitats. In addition, green sea turtles forage in seagrass where the fisheries in this Opinion do not operate. Leatherback sea turtles have a broader distribution in New England waters, which may include clay outcroppings, but are pelagic feeders, and would be less impacted by alterations to benthic habitat. For these reasons, and the lack of any evidence that fishing practices affect habitats in degrees that harm or harass ESA-listed species, we find that while continued fishing efforts by the fisheries may potentially alter benthic habitats, these habitat alterations will be too small to be meaningfully measured or detected and will, therefore, have an insignificant effect on ESA-listed sea turtles.

7.4. *Effects to Atlantic Sturgeon*

7.4.1. *Gear Interactions*

Gear types used in the fisheries considered in this Opinion known to interact with Atlantic sturgeon include trawl and gillnets. It is also possible that bottom longline gear could hook Atlantic sturgeon while foraging, but there have been no reported interactions. Entanglement or capture of Atlantic sturgeon in trap/pot gear is extremely unlikely. A review of all available information resulted in several reported captures of Atlantic sturgeon in trap/pot gear in Chesapeake Bay as part of a reward program for Maryland, yet all appeared to be juveniles no greater than two feet in length. In addition, there has been one observed interaction, in 2006, on a trip where the top landed species was blue crab (NEFSC observer/sea sampling database, unpublished data). No incidents of trap/pot gear captures or entanglements have been reported in any of the ten federal fisheries under consultation.

7.4.1.1. *Factors Affecting Atlantic Sturgeon Interactions*

Diets of sub-adult and adult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (ASSRT 2007, Bigelow and Schroeder 1953a, Collins et al. 2008, Guilbard et al. 2007, Haley 1998, Hatin et al. 2002, Johnson et al. 1997, Novak et al. 2017, Savoy 2007). Because of their size, body design, and the benthic nature of their invertebrate prey, it is likely that feeding sub-adult and adult Atlantic sturgeon could swim into or become entangled in the mesh of sink gillnet gear or be captured by bottom otter trawl gear operating in the action area.

While migrating, Atlantic sturgeon may be present throughout the water column and could interact with trawl gear while it is moving through the water column. Atlantic sturgeon interactions with gillnet and bottom trawl gear are likely at times when and in areas where their distribution overlaps with the operation of the fisheries. Atlantic sturgeon also may encounter hooks from both hook-and-line gear and longline gear while traveling through the water column.

Oceanic habitat use of sub-adult Atlantic sturgeon was examined by Dunton et al. (2010) by identifying their spatial distribution using five fishery-independent surveys. They found areas near the mouths of large bays (Chesapeake and Delaware) and estuaries (Hudson and Kennebec rivers) had higher concentrations of individuals during the spring and fall (Dunton et al. 2010).

Similarly, Breece et al. (2018) found Atlantic sturgeon occur at higher concentrations at the Delaware mouth from late spring through fall. This work also suggested that shallower waters, warmer bottom temperatures, and areas to the eastern portion of Delaware Bay were predictive of residency, while movement was predicted by increased depth, cooler bottom temperatures, and areas toward the western part of the Bay (Breece et al. 2018). In a study, matching fisheries independent biotelemetry observations of Atlantic sturgeon with daily satellite observations found that depth, day-of-year, sea surface temperature, and light absorption by seawater were the most important predictors of Atlantic sturgeon occurrence (Breece et al. 2017). A recent analysis suggests that Atlantic sturgeon may select for co-varying environmental properties (i.e., ocean color and seas surface temperature) than geographical location (Breece et al. 2016). Atlantic sturgeon may experience higher levels of harm from bycatch during seasonal aggregations (Dunton et al. 2015) or migration (Breece et al. 2017).

Factors currently thought to affect Atlantic sturgeon interactions with fishing gear and mortality due to fishing gear include: (1) gear type; (2) location and depth of gear, (3) water temperature, (4) gear characteristics (i.e., mesh size, use of tie-downs on gillnets), (5) soak/tow duration, and (6) geographic formations and environmental factors that influence placement of fishing gear and sturgeon movements. Atlantic sturgeon bycatch in ocean fisheries has been documented in all four seasons with higher numbers of interactions in November and December in addition to April and May (Miller and Shepard 2011). Mortality is also correlated to higher water temperatures, the use of tie-downs, increased soak times (>24 hours), and areas of concentrated occurrence such as overwintering areas (ASMFC 2007). Most observed sturgeon deaths occur in sink gillnet fisheries. For otter trawl fisheries, Atlantic sturgeon bycatch incidence is highest in shallower depths in June (ASMFC 2007).

Recently, a number of designated wind energy areas off the U.S. Atlantic coast have been surveyed for Atlantic sturgeon occurrence and their findings generally support the above information on sturgeon movements and seasonality. In the New York Wind Energy area, a recent study showed that acoustic detections of Atlantic sturgeon were highly seasonal and peaked from November through January. Conversely, fish were relatively uncommon or entirely absent during the summer months (July-September) (Ingram et al. 2019). In the Delaware Wind Energy Area, Atlantic sturgeon were detected during all months of the year; however, their occurrence was lowest in August, and highest in November and December (Haulsee et al. 2020). In the Maryland Wind Energy Area, Atlantic sturgeon incidence was highest in the spring and fall and tended to be biased toward shallow regions and warmer waters (Rothermel et al. 2020).

7.4.1.2. Existing Information on Interactions with Atlantic Sturgeon

Sub-adult and adult Atlantic sturgeon may be present in the action area year-round. For sink gillnets, higher levels of Atlantic sturgeon bycatch have been associated with depths of less than 131 ft (40 m), mesh sizes of greater than 10 inches (25 cm), and the months of April and May (ASMFC 2007). For otter trawl fisheries, the highest incidence of Atlantic sturgeon bycatch have been associated with depths less than 98 ft (30 m) (ASMFC 2007). More recently, over all gears and observer programs that have encountered Atlantic sturgeon, the distribution of haul depths on observed hauls that caught Atlantic sturgeon was significantly different from those that did not encounter Atlantic sturgeon (KS test: $D = 0.60$, $p < 0.001$) with Atlantic sturgeon encountered primarily at depths less than 66 ft (20 m) (ASMFC 2017). Atlantic sturgeon captures in both state and federal waters are reported by observers and have been included in the NEFSC

observer/sea sampling database since 1989, even though they were not listed under the ESA until 2012.

We have reviewed available bycatch information and have found that Atlantic sturgeon are frequently reported to interact with both gillnet and trawl gear throughout the action area (ASMFC 2007, 2017, Miller and Shepard 2011, Stein et al. 2004a). The above-mentioned studies have examined Atlantic sturgeon bycatch as well as mortality in commercial gillnet and trawl gear along the U.S. Atlantic coast.

Fishing records collected by onboard observers for 1989-2000 showed that, at that time, the highest levels of bycatch occurred in fisheries using sink gillnets (targeting spiny dogfish, monkfish, and Atlantic cod) and that bycatch was higher in the southern parts of the fisheries (Stein et al. 2004a). The mortality rate for Atlantic sturgeon captured in sink gillnets was 22 percent, and the peak occurred in winter and spring (Stein et al. 2004a). Inshore drift gillnets also showed high capture rates for Atlantic sturgeon, peaking in April, and mortality was calculated to be 10 percent. Otter trawls also accounted for high levels of bycatch, with bycatch peaking in winter and late spring, but there were no observed mortalities. However, the effect of fishing gear may last beyond contact and release (Boreman 1997, Clark and Hare 1998, Kynard 1997, Stein et al. 2004a). The review of bycatch data (Stein et al. 2004b) suggested that the following factors may affect bycatch rates:

1. Differences in regional temperatures that affect movements and migration patterns, thus, affecting the amount of time sturgeon spend in the marine environment where fishing is occurring, particularly for the sub-adult and non-spawning adults.
2. Geographic formations, such as the narrow continental shelf at the Mid-Atlantic Bight, that affect foraging sturgeon and fishing gear use, bringing them into closer contact.

The analysis also found that 85 percent of all recorded sturgeon bycatch involved the following targeted species: monkfish, spiny dogfish, Atlantic cod, summer flounder, American shad and scup (Stein et al. 2004b). It should be noted that gear may also have been a factor as some gear used to target other species may be easier for sturgeon to break through, resulting in encounters with the gear that the animal is able to break out of. Bycatch was at its lowest in the summer months.

The ASMFC's Technical Committee issued a 2007 report on the estimated bycatch of Atlantic sturgeon in coastal Atlantic commercial fisheries of New England and the Mid-Atlantic using different methodology and a different time frame (2001-2006) than Stein et al. (2004b) used. While not directly comparable, both studies found that deaths were infrequent in the otter trawl observer dataset. The ASMFC report found substantially lower bycatch in both gillnet and otter trawl datasets, and substantially lower mortality in sink gillnets (13.8 percent as compared to 22 percent reported for the earlier period) (ASMFC 2007).

It is important to note that observer coverage, on which this data is based, varies across fisheries. However, some patterns did emerge among the factors associated with mortality in sink gillnets: tie-downs, mesh sizes, water temperature, and soak times (ASMFC 2007). Tie-downs increase the mesh to area ratio within a given space by reducing the vertical profile of the net and create "bags" in the gear between each vertical line (ASMFC 2007).

- Larger mesh sizes, particularly the 12-inch (30.5 cm) mesh, showed high mortality rates
- Longer soak times increased bycatch and mortality

- Warmer water temperatures resulted in higher mortalities
 - In warmer waters, soak times of >24 hours resulted in 40 percent mortality and soak times of <24 hours resulted in 14 percent mortality
- Significant positive associations with higher mortalities and warmer water combined with tie-downs, as well as longer soak times combined with tie-downs.

The third study examined otter trawl and sink gillnet data from the NEFOP and ASM programs that was collected from 2006 to 2010. This study expanded the frequency of encounters by using total landings recorded on VTRs (Miller and Shepard 2011).

Miller and Shepard (2011) also characterized observed and estimated sturgeon takes by division and quarter, as well as provided annual and total predicted takes and relative influence of FMP species groups to annual take estimates. The fisheries using sink gillnet gear with the highest predicted take rates were monkfish, skate and flounder/scup/black sea bass. The fisheries with the highest predicted take rates using otter trawls were flounder/scup/black sea bass, skate, and squid/mackerel/butterfish. The NEFSC study reported a higher rate of Atlantic sturgeon mortality in otter trawls than the previous two studies.

For Atlantic sturgeon, the model-based estimates of annual bycatch in gillnet and bottom trawl gear published in ASMFC (2017) represent the best available information for and analysis of bycatch in the ten fisheries assessed in this Opinion, yet unlike the estimates for sea turtles, they cannot be apportioned into state and federal waters estimates at this time. From 2011-2015, the average annual bycatch of Atlantic sturgeon in bottom otter trawl gear was 777.4 sturgeon under the best fit model. From 2011-2015, the average annual bycatch of Atlantic sturgeon in gillnet gear was 627.6 sturgeon under best fit model (ASMFC 2017).

The best performing model for each gear type was applied to VTRs to predict Atlantic sturgeon bycatch across all trips. The total bycatch of Atlantic sturgeon from bottom otter trawls ranged between 624-1,518 fish over the 2000-2015 time series. The proportion of the encountered Atlantic sturgeon recorded as dead ranged from 0-18 percent (average 4 percent). This resulted in annual dead discards ranging from 0-209 fish. The total bycatch of Atlantic sturgeon from gillnets ranged from 253-2,715 fish. The proportion of Atlantic sturgeon recorded as dead ranged from 12-51 percent (average 30 percent), resulting in annual dead discards ranging from 110-690 fish. Otter trawls and gillnets caught similar sizes of Atlantic sturgeon, with most fish in the 3.3-6.6 ft (100-200 cm) total length range, although both larger and smaller individuals were captured.

The distribution of haul depths on observed hauls (all gears) that caught Atlantic sturgeon was significantly different from those that did not encounter Atlantic sturgeon (KS test: $D = 0.60$, $p < 0.001$). Atlantic sturgeon were encountered primarily at depths less than 66 ft (20 m). The distribution of SST on observed hauls encountering Atlantic sturgeon was also significantly different from those not encountering Atlantic sturgeon (KS test: $D = 0.14$, $p < 0.001$), with Atlantic sturgeon primarily encountered at water temperatures of approximately 7.2–15.6 °C (ASMFC 2017).

Although they are not yet included in any model-based estimates of Atlantic sturgeon bycatch, documented Atlantic sturgeon interactions with gillnet and bottom trawl gear from 2016-2019 are included below for additional reference (Table 72). The number of observed takes is affected by the level and spatial extent of observer coverage. A review of observer coverage by SBRM

year and SBRM fleet indicates that there was variation between the fleets. When averaging the coverage achieved across the gear type (excluding fleets with pilot coverage), observed sea days averaged between 10.2 percent and 13.2 percent for trawl fleets and between 9.8 percent to 12.7 percent for gillnet fleets for SBRM 2017 (July 2015 through June 2016) through SBRM 2020 (July 2018 through June 2019). Observed trips for these fleets averaged between 8.8 percent and 12.4 percent for the trawl fleets and 9.6 percent to 12.7 percent for the gillnet fleets during this period (Hogan et al. 2019, Wigley et al. 2021) The observed numbers are generally in line with the documented bycatch levels from the previous 5-year period of 2011-2015 for which bycatch estimates for gillnet and trawl gear have been calculated.

Table 72: Documented bycatch of Atlantic sturgeon in bottom otter trawl (fish) and gillnet gear recorded during the NEFOP and ASM programs from 2016 through 2019. Gillnet gear includes fixed or anchored sink, drift sink, anchored floating, and drift floating gillnets.

Year	Documented # of bycatch in bottom otter trawl gear	Documented # of bycatch in gillnet gear
2016	70	190
2017	82	122
2018	188	121
2019	58	154

7.4.1.3. *Estimating Interactions with and Mortalities of Atlantic Sturgeon*

Interactions are typically described in terms of impacts (e.g., exposure to increased water temperature resulting in injury, loss of access to spawning grounds, or capture) to individual fish, and the life stage is identified, when possible. Each of the five DPSs of Atlantic sturgeon are considered a separate species under the ESA; therefore, we must attribute the fish taken to the appropriate DPS. Several papers have been prepared since the ESA listing which provides the methodology and data that is used to make these assignments (Damon-Randall et al. 2013, Kazyak et al. 2020, Wirgin et al. 2018).

The primary cause of Atlantic sturgeon interactions with the fisheries in this Opinion is the deployment of particular gears in specific areas and times. While attempts to quantify interactions by FMP may, at times, be necessary for regulatory purposes, quantifying this linkage between individual FMPs and sturgeon interactions is difficult because of the nature of fishing in the Greater Atlantic Region that results in a trip landing species across multiple FMPs. The NEFSC conducted several analyses of sturgeon bycatch data in an attempt to categorize interaction rates by commercially sought species groups (i.e., FMP species groups or proxies to FMP species groups). At the conclusion of their efforts, the NEFSC found that partitioning discard encounters to FMPs is not particularly informative due to the high likelihood of inappropriately attributing interactions. Batching the ten FMPs into this single consultation allows us to identify, analyze, and address interactions of Atlantic sturgeon more holistically by gear type, area, and time.

The ASMFC (2017) Atlantic sturgeon stock assessment analyzed fishery observer and VTR data to estimate Atlantic sturgeon interactions in gillnet and otter trawl gear in the Mid-Atlantic and New England regions from 2000-2015, the timeframe which included the most recent, complete data at the time of the report. This report represents the most accurate predictor of annual Atlantic sturgeon interactions in the fisheries. We chose to use the most recent 5-year period of

2011-2015 as the best available information on Atlantic sturgeon bycatch in trawl and gillnet gear used in the fisheries, as it is the period most accurately resembles the current fisheries.

While previous estimates of sturgeon discards (ASMFC 2007, Stein et al. 2004a) used ratio estimators, later analysis indicated that these ratio estimators may not be sufficient because sturgeon encounters within defined spatial and temporal strata were more heterogeneous than desirable for a ratio estimator. In addition, an examination of observer data indicated that the species mix within a trip may be a better predictor of Atlantic sturgeon encounter rates than the traditional variables (e.g., mesh and gear) used to describe a stratum and that a model-based approach may help resolve some of the heterogeneity within a stratum. Accordingly, a GLM framework was developed to estimate Atlantic sturgeon discards in federal waters (Miller and Shepard 2011).

This GLM framework was used to estimate Atlantic sturgeon discards for the ASMFC (2017) benchmark assessment. The model estimated Atlantic sturgeon takes on each trip as a function of the trip-specific species mix, year, and quarter. In Miller and Shepard (2011), the species mix considered was comprised of those species currently managed with federal FMPs. However, in the ASMFC (2017) assessment, the species considered as covariates were those species with the highest catch on observed hauls encountering Atlantic sturgeon. More specifically, the total haul weights were estimated for all individual species on hauls that encountered Atlantic sturgeon and the species included as covariates were those whose cumulative sums represented 95 percent of the total haul weights on these hauls. Depth and mesh were examined as potential covariates; however, these variables were not included because they were often missing and can change substantially over the course of a trip. The composition of species landed on a trip was thought to be a proxy for differences in mesh size and depth (ASMFC 2017).

To predict Atlantic sturgeon take for all commercial landings, landings from each trip between 2000 and 2015 in the GARFO VTR database were determined for each species covariate. Using the estimated coefficients from the best performing model for each gear, the expected Atlantic sturgeon take was predicted for each VTR trip where information was available on whether the species was landed, and, if necessary, year and quarter. Total annual discard estimates were the sums of all predictions from the best-performing model for trips made in the relevant year (ASMFC 2017).

To estimate dead bycatch, GLMs were fit to data based only on those Atlantic sturgeon encounters where individuals were recorded as dead. These models, however, resulted in nonsensical estimates for the total expected Atlantic sturgeon take when expanded to the VTR trips, presumably due to low sample sizes (ASMFC 2017). As a result, dead discards were estimated by calculating the proportion of observed Atlantic sturgeon recorded as dead and applying this proportion to the total take estimate (ASMFC 2017).

The best performing model for each gear type was applied to VTRs to predict Atlantic sturgeon take for all trips. The total bycatch of Atlantic sturgeon from bottom otter trawls ranged from 624-1,518 fish over the time series. The proportion of the encountered Atlantic sturgeon recorded as dead ranged between 0-18 percent and averaged 4 percent. This resulted in annual dead discards ranging from 0-209 fish. The total bycatch of Atlantic sturgeon from sink and drift gillnets ranged from 253-2,715 fish. The proportion of Atlantic sturgeon recorded as dead ranged between 12-51 percent and averaged 30 percent, resulting in annual dead discards ranging from 110-690.

Table 73: Estimated interactions of Atlantic sturgeon by gear type

	Total Interactions	Otter Trawl		Gillnet	
		#	%	#	%
2011	1,306	892	68.3	414	31.7
2012	1,013	760	75.0	253	25.0
2013	2,640	894	33.9	1,746	66.1
2014	1,424	717	50.4	707	49.6
2015	1,309	624	47.7	685	52.3
Average	1,405	777.4	55.3	627.6	44.7

Otter Trawls

Based on data collected by observers for reported Atlantic sturgeon captures in bottom otter trawl gear, the ASMFC (2017) report estimated the average annual bycatch of Atlantic sturgeon in bottom otter trawl gear during 2011-2015 to be 777.4 individuals (Table 73). For the purposes of this Opinion, we are rounding the annual average of 777.4 to 778 since a partial sturgeon take is not possible. This estimate of Atlantic sturgeon bycatch in bottom otter trawl gear provides the best available information for determining the anticipated number of Atlantic sturgeon interactions per year in the bottom trawl components of the ten fisheries. Therefore, we expect that, on average over a 5-year period, 778 Atlantic sturgeon will be taken in bottom trawls each year. This represents the total number of interactions we are expecting on average annually in the bottom trawl component of these fisheries and not just the number observed. This is likely to be an overestimate for bycatch in federal waters as we cannot partition bycatch between state and federal waters at this time.

Gillnets

From 2011 to 2015, the average annual bycatch estimate of Atlantic sturgeon in Northeast and Mid-Atlantic gillnet gear was 627.6 individuals (Table 73) (ASMFC 2017). For the purposes of this Opinion, we are rounding the annual average of 627.6 to 628 since a partial sturgeon take is not possible. These estimates of Atlantic sturgeon interactions with Northeast and Mid-Atlantic gillnet gear provide the best available scientific and commercial data for determining the anticipated bycatch of Atlantic sturgeon in that gear type in the action area. Thus, an annual average of 628 Atlantic sturgeon per year is the best available information on the anticipated number of interactions in the gillnet component of these fisheries. In other words, over the course of the time period of the proposed action, we expect that, on average over a 5-year period, 628 Atlantic sturgeon will be taken in gillnets each year, but that we expect more or less in each individual year. This represents the total number of interactions we are expecting annually in the gillnet component of these fisheries and not just the number observed. This may be an overestimate of bycatch in federal waters as we cannot partition bycatch between state and federal waters at this time. One thing to note from the above table is that there was a large range in gillnet takes over the 2011-2015 time period, with a large number of interactions in 2013 (1,746) and a small number in 2012 (253). Although the observed bycatch was very similar for some years, the modeled results for the estimated take appear quite dissimilar, perhaps because of differences in the amount of unobserved fishing effort that fit the model parameters. The bycatch estimate for gillnets could also be an underestimate if any future years mimic 2013 where the distribution of fishing effort and sturgeon likely overlapped to a large degree.

Mortalities and Age Classes of Atlantic Sturgeon

NEFOP data from Miller and Shepherd (2011) indicates that mortality rates of Atlantic sturgeon caught in otter trawl gear and gillnet gear is approximately 5 percent and 20 percent, respectively. The ASMFC (2017) report did not provide updated mortality rates for trawls and gillnets, so we are using the values from Miller and Shepard (2011) as the best available scientific information. As explained in the Status of Species section, the range of all five DPSs overlaps and extends from Canada through Cape Canaveral, Florida. Atlantic sturgeon originating from all five DPSs use the action area. We have considered the best available information from a recent mixed stock analysis done by Kazyak et al. (2020) to determine from which DPSs individuals in the action area are likely to have originated. The authors used 12 microsatellite markers to characterize the stock composition of 1,704 Atlantic sturgeon encountered across the U.S. Atlantic Coast, to provide an enhanced understanding of life history for this species, its exposure to anthropogenic threats, and to support efforts to understand the relative abundance of specific stocks. We have determined that when evaluating the entire action area, which most closely aligns with their GARFO study region, Atlantic sturgeon throughout likely originate from the five DPSs at the following frequencies: New York Bight 71.4 percent; Chesapeake Bay 10.7 percent, Gulf of Maine 8.7 percent, South Atlantic 5.6 percent, and Carolina 2.6 percent, and Canada 1.0 percent (Table 74). Therefore, this represents the best available information on the likely genetic makeup of individuals occurring throughout the action area. The genetic assignments have corresponding 95 percent confidence intervals. However, for purposes of section 7 consultation, we have selected the reported values without their associated confidence intervals. The reported values, which approximate the mid-point of the range, are a reasonable indication of the likely genetic makeup of Atlantic sturgeon in the action area. These assignments and the data from which they are derived are described in detail in Kazyak et al. (2020).

Table 74: Estimated mortalities by DPS for the batched FMPs based on NEFOP data 2011-2015. DPS percentages listed are the point values representing the genetics mixed stock analysis results.

Sink Gillnets

	% Mortality	Estimated Mortalities
Annual average (628)	0.20	125.6
GOM (8.7%)		10.9
NYB (71.4%)		89.7
CB (10.7%)		13.4
Carolina (2.6%)		3.3
SA (5.6%)		7.0
Canada (1.0%)		1.3

Otter Trawls

	% Mortality	Estimated Mortalities
Annual average (778)	0.05	38.9
GOM (8.7%)		3.4
NYB (71.4%)		27.8
CB (10.7%)		4.2
Carolina (2.6%)		1.0
SA (5.6%)		2.2
Canada (1.0%)		0.4

Total	
	Estimated Mortalities
Annual average (1,406)	164.5
GOM (8.7%)	14.3
NYB (71.4%)	117.5
CB (10.7%)	17.6
Carolina (2.6%)	4.3
SA (5.6%)	9.2
Canada (1.0%)	1.7

7.4.2. *Vessel Strikes*

Based on the best available information, vessel strikes are a significant threat to Atlantic sturgeon (77 FR 5880 and 77 FR 5914; February 6, 2012). Given that Atlantic sturgeon sub-adults and adults from all DPSs use ocean waters from Labrador, Canada to Cape Canaveral, Florida, as well as estuaries of large rivers along the U.S. East Coast, activities affecting these water bodies are likely to impact more than one Atlantic sturgeon DPS.

The exact number of Atlantic sturgeon that die due to vessel strikes is unknown. The factors relevant to determining the risk to Atlantic sturgeon from vessel strikes are currently unknown, but may be related to size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of Atlantic sturgeon in the area (e.g., foraging, migrating, etc.). While we have some information on the number of mortalities in the Delaware and James rivers that are thought to be due to vessel strikes (Balazik et al. 2012c, Brown and Murphy 2010) we are not able to use those numbers to extrapolate effects throughout one or more DPS. This is because of (1) the small number of data points and (2) lack of information on the percent of incidences that the observed mortalities represent. While vessel strikes are believed to be a threat in several rivers as noted in the *Status of the Species* and *Environmental Baseline* sections above, we do not have information that suggests that Atlantic sturgeon are struck by vessels in the open marine environment of the action area where the vessels participating in these fisheries are operating. The risk of strike is expected to be considerably less in the Atlantic Ocean than in rivers. This is because of: (1) the greater water depths in ocean areas, which increases the space between bottom oriented sturgeon and vessel propellers and hulls, (2) a lack of obstructions or constrictions that would otherwise restrict the movement of sturgeon, and (3) the more dispersed nature of vessel traffic and more dispersed distribution of individual sturgeon which reduces the potential for co-occurrence of individual sturgeon with individual vessels. Given the greater depths in the vast majority of the action area (with the exception of nearshore areas where vessels will dock) and that sturgeon most often occur at or near the bottom while in the action area, the potential for co-occurrence of a vessel and a sturgeon in the water column is extremely low even if a sturgeon and vessel co-occurred generally. All of these factors are expected to decrease the likelihood of an encounter between an individual sturgeon and a vessel and also increase the likelihood that a sturgeon would be able to avoid any vessel. Based on these factors and the lack of any information to suggest that Atlantic sturgeon are struck and killed by vessels in the marine environment, vessel strikes in the action area are extremely unlikely to occur during vessel transits or fishing operations and, therefore, the effects are discountable.

7.4.3. **Prey**

Diets of adult and migrant sub-adult Atlantic sturgeon include mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (ASSRT 2007, Bigelow and Schroeder 1953a, Guilbard et al. 2007, Savoy 2007). Juvenile Atlantic sturgeon feed on aquatic insects, insect larvae, and other invertebrates (ASSRT 2007, Bigelow and Schroeder 1953a, Guilbard et al. 2007).

Sink gillnets are anchored to the bottom and fish in the lower one-third of the water column. Although sink gillnets are anchored to the seafloor, several studies have found that gillnet gear has little or low impact on bottom habitat (GBCHS 2008, Morgan and Chuenpagdee 2003, Northeast Region Essential Fish Habitat Steering Committee 2002). In an analysis of effects to habitat from fishing gears, mud and sand habitats were found to recover more quickly than courser substrates (see Appendix D in NEFMC 2016b, NEFMC 2020b). Any negative effect from gillnets would vary between fishing habitats, with very low levels of damage on sand, some damage lasting a few days on mud, and more lasting damage on hard bottom clay habitats (Northeast Region Essential Fish Habitat Steering Committee 2002). Sink gillnets are therefore expected to have discountable effects on Atlantic sturgeon prey.

The effects of bottom trawls on benthic community structure have been the subject of a number of studies. In general, the severity of the impacts to bottom communities is a function of three variables: (1) energy of the environment, (2) type of gear used, and (3) intensity of trawling. High-energy and frequently disturbed environments are inhabited by organisms that are adapted to this stress and/or are short-lived and are unlikely to be severely affected, while stable environments with long-lived species are more likely to experience long-term and significant changes to the benthic community (Johnson 2002, Kathleen A. Mirarchi Inc. and CR Environmental Inc. 2005, Stevenson et al. 2004). Modern otter trawls are lighter than older trawls and scallop dredges, and cause less disturbance to benthic communities, but many older-style beam trawls are still in use (Kathleen A. Mirarchi Inc. and CR Environmental Inc. 2005). The intensity of trawling also affects benthic communities, and significant loss of large sessile epifauna from hard substrates has been demonstrated (Kathleen A. Mirarchi Inc. and CR Environmental Inc. 2005, Stevenson et al. 2004). A majority of studies has found that trawling on mud bottoms decreases the species richness, diversity, abundance, and biomass (Johnson 2002, Stevenson et al. 2004). However, a Massachusetts Bay trawling study found no difference between the species composition in trawled and control lanes, but found that faunal density was slightly higher in the trawled lanes (Kathleen A. Mirarchi Inc. and CR Environmental Inc. 2005). While there may be some changes to the benthic communities on which Atlantic sturgeon feed as a result of bottom trawling, there is no evidence the bottom trawl activities of the ten fisheries have a negative impact on availability of Atlantic sturgeon prey.

The trap/pot gear used in the lobster, red crab, Jonah crab, black sea bass, and scup fisheries is considered to have low impact to bottom habitat, and is unlikely to incidentally capture Atlantic sturgeon prey. Hook-and-line gear is also unlikely to affect prey, as it has little effect on bottom habitat and is unlikely to incidentally capture Atlantic sturgeon prey. Currently, there is no indication that Atlantic sturgeon are food-limited or that commercial fisheries might negatively impact their food availability, given the diversity of their diets. Given this information, it is extremely unlikely the fisheries will have an effect on Atlantic sturgeon prey and, therefore, effects are discountable.

7.4.4. *Habitat*

Atlantic sturgeon use the action area as a migratory route and for overwintering and likely foraging. Within the marine range of Atlantic sturgeon, several marine aggregation areas (see papers listed below for definitions of aggregation areas) have been identified adjacent to estuaries and/or coastal features formed by bay mouths and inlets along the U.S. eastern seaboard. Depths in these areas are generally no greater than 82 ft (25 m) (Dunton et al. 2010, Erickson et al. 2011, Laney et al. 2007, Stein et al. 2004b). Additional studies are still needed to understand why aggregations are found at these particular sites. The sites likely serve different purposes; there is some indication that they may serve as thermal refuges, wintering sites, or marine foraging areas (Dunton et al. 2010, Erickson et al. 2011, Stein et al. 2004b). The following known marine aggregation sites are generally inshore of federal waters where the fisheries operate:

- Waters off North Carolina, including Virginia/North Carolina border (Laney et al. 2007);
- Waters off the Chesapeake and Delaware Bays (Dunton et al. 2010, Erickson et al. 2011, Oliver et al. 2013, Stein et al. 2004b)
- New York Bight (e.g., waters off Sandy Hook, New Jersey, and Rockaway Peninsula, New York) (Dunton et al. 2015, Erickson et al. 2011, O’Leary et al. 2014, Stein et al. 2004b)
- Massachusetts Bay (Stein et al. 2004b)
- Long Island Sound (Bain et al. 2000, Savoy and Pacileo 2003, Waldman et al. 2013);
- Connecticut River Estuary (Waldman et al. 2013);
- Kennebec River Estuary (Wippelhauser 2012, Wippelhauser and Squiers 2015).
- Mouth of the Saco River (Novak et al. 2017)

While there may be some overlap in aggregations and fishing effort, we have no information that indicates negative effects on Atlantic sturgeon prey items, although foraging, overwintering, and migrations may be temporarily disturbed by the use of bottom fishing gear. However, any disturbance will not rise to the level of harm or harassment as there is plenty of room in the open ocean environment for Atlantic sturgeon to move around obstacles such as nets with little expenditure of energy. Gillnet gear may also impede Atlantic sturgeon migrations, but the effects are also expected to be insignificant for the same reasons above. Compared to the overall size of the action area, the amount of area occupied by commercial and recreational fishing gear at any point in time is extremely small. Given this information, any habitat alterations will be too small to be meaningfully measured or detected and will, therefore, have insignificant effects on Atlantic sturgeon.

7.5. *Effects to Atlantic Salmon*

7.5.1. *Gear Interactions*

7.5.1.1. *Factors Affecting Atlantic Salmon Interactions*

Atlantic salmon in the ocean are pelagic and highly surface oriented (Kocik and Sheehan 2006, Renkawitz and Sheehan 2012). The preferred habitat of post-smolt salmon in the open ocean is principally the upper ten meters of the water column (Baum 1997, ICES 2005), although there is evidence of forays into deeper water for shorter periods. Adult Atlantic salmon demonstrate a wider depth profile (ICES 2005), but overall salmon tend to be distributed in the surface layer, and all fisheries covering this part of the water column are considered to have a potential to

intercept salmon. Due to these factors and the limited abundance of Atlantic salmon in the action area, they are not typically caught in the ten fisheries under discussion as these fisheries primarily focus on bottom-dwelling species in areas such as the Gulf of Maine where Atlantic salmon are most prevalent.

While migrating, Atlantic salmon may be present throughout the water column and could interact with bottom trawl and gillnet gear. All observed takes of Atlantic salmon in the ten fisheries that have been recorded by the NEFOP and ASM programs since 1989 have occurred in bottom trawls or gillnets. Atlantic salmon interactions with bottom trawl and gillnet gear are likely to occur at times when and in areas where their distribution overlaps with the operation of the fisheries. Atlantic salmon also may encounter hooks from both hook-and-line and longline gear while traveling through the water column, although commercial interactions in federal waters have not been documented and, hence, are extremely unlikely to occur and therefore discountable.

7.5.1.2. *Description of Existing Information on Interactions with Atlantic Salmon*

Adult Atlantic salmon may be present in the action area year round. However, fishermen permitted under the ten fisheries in this Opinion rarely capture them in the marine environment. NEFOP data from 1989-2019 show records of incidental bycatch of Atlantic salmon in seven of the 31 years, with a total of 15 individuals caught, nearly half of which (seven) occurred in 1992. There is no information available on the genetics of these bycaught Atlantic salmon, so we do not know how many of them were part of the GOM DPS. It is likely that some of these salmon, particularly those caught south of Cape Cod, may have originated from the stocking program in the Connecticut River. Those Atlantic salmon caught north of Cape Cod and/or in the Gulf of Maine are more likely to be from the GOM DPS.

Of the observed incidentally caught Atlantic salmon, ten were listed as “discarded,” which is assumed to be a live discard (Kocik, pers comm.; February 11, 2013). Five of the 15 were documented as lethal interactions. The incidental takes of Atlantic salmon occurred in bottom otter trawls (4) and gillnets (11). Observed captures occurred in March (2), April (2), May (1), June (3), August (1), and November (6).

7.5.1.3. *Estimating Interactions with and Mortality of Atlantic Salmon*

Due to the low number of observed interactions and the low number of Atlantic salmon in the action area, it is expected that interactions between the ten fisheries and Atlantic salmon will be low in any given year.

There are no model-based bycatch estimates for Atlantic salmon in bottom trawl or gillnet gear. The very low number of observed Atlantic salmon interactions in bottom trawl and gillnet gear as reported in the NEFSC observer/sea sampling database suggests that interactions within the action area are rare events. However, given the fact that observer coverage in these fisheries is much less than 100 percent, additional interactions with Atlantic salmon may have occurred, but were not observed or reported. In the most recent 3-year report on the Standardized Bycatch Reporting Methodology (SBRM years 2018-2020), the percentages of observed trips, in terms of number of trips, varied by fleet and ranged from approximately 1.5 percent to 40 percent for the different trawl and gillnet fleets in New England and mid-Atlantic that use gears considered in this Opinion (Wigley et al. 2021). In the prior report (SBRM years 2015-2017), the percentages

of observed trips also varied by fleet and ranged from approximately 2 percent to 23 percent for the different trawl and gillnet fleets, excluding 1 fleets for which 100 percent observer coverage was a requirement (New England small mesh haddock separate trawl) (Hogan et al. 2019). It should be noted that fleets are defined as a region, gear type, mesh group, access area, and trips category combination and not by FMP. Due to the effort in the fisheries as a whole, and the seasonal overlap in distribution of these species with operation of bottom trawl and gillnet gear, a small number of Atlantic salmon may interact with both gear types.

In coming up with an estimate for Atlantic salmon interactions in the ten fisheries, we have chosen to look primarily at incidental takes recorded over the most recent ten year timeframe of 2010-2019, as those years most accurately reflect current effort trends and gear use in the fisheries, the current biological environment in the action area, and encompass years following the “regime shift” of low marine survival for Atlantic salmon that began in the early 1990s and has persisted to date.

A review of the NEFOP and ASM observer records from 2010-2019 reveals that there were no reported takes in bottom trawl gear. However, prior to 2010 there were four incidental takes that occurred in bottom trawl gear (one in 1992, one in 2004, and two in 2005). Thus, we anticipate that incidental takes of Atlantic salmon in bottom trawl gear could occur in future years.

A review of the NEFOP and ASM observer records from 2010-2019 reveals that there were three reported takes Table 75 in gillnet gear (one in 2011 and two in 2013). The average annual number of Atlantic salmon captures in gillnet gear in the action area documented through the NEFOP and ASM data is 0.30. The three documented incidental captures of Atlantic salmon from 2010-2019 occurred in the multispecies and spiny dogfish gillnet fisheries during the spring and summer months (April, June, and August) in the Gulf of Maine (NMFS statistical areas 513 and 515). These interactions occurred in federal waters.

Table 75: Observed salmon takes in gillnet gear from 2010-2019

Year	Month	Fishery	Gear	Stat Area
2011	June	Spiny Dogfish	Sink Gillnet	513
2013	April	Multispecies	Sink Gillnet	515
2013	August	Multispecies	Drift Gillnet	513

Considering the most recent ten years of data on Atlantic salmon interactions in the ten fisheries, in addition to the historic records dating back to 1989, we believe that there will be two Atlantic salmon interactions every five years in either trawl or gillnet gear. This is because there were three reported interactions in these gear types combined from 2010-2019, which averages to 1.5 every five years. Since the capture of a partial Atlantic salmon is not possible, since trawl interactions have been known to occur in previous years, and to give the benefit of the doubt to the species, we are rounding 1.5 up to 2. To give further benefit of the doubt to the species, we expect that all captures of Atlantic salmon in the ten fisheries will be GOM DPS fish, as all recent interactions in the past ten years have occurred in the Gulf of Maine. Although it is possible for some fish to be from non-listed Canadian or Saco, Merrimack, or Connecticut River stocks, we do not have any genetic information at present to determine the likely percentage breakdown of takes amongst those populations. Therefore, we are assuming that any future captures will be GOM DPS fish unless otherwise identified by genetic sampling.

In regards to the life stages of Atlantic salmon that may be captured, we anticipate that all captured salmon will either be post-smolts or adults. This is based on the size ranges (length and weight) of the individuals that have been captured over the past ten years (31-34 inches (79-87 cm), 7-11 lbs (3-4 kg). Smaller individuals (2-4 lbs (0.9-1.8 kg) in weight) have been captured in prior years dating back to 1989, but none in that size range since 2005.

Estimated Mortality

Of the three reported interactions in the fisheries from 2010-2019, two were recorded as dead and one was released alive. For the fish that was released alive, its post-capture and release condition is not known, and there is the potential that that fish could have been injured or ultimately died as a result of the capture, handling, and release. The primary contributing factors to stress and death from handling are differences in water temperatures (between the ocean and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on Atlantic salmon increases rapidly from handling if the water temperature is too warm or dissolved oxygen is below saturation.

Of the 15 total reported interactions with Atlantic salmon in the ten fisheries dating back to 1989, at least five, and possibly more, resulted in mortalities. Ten are listed as “discarded” in the NEFSC observer/sea sampling database and are assumed to have been discarded alive, however, the ultimate condition of the fish is not known. Of the 11 documented takes in gillnet gear, three were dead (27 percent), while eight were discarded presumed alive (73 percent). Of the four documented takes in bottom otter trawl gear, two were dead (50 percent) and two were discarded presumed alive (50 percent).

For the purposes of this Opinion, to give benefit of the doubt the species, and due to the potential for stress, injury and death post-capture, we will assume that both of the interactions in bottom trawl or gillnet gear in the ten fisheries over a 5-year period will result in mortality.

7.5.2. Vessel Strikes

Vessel strikes are not known to be a major threat to Atlantic salmon in the Gulf of Maine. The threats assessment done for Atlantic salmon as part of the 2009 endangered listing of the expanded GOM DPS did not list vessel strikes as a high priority threat (74 FR 29344; June 19, 2009). There are no known reports of vessel strike injuries. In addition, the co-occurrence of Atlantic salmon and vessels in the action area is very low. As described in the Status of the Species (section 4), Atlantic salmon occur in a portion of the action area, further limiting the co-occurrence. In a review of the literature on avoidance of vessels by fish, De Robertis and Handegard (2013) summarized how fish react to approaching vessels and considered the mechanisms that might influence whether fish that have detected the presence of a vessel will react. They found that when fish are observed to react to moving research vessels, the reaction is generally consistent with an avoidance response. Potential stimuli to which the fish react to include low frequency sound, sound pressure levels, visual cues, ship bow wave, particle motion or acceleration, and stimulated bioluminescence. While none of the studies reviewed by De Robertis and Handegard (2013) were specific to salmon, a study completed by Knudsen et al. (1992), which assessed juvenile Atlantic salmon awareness and avoidance responses to sound, did support many of findings in De Robertis and Handegard (2013). The auditory system of fish are sensitive to particle motion and low frequency sounds (De Robertis and Handegard 2013) and in the study completed by Knudsen et al. (1992), salmonids showed a strong awareness/avoidance response to 5-10 Hz sounds, and particle velocities of 10^{-2} m s^{-2} . Low

frequency sounds are introduced into the marine environment by vessels transiting to and from shore. Specifically, low frequency particle motion is produced by the displacement of water as vessels move through the water column, combined with the low frequency excitation of the hull caused by the vessel machinery (De Robertis and Handegard 2013). Given the infrequent presence of Atlantic salmon in the action area, their low density when they do occur, the relatively small numbers of fishing vessels, and the likelihood of an avoidance response if encountered/approached by a vessel, the risk of a vessel interaction with a salmon is extremely unlikely, and therefore, discountable.

7.5.3. **Prey**

Upon completion of the physiological transition to salt water, post-smolt Atlantic salmon grow rapidly and have been documented to move in small schools loosely aggregated close to the surface (Dutil and Coutui 1988). After entering into the nearshore waters of Canada and the U.S., post-smolts become part of a mixture of stocks of Atlantic salmon from various North American streams. Their diet includes invertebrates, amphipods, euphausiids, and fish (Fraser 1987, Hislop and Shelton 1993, Hislop and Youngson 1984, Jutila and Toivonen 1985). Results from a 2001-2005 post-smolt trawl survey in Penobscot Bay and the nearshore waters of the Gulf of Maine indicate that Atlantic salmon post-smolts are prevalent in the upper water column (Sheehan et al. 2005).

Most of the GOM DPS-origin salmon spend two winters in the ocean before returning to streams to spawn. Aggregations of Atlantic salmon may still occur after the first winter at sea, but most evidence indicates that they travel individually (Reddin 1985). At this stage, Atlantic salmon primarily eat fish, feeding upon capelin, herring, and sand lance (Hansen and Pethon 1985, Hislop and Shelton 1993, Reddin 1985).

The majority of the fishing gears utilized by the ten fisheries operate on or very near the bottom. Fish species caught in these gears are species that live in benthic habitat (on or very near the bottom) such as flounders. Schooling fish, such as herring, capelin, and sand lance, occur within the water column, and therefore, with the exception of the mackerel/squid/butterfish fishery, the operation of the fisheries will not affect the availability of prey for foraging post-smolt and adult Atlantic salmon. Although small schooling fish species (including mackerel) may be caught in net gear targeting mackerel/squid/ butterfish, we have found no information that indicates this causes significant impacts to the GOM DPS of Atlantic salmon. Given this information, it is extremely unlikely the fisheries will have an effect on Atlantic salmon prey and, therefore, effects are discountable.

7.5.4. **Habitat**

Atlantic salmon also use the action area as a migratory route and for foraging. Aggregations of Atlantic salmon may occur both at the post-smolt stage and after their first winter at sea, but most evidence indicates that they travel individually as adults (Reddin 1985). Foraging and travel activity may be temporarily disturbed by the use of bottom fishing gear, but the effects are expected to be extremely unlikely, and therefore discountable, as Atlantic salmon that occur in ocean waters are primarily pelagic rather than benthic. As a result, any potential overlap between salmon and bottom fishing gear will be minimal and occur on only brief occasions when the gear is being lowered to the ocean floor or pulled back up to the surface. Furthermore, in the open ocean there is ample room for highly mobile salmon to move around slow moving obstacles such as bottom trawling gear and, thus, any effects are likely to be too small to be meaningfully

measured or detected (i.e., are insignificant). Immobile gillnet and trap/pot gear may also impede Atlantic salmon travel, but the effects are also expected to be insignificant and discountable for similar reasons related to salmon mobility and ample room in the open ocean to maneuver. There is designated critical habitat for Atlantic salmon in proximity to the action area and physical and biological features have been identified in the freshwater and estuarine environment (74 FR 29300; June 19, 2009). However, although successful marine migration is essential to the survival and recovery of GOM DPS Atlantic salmon, we were not able to identify the essential features of marine migration and feeding habitat or their specific locations at the time critical habitat was designated.

7.6. Effects to Giant Manta Rays

7.6.1. *Gear Interactions*

As described in section 4.2.3.3, giant manta rays occur in coastal, nearshore, and pelagic waters off the U.S. east coast. Although sightings north of Cape Hatteras are rare, giant manta rays have been observed as far north as New Jersey, usually found in water temperatures between 19 and 22 °C (Miller and Klimovich 2017). Giant manta rays are potentially susceptible to capture by trawl, longline, vertical longline, and gillnets based on records of their capture in fisheries using these gear types. Given the occasional occurrence and water temperature preferences of giant manta rays off the U.S. Atlantic coast from Florida to New Jersey, the distribution of giant manta rays is likely to overlap with most of the fisheries under the proposed actions. This is confirmed by the past captures of manta rays in commercial fisheries using similar gear types as evidenced by NEFOP incidental take data.

We have reviewed collections from the different gear types and noted giant manta rays have been collected during the fisheries activities in the past 18 years by two gear types – trawls and gillnet. Based on this information, we believe that trawl and gillnet are the only gears used in the fisheries that may adversely affect giant manta rays. We believe the potential risk from the other gear types is discountable.

7.6.1.1. *Factors Affecting Giant Manta Ray Interactions by Gear Type*

Spatial Overlap of Fishing Effort and Giant Manta Ray Abundance

The spatial and temporal overlap of giant manta rays with fishing effort is a factor that affects the likelihood of these species becoming entangled in gillnet gear or captured in trawl gear. The more abundant the animals are in a given area where fishing occurs, the greater the probability that one of them will interact with gear. The temporal distribution of fishing effort and giant manta ray abundance may also be a factor.

Species Morphology

The conditions faced by manta rays during the different phases of capture in fishing operations include traumatic handling practices (lifting up by the gills or dragging on the deck and/or towing). Giant manta rays may also be exposed to physical contact with hard objects, the harsh harvesting process of removing it from the fishing gear and removal from the water (lack of oxygen, exposure to the sun and organs crushed because of the weight of gravity). Manta rays are large; thus, it can be extremely difficult to lift them back into the water.

Environmental Conditions

Water temperature may play a role in the timing of giant manta ray migrations and presence at aggregation sites. More research is needed to understand the movements of giant manta rays and potential interactions with gillnets during various times of the year. Initial studies seem to show a seasonal component to their movements.

7.6.1.2. Description of Existing Information on Interactions with Giant Manta Rays

NMFS' observers document each interaction with a Mobulid ray by species when possible. Observations historically included giant manta ray, *Mobula birostris*; Atlantic devil ray, *Mobula hypostoma*; and manta, unknown Mobulidae (any manta and devil ray species that could not be confirmed to species). Because of the unique form and cephalic lobes adjacent to the mouth of manta and devil rays, it is unlikely but possible that these records would have been listed more generally as a stingray, unknown; or a ray, unknown. Historically, many Mobulidae species may have been identified as giant manta rays because observers were provided with the Peterson Field Guide of Atlantic Coast Fishes (1986) as a primary resource for species identification, and the giant manta ray was the only large Mobulidae species shown (L. Kellogg, pers. comm. March 25, 2019). In 2015, NMFS NEFSC re-evaluated photo records of Mobulidae species and found that numerous historic records that were originally identified as giant manta rays were actually other *Mobula* species. Thus, historic records that did not include photos, or where photos were not detailed enough to determine a species, were then classified as ray, manta, unknown (Mobulidae), an unresolved Mobulidae species.

An annual estimate of giant manta ray interactions was determined based on the number of observed cases in the NEFSC observer/sea sampling database from 2010-2019. Observed interactions from 2010-2019 between giant manta rays and unknown ray species in gear types used in the fisheries are listed in Table 76 (NEFSC observer/sea sampling database, unpublished data). *Mobula* records confirmed as species other than giant manta ray species are not considered in this analysis. From 2010–2019, two records in federal waters were confirmed by photo to be giant manta rays. Two Mobulidae records in state waters were not able to be identified to species. Given that these unknown ray species may have been giant manta rays, for the purpose of this analysis, we assume that both unidentified rays were giant manta rays. All four interactions occurred off North Carolina. These captures are an underestimate given that they are only observed captures, and we are not currently able to extrapolate this number to generate an estimate of total bycatch. In order to partially compensate for this underestimate and for the purposes of estimating interactions under the ten FMPs in this Opinion, we used all observed interactions from 2010-2019.

Table 76: Observed interactions with *Mobula birostris* and unknown Mobulida

Year	Species	Gear
2014	Giant Manta Ray	Bottom Otter Trawl
2014	Giant Manta Ray	Bottom Otter Trawl
2015	Unknown Mobulida	Gillnet
2015	Unknown Mobulida	Gillnet

7.6.1.3. *Estimating Interactions with and Mortality of Giant Manta Rays*

From 2010 through 2019, there were two (unidentified) giant manta rays observed in gillnet gear and two giant manta rays observed in trawl gear (Table 76). The number of interactions occurring annually is variable and influenced by sea temperatures, species abundances, fishing effort, and other factors that are difficult to predict. Because of this variability, it is unlikely that giant manta rays will be consistently impacted year after year. For example, there were two observed giant manta ray captures in gillnet gear in one year and other years with zero. As a result, estimating interactions using 1-year estimates is largely impractical. For these reasons, we believe that four interactions may occur over a 5-year time period. Therefore, we have determined that an annual average of 0.8 giant manta rays may be captured in gillnet gear or trawl gear used in the fisheries.

In the four cases observed between 2010-2019, the records indicate all animals were encountered alive and released alive. Additionally, all of the giant manta ray interactions in gillnet or trawl gear recorded in the NEFSC observer/sea sampling database (13 between 2001 and 2019) indicate the animals were encountered alive and released alive. Furthermore, during 2005-2012, ten giant manta rays caught in gillnet gear used in the Gulf of Mexico and South Atlantic Coastal Migratory Pelagic Fishery were observed to be released alive. Therefore, we expect that nearly all giant manta ray interactions with gear used in the fisheries will be released alive within the same general area and survive the interaction. However, details about specific conditions such as injuries, damage, time out of water, how the animal was moved or released, or behavior on release is not always recorded. While there is currently no information on post-release survival, NMFS Southeast Gillnet Observer Program observed a range of 0 to 16 giant manta rays captured per year between 1998 and 2015 and estimated that approximately 89 percent survived the interaction and release (see NMFS reports available at <http://www.sefsc.noaa.gov/labs/panama/ob/gillnet.htm>). If 89 percent of the giant manta rays anticipated to interact with gears used in the fisheries survive, it is reasonable to expect one giant manta ray mortality in gillnet or trawl gear over a 10-year period. Therefore, we expect no more than one mortality as a result of interactions with gear used in the fisheries every 10 years.

7.6.2. *Vessel Strikes*

As giant manta ray aggregation sites are sometimes in areas of high maritime traffic, giant manta rays are potentially at risk of being struck by vessels (Miller and Klimovich 2017). Along Florida's southeast coast, five giant manta rays have been struck by vessels from 2016-2019; these individuals had injuries (i.e., fresh or healed dorsal surface propeller scars) consistent with a vessel strike. Available information indicates the threat of vessel strike on giant manta ray is predominantly an issue in shallow, coastal waters and in proximity to inlets where giant manta ray frequent, likely to facilitate feeding (NMFS 2020d). Yet, few instances of confirmed or suspected mortalities of giant manta ray attributed to vessel strikes (e.g., via strandings) have been documented. This lack of documented mortalities could also be the result of other factors that influence carcass detection (i.e., wind, currents, scavenging, decomposition etc.) (NMFS 2020d). In addition, manta rays appear to be able to heal from wounds very quickly, while high wound healing capacity is likely to be beneficial for their long-term survival, the fitness cost of injuries and number of vessel strikes occurring may be underestimated (McGregor et al. 2019).

While there is evidence of vessel interactions in nearshore aggregation areas where giant manta rays and vessels may be concentrated, we believe vessels used in the proposed action are

extremely unlikely to strike a giant manta ray. While giant manta rays can be frequently observed traveling just below the surface and will often approach or show little fear toward vessels, few instances of strandings of giant manta ray are attributed to vessel strike injury. They also appear able to move fast enough to avoid most moving vessels, as anecdotally video evidence shows high speed vessels passing over giant manta rays and the ray being able to maneuver away in time to avoid the interaction (NMFS 2020d). In addition, vessels associated with the proposed action do not transit through giant manta ray aggregation areas. As a species more prevalent in the southern waters of the action area, the overlap of giant manta rays and vessels used by the fisheries considered in this Opinion is limited, and there is a low density of giant manta rays in the area these vessels primarily operate. Given that (1) giant manta rays have limited distribution in the vast majority of the areas the vessels in this Opinion operate, (2) giant manta rays are highly mobile, and (3) there are very limited reports of vessel interactions with giant manta rays, we have determined that interactions between vessels and giant manta rays are extremely unlikely to occur. Thus, the effects to giant manta rays from fishing vessels used in the federal fisheries are discountable.

7.6.3. **Prey**

Giant manta rays are filter-feeders and generalist carnivores that feed on planktonic organisms such as euphausiids, copepods, mysids, decapod larvae and shrimp, but some studies have noted their consumption of small and moderate sized fishes (Bigelow and Schroeder 1953b, Burgess et al. 2016, Miller and Klimovich 2017, Stewart et al. 2017). However, planktonic organisms appear to comprise the majority of the diet for giant manta rays. Foraging is rarely observed in U.S. waters, and the available data do not indicate any specific areas that appear to be used for foraging purposes within waters under U.S. jurisdiction (84 FR 66652, December 5, 2019). Overall, the best available information indicates that giant manta rays will feed on a variety of planktonic organisms and are not limited by the required presence of a specific prey species for successful foraging to occur (84 FR 66652, December 5, 2019). Additionally, planktonic organisms are extremely small and will pass through or around the fishing gears rather than be captured on or in them. Based on this information, we have determined that the effects of the fisheries on the availability of planktonic organisms for foraging giant manta rays are likely so small that they cannot be meaningfully measured, detected, or evaluated, and, therefore, insignificant.

7.6.4. **Habitat**

Recent manta ray research in U.S. waters has documented the presence of juvenile giant manta rays off the east coast of Florida, suggesting the existence of juvenile and potential manta ray nursery habitat (84 FR 66652, December 5, 2019). While we have evidence of the presence and use of specific areas by juvenile giant manta rays, the available information does not allow us to identify any physical or biological features within these areas that are essential to support a manta ray nursery habitat. As described above, bottom trawl is the only gear type that has the potential to adversely affect bottom habitat in the action area. Given that the bluefish fishery is the only fishery to overlap with the habitat off Florida, that this overlap is limited by the low effort in this area, and the fishery off Florida is primarily gillnet and hook-and-line (gear types we don't expect to adversely affect bottom habitat), we have determined that the effects of the fisheries on the essential habitat for giant manta rays are extremely unlikely and therefore, discountable.

7.7. Summary of Anticipated Interactions with ESA-listed Species

Large Whales

Based on the analysis above, we anticipate that 9.14 percent of the right whale population will become entangled each year. We estimated that between 2010 and 2018, entanglements resulted in an annual average of 4.7 M/SIs to right whales entangled in U.S. federal fishing gear. These interactions will be reduced with the implementation of Phase 1 of the Framework (i.e., the ALWTRP rule), which will reduce risk to right whales in American lobster and Jonah crab trap/pot fisheries by 60 percent. Based on the distribution of risk in state and federal waters, this will reduce M/SI from entanglements in gear used in the U.S. federal fisheries to annual average of 2.69. The Framework will further reduce the annual average of M/SI to 2.61 in 2023, 1.04 in 2025, and 0.136 in 2030. We also estimate that the operation of the U.S. federal fisheries with the ALWTRP measures implemented will entangle an annual average of 1.89 fin whales, resulting in an annual average of 1.08 M/SI; 1 sei whale, resulting in 1 M/SI; and 1 sperm whale, resulting in 1 M/SI.

Sea Turtles

Based on the information above, we anticipate 1,995 loggerhead sea turtles from the Northwest Atlantic DPS (1,036 in gillnet, 954 in trawls, and 5 in trap/pot) will interact gear utilized in the ten fisheries assessed in this Opinion every five years. Of these, 78 percent (808) of the interactions in gillnet gear 50 percent (477) of the interactions in bottom trawl gear, and 64 percent (4) of the interactions in trap/pot over a 5-year period are expected to lead to mortality. Therefore, 1,289 of the 1,995 loggerhead sea turtles that interact with these fisheries every five years are expected to die or sustain serious injuries leading to death or failure to reproduce.

We anticipate 142 leatherbacks (52 in gillnets, 40 in trawls, and 50 in trap/pots) will interact with gear utilized in the ten fisheries assessed in this Opinion every five years. Of these, 78 percent (41) of the interactions in gillnet gear, 50 percent (20) of the interactions in bottom trawl gear, and 64 percent (32) of the interactions in trap/pot gear over a 5-year period are expected to lead to mortality. Therefore, 93 of the 142 leatherback sea turtles that interact with these fisheries every five years are expected to die or sustain serious injuries leading to death or failure to reproduce.

We anticipate 292 Kemp's ridleys (239 in gillnets and 53 in trawls) will interact with gear utilized in the ten fisheries assessed in this Opinion every five years. Of these, 78 percent (187) of the interactions in gillnet gear and 50 percent (27) of the interactions in bottom trawl gear over a 5-year period are expected to lead to mortality. Therefore, 214 of the 292 Kemp's ridley sea turtles that interact with these fisheries every five years are expected to die or sustain serious injuries leading to death or failure to reproduce.

We anticipate 42 green sea turtles (10 in gillnet and 32 in trawls) will interact with gear in the ten fisheries assessed in this Opinion every five years. Of these, 78 percent, (8) of the interactions in gillnet gear and 50 percent (16) of the interactions in bottom trawl gear over a 5-year period are expected to lead to mortality. Therefore, 24 of the 42 green sea turtles that interact with these fisheries every five years are expected to die or sustain serious injuries leading to death or failure to reproduce.

In addition, we anticipate that three sea turtles of any species may be struck by vessels operating in these fisheries each year and that these interactions may result in mortality. This results in 15

mortalities over a 5-year period. The total number of anticipated sea turtle interactions with fishing gear and vessels in the ten fisheries addressed in this Opinion over a 5-year period is summarized in Table 71.

Atlantic Sturgeon

Based on the history of documented interactions with commercial fishing gear and largely on the results of the ASMFC (2017) Atlantic sturgeon stock assessment, we anticipate 1,406 interactions annually between Atlantic sturgeon and otter trawls and gillnets used in the ten fisheries. Of those interactions, 628 are expected from gillnet gear and 778 are expected to be from otter trawls.

NEFOP data indicates that average mortality rates of Atlantic sturgeon caught in otter trawl gear and gillnet gear across the federal fisheries is approximately 5 percent and 20 percent, respectively. Using those percentages and results from the genetics mixed stock analysis, we have been able to estimate the number of sub-adult and adult interactions and mortalities with each gear type per DPS. A summary of the annual anticipated Atlantic sturgeon interactions in the ten fisheries addressed in this Opinion is summarized by gear type Table 77.

Table 77: Anticipated Atlantic sturgeon mortalities by gear type and DPS in the ten fisheries each year.

	Gillnet Interactions	Gillnet Mortalities	Trawls Interactions	Trawl Mortalities
GOM DPS	54.6	10.9	67.7	3.4
NYB DPS	448.4	89.7	555.5	27.8
CB DPS	67.2	13.4	83.2	4.2
Carolina DPS	16.3	3.3	20.3	1.0
SA DPS	35.2	7.0	43.6	2.2
Canada	6.3	1.3	7.8	0.4
USA DPS Sum	621.7	124.3	770.3	38.6

Atlantic Salmon

Based on the known distribution of GOM DPS Atlantic salmon yet the lack of genetic information on the fish involved in interactions from 2010-2019, we are taking a precautionary approach by assuming that all the interactions were with GOM DPS Atlantic salmon. Based on past data, we anticipate two GOM DPS Atlantic salmon interactions every five years in either trawl or gillnet gear. Both of these interactions may result in mortality.

Giant Manta Rays

Based on observer data from 2001 through 2019, we estimate that four giant manta rays will interact with the trawl or gillnet gear over a 5-year period. One of these interactions (either in trawl or gillnet) may result in mortality in a 10-year period.

7.8. NEFMC's Omnibus Essential Fish Habitat (EFH) Amendment 2

As described in the proposed action, NMFS implemented approved regulations for the New England Fishery Management Council's Omnibus Essential Fish Habitat (EFH) Amendment 2 (Habitat Amendment or Amendment) on April 9, 2018 (68 FR 15240). In this section, we evaluate how the implementation of the Habitat Amendment affected the operation of the fisheries in this Opinion, as well as fisheries outside the Opinion, and whether any changes in the operation of the fisheries changed the anticipated effects on ESA-listed species considered above

or in previous consultations. For fisheries outside of this Opinion (i.e., Atlantic sea scallop, Atlantic herring, surfclam/ocean quahog, and tilefish), only those that are likely to adversely affect listed species (e.g., interactions between fishing gear and listed species have been documented) are considered in this evaluation. The Atlantic sea scallop fishery operates in the GAR. Interactions between scallop fishing gear (scallop dredge or trawl) and listed species have been observed, with interactions often resulting in the injury or mortality to the animal. Given this, the Atlantic sea scallop fishery, along with the other fisheries in this Opinion, will be considered in the following assessment. As provided in section 2, the Atlantic herring (primarily purse seine and mid-water trawl gear), surfclam/ocean quahog (primarily hydraulic clam dredge gear), and tilefish (primarily bottom longline and rod/reel gear) FMPs operate in the GAR; however, interactions with ESA-listed species in these fisheries have not been documented, are extremely unlikely, or the gear is not known to interact with listed species or critical habitat.⁴⁶ As the Amendment did not implement measures that changed the overall nature and operation of these fisheries (i.e., gear and area fished; see Appendix 2), the Amendment did not introduce effects to listed species that have not been previously considered in prior consultations.⁴⁷ Given this, the underlying consultations and determination of effects for these fisheries remain valid. These fisheries and their associated gear types (i.e., purse seine, mid-water trawl, hydraulic clam dredge, bottom longline, and /or rod and reel), therefore, will not be considered further in this evaluation. the animal. Given this, the Atlantic sea scallop fishery, along with the other fisheries in this Opinion, will be considered in the following assessment.

The Habitat Amendment revised the EFH and habitat areas of particular concern (HAPC) designations; revised, removed, or created habitat management areas (including gear restrictions); established dedicated habitat research areas (DHRA); established, maintained, or removed spawning protection areas; and, implemented administrative measures (i.e., framework adjustment and monitoring measures). However, as provided in section 3.3, on October 28, 2019, the court enjoined NMFS from allowing gillnet fishing within the Nantucket Lightship (NLS) and Closed Area 1 (CA I) Groundfish Closure Areas (CLF v. Ross, Civil Action No. 18-1087 (JEB)). Per this Order, on December 17, 2019, NMFS issued a rule suspending the Amendment's opening of the NLS and CA I Groundfish Closure Areas to gillnet fishing. All other measures implemented by the Amendment remain in place.

As habitat management measures, pre-or post- Habitat Amendment, have been implemented in various portions of the Gulf of Maine (GOM), Georges Bank (GB), and Southern New England (SNE), it is important to define these sub-regions. For the purposes of this assessment, the sub-regions are defined by ecological sub-regions or (EPU) (Ecosystem Assessment Program 2012). Specifically, four primary EPUs have been identified in the Northeast U.S. Continental Shelf

⁴⁶ ESA section 7 consultation has been completed on the Atlantic herring (February 9, 2010), Surfclam/ocean quahog (January 2, 2020), and Tilefish FMPs (October 27, 2017). NMFS determined that these fisheries may affect, but are not likely to adversely affect ESA-listed species or designated critical habitat. As the Amendment did not implement measures that changed the nature and operation of these fisheries, the Amendment did not introduce effects to listed species that have not been previously considered in prior consultations. Given this, the underlying consultations and determination of effects for these fisheries remain valid. Therefore, these fisheries remained covered by the consultations issued on February 9, 2010 (Atlantic herring FMP); January 2, 2020 (Surfclam/ocean quahog FMP); and, October 27, 2017 (Tilefish FMP).

⁴⁷ See footnote 1.

Large Marine Ecosystem: GOM, Scotian Shelf, GB, and Mid-Atlantic Bight (MAB) (Figure 54). The boundaries of the EPU are based upon regions of the Northeast U.S. Continental Shelf Large Marine Ecosystem that have distinct patterns in oceanographic properties, primary production, and fish distribution (Ecosystem Assessment Program 2012). Although the SNE sub-region is not defined as an EPU, it is included in our analysis below. The approximate location of the SNE sub-region overlaps the Mid-Atlantic and GB EPU (i.e., see overlap in statistical areas 538, 537, 526). Taking this into consideration, and based on input from SFD and the Councils, this assessment will consider statistical area 539 and portions of 538, 537, and 526 as the SNE sub-region.

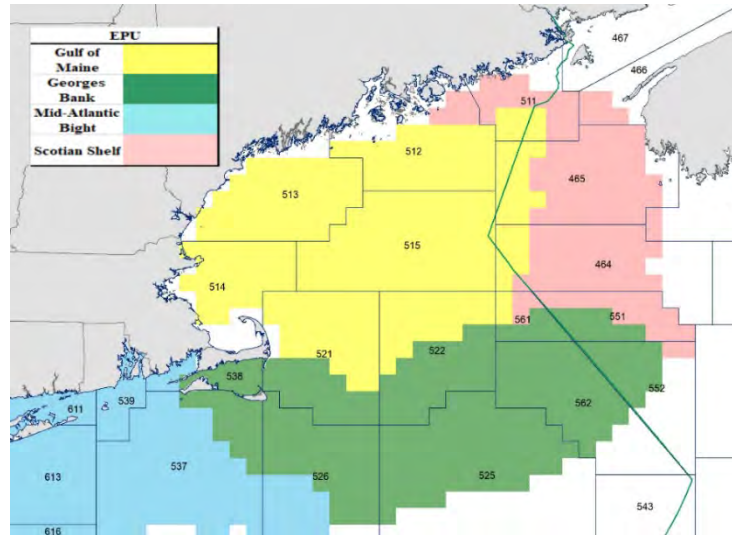


Figure 54: Ecological Production Units of the Northeast U.S. Continental Shelf Large Marine Ecosystem

Given the size and complexity of the Habitat Amendment, the analysis is broken down into the following categories of habitat management: (1) habitat management measures; (2) EFH and HAPC; (3) spawning protection measures; and, (4) framework adjustments and monitoring.

In order to comprehensively evaluate the measures implemented by the Habitat Amendment, including those NMFS suspended (see section 3.3), the following analysis will compare the impacts resulting from the implementation of all approved measures to impacts occurring before the measures were implemented. To do this, we first assess what changes occurred by region and what affect this would have on fishing effort. We then assessed the effects to protected species that may result from any changes in the fishery as a result of the Habitat Amendment.

More specifically, we used the following methods for each region. As actions authorized in the Habitat Amendment have the potential to change fishing behavior (e.g., shifts in effort), the following analysis will describe how effort is expected to change in response to the measures authorized in the Amendment and whether these changes, if they occur, equate to new or elevated risks to listed species. To inform this analysis, we consider:

1. fishing effort and behavior (e.g., area fished) in the GOM, on GB, and in SNE pre-and post- implementation of the Habitat Amendment. This includes assessing any shifts in effort, with the term “localized” referring to shifts within the same general area within the EPU or a habitat or groundfish management area.

2. changes to, or removal of, management area boundaries; fishing gear restrictions within management areas; and fishing gear types predominantly used in and around the designated habitat management areas pre-and post-Amendment (NEFMC 2016b);
3. listed species distribution in the GOM, on GB, and in SNE. Specific emphasis is placed on the overlap, in time and space, with the designated habitat management areas pre- and post-implementation of the Habitat Amendment); and,
4. documented records of listed species gear interactions.

Fishing effort can be defined in a number of ways (e.g., number of permits, trips, days fished, amount of landings). Given this, careful consideration is made when using the term “effort” and in inferring any changes to fishing effort post-Amendment. When assessing risks to protected species, the quantity of gear in the water (e.g., number of vertical lines, gillnets, bottom trawls), gear soak/tow duration, and the temporal and spatial overlap of the gear and protected species is considered. This analysis evaluates the distribution and quantity of gear in the water, as well as the number of trips as a proxy for fishing effort. In terms of evaluating the distribution and quantity of gear in the water, only those gear types identified in this section and in section 7 as likely to adversely affect listed species are considered in the assessment (i.e., trap/pot, sink gillnet, bottom trawl, and scallop dredge).

To evaluate fishing effort for all gear types except trap/pot, we reviewed data provided on the Northeast Ocean Data Portal⁴⁸ (1996 through 2015), the NEFSC’s Fishing Footprints⁴⁹ (1996 through 2015), and more recent VTR data (2016-2019) (NMFS unpublished data, Appendix 2). When applicable, NMFS also used information from NMFS’ Marine Mammal Stock Assessment Reports (SARS).⁵⁰ The SARS provide fishery information for those fisheries that interact with marine mammals. In general, these data sources showed similar patterns of fishing effort. When differences were apparent, we have described the differences below. For recent VTR data, both pre-Amendment (September 1, 2016, through March 31, 2018) and post-Amendment (April 1, 2018, through October 31, 2019) data was evaluated. The number of trips reported on VTRs in specified regions and by gear type was used to assess whether there were shifts in effort after implementation of the Amendment. While VTR data prior to 2016 is available, these specific timeframes were chosen to allow us to compare similar periods (approximately 572 days). Each of these time periods include one complete fishing year and part of another. As fishing effort can vary seasonally, sampling data in the midst of a fishing year can result in an incomplete picture of overall effort for that fishing year. Depending on the fishery and the targeted stock, there may be months when there is more directed effort than others. Given the variable timeframes considered as pre- or post- Amendment, it is possible that the VTR data sets considered to be pre- or post- Amendment, do not equally capture overall effort a fishery over the designated timeframe. As a result, apparent changes in effort may be due to sampling, and not necessarily a result of the measures implemented under the Amendment. In these cases, we also describe the fishery and potential shifts qualitatively. Figures provided in Appendix 2 depict the distribution of trips in the GOM, GB, and SNE pre- and post- Amendment.

⁴⁸ <https://www.northeastoceandata.org/>

⁴⁹ <https://fish.nefsc.noaa.gov/read/socialsci/fishing-footprints.php>

⁵⁰ See Appendix III (Fishery Descriptions) in the marine mammal SARS: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments>

Quantifying federal trap/pot gear effort from these data sources at fine spatial scales is difficult given data necessary to quantify this effort (e.g., VMS or VTR) is often lacking. Recent tools developed by the NEFSC, in support of the ALWTRT, have helped inform the spatial resolution of the lobster and Jonah crab trap/pot fisheries; American lobster is the predominant trap/pot fisheries in the Northeast Region (i.e., GOM, GB, and SNE). The NEFSC's DST assists managers, decision makers, and stakeholders visualize and understand the spatiotemporal distribution of trap/pot gear and the spatiotemporal overlap of this gear with large whales. This assessment uses the information and results from the NEFSC's Decision Support Tool as the best available information on the distribution of trap/pot effort in the GOM, GB, and SNE. The Decision Support Tool estimates the number of traps per square mile. This is the best available estimate of trap/pot effort in waters off the northeast United States. This output is found in the draft Environmental Impact Statement on the proposed ALWTRT measures (NMFS 2020b)⁵¹.

After evaluating the fishing effort (magnitude and distribution) in each region and how it may have changed with the implementation of the Habitat Amendment, we assess the risks to ESA-listed species. To assess risk, we take into consideration our analysis of effort pre- and post-Amendment, ESA-listed species distribution (see *Status of the Species*), and documented interactions. This informs the degree of overlap between listed species and fisheries in each region. We then identify which gears pose a risk to listed species. This information is used to inform how risks to ESA-listed species may have changed with the implementation of the Habitat Amendment. In assessing risk, we consider how the level of risk affected by changes in the:

1. temporal and spatial overlap of the gear and a protected species.
2. quantity of gear in the water (e.g., number of vertical lines, gillnets, bottom trawls).
3. gear soak/tow duration.

Finally, we consider the impacts across all regions and assess whether additional (or less) risk is anticipated from the implementation of the Habitat Omnibus Amendment.

7.8.1. **Habitat Management Areas (Habitat and Groundfish Closed Areas)**

Habitat management areas include Habitat and Groundfish Closed Areas, which restrict the use of certain gears to minimize, to the extent practicable, adverse⁵² effects of fishing on EFH. Gear used in the Northwest Atlantic fisheries fall in two major categories: mobile gear (e.g., bottom trawls, scallop dredge) and fixed gear (e.g., trap/pot, sink gillnet). Changes to restrictions of gear fished in designated habitat management areas has the potential to directly or indirectly affect mobile and/or fixed gear fishing effort. Therefore, this assessment first evaluates how gear restrictions in these areas, pre- and post- Amendment, affect effort in the region. This information will then be used to assess interactions risks to listed species pre- and post-Amendment.

Between 1994 and 2004, habitat and groundfish closure areas were established in the GOM, GB, and SNE (Figure 55). These closure areas were designated to protect EFH and/or groundfish

⁵¹ In the DEIS for the proposed ALWTRP rule (NMFS 2020b), see appendix 3.1 for information and results of the DST.

⁵² Specific to EFH, the Secretarial EFH guidelines (67 FR 2343, January 17, 2002) define an 'adverse effect' as any impact that reduces the quality and/or quantity of EFH, but only requires that actions be taken to prevent, mitigate, or minimize adverse effects from fishing, if they are both 'more than minimal' and 'not temporary'.

stocks by restricting particular fishing gears (e.g., bottom trawls, sink gillnets) (NEFMC 2016b); they were not designed to reduce interactions with listed species. Given that the closures have been in place for 16-26 years, patterns of fishing behavior and effort in the GOM, on GB, and in SNE are well-established, with effort often concentrating at the closure boundaries. This behavior, in turn, results in some gear types being more prevalent in certain areas of the GOM, on GB, or in SNE. Here, we describe the long-established behaviors that were present prior to the implementation of the Habitat Amendment and evaluate whether changes are expected due to the Amendment's implementation of measures that removed, modified, or maintained long-term closures in the three sub-regions (Figure 55).

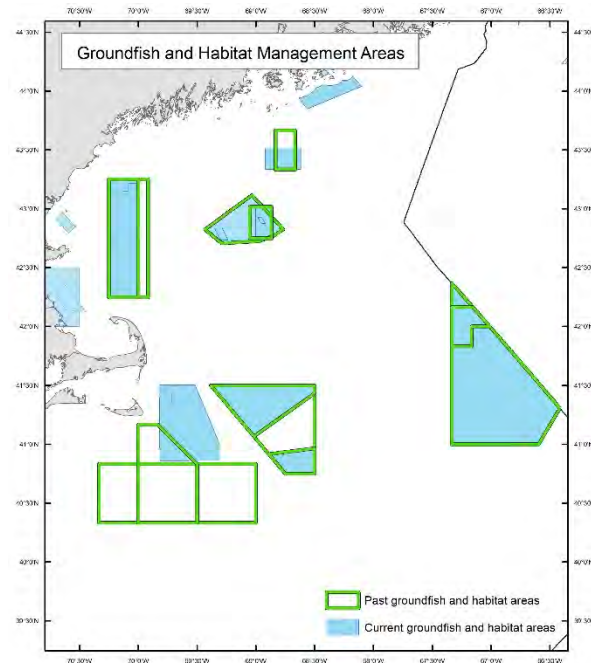


Figure 55: Habitat and groundfish closure areas pre- and post- Habitat Amendment

7.8.1.1. *Measures in the Gulf of Maine (GOM)*

Prior to the Habitat Amendment, the following Habitat and/or Groundfish Closure Areas existed in the GOM and provide an understanding of pre-existing fishing behavior and effort:

Western Gulf of Maine (WGOM) Habitat and Groundfish Closure Areas and Inshore Roller Gear Restricted Area

In the western portion of the GOM, an Inshore Roller Gear Restricted Area and the WGOM Habitat and Groundfish Closure Areas existed prior to the Amendment. The boundaries of the WGOM Habitat and Groundfish Closure Areas overlapped with the exception of the eastern boundary of the Groundfish Closure area which extended farther into the GOM (Figure 56).

Prior to the Amendment, the following management measures applied:

- Inshore Restricted Roller Gear Area: maximum diameter of any part of the trawl footrope of 12 inches; fishing with all other gear types permitted in this area.
- WGOM Habitat Closure: Mobile bottom-tending gears (e.g., bottom trawl, scallop dredge) prohibited. Fishing with all other gear types (e.g., sink gillnet, trap/pot) permitted.

- WGOM Groundfish Closure: sink gillnet, bottom trawl, scallop dredge, and bottom longline gears prohibited. Pot/trap, mid-water trawl, purse seine, and clam dredge gears permitted.

In addition to the long-established habitat and groundfish closures, sequential (later termed rolling) closures to protect GOM cod have been implemented in the GOM since 1998, with the most recent adjustment in 2015 (63 FR 15326, March 31, 1998; 80 FR 25110, May 1, 2015). Based on our review of the available data, scallop dredge, sink gillnet, bottom trawls, and trap/pot gear are commonly used in this area of the GOM. Prior to the Amendment: (1) there was a predominance of scallop dredge effort on Stellwagen Bank near the southern boundary of the WGOM Habitat and Groundfish Closure Areas, as well as within the nearshore waters of Ipswich Bay; (2) sink gillnet effort was prevalent along the western and northeastern boundary of both the WGOM Habitat and Groundfish Closure Areas; and (3) bottom trawl operations were prevalent around all the boundaries of both areas. Pot/trap effort was prevalent throughout the WGOM (both within and outside of the Closure Areas). Depending on distance from shore, the number of traps per square mile varies, with inshore waters of the WGOM (within 3 miles from shore) containing approximately 10 to 1,000 traps per square mile, and waters in the WGOM greater than 3 miles from shore containing approximately 1 to 100 traps per square mile (NMFS 2020b). To summarize, prior to the Amendment fishing in and around the Closed Areas is dominated by bottom trawl, sink gillnet, scallop dredge, and trap/pot gear.

In the Western GOM, the Habitat Amendment implemented the following management measures (Figure 56):

- Maintained the Inshore Roller Gear Restriction. Gear restrictions and exemptions remain unchanged.
- Maintained the WGOM Habitat Closure (now termed Habitat Management Area (HMA)). Gear restrictions and exemptions remain unchanged.
- Aligned the eastern boundary of WGOM Groundfish Closure with the WGOM HMA. Gear restrictions and exemptions remain unchanged.
- Exempted shrimp trawling from the designated portion of the northwest corner of the WGOM Closure Areas (i.e., WGOM Habitat HMA and Groundfish Closure Area).
- Established the Stellwagen DHRA. The footprint of the DHRA is located within the WGOM Closure Areas and is closed to all commercial mobile bottom-tending, sink gillnet, and demersal longline gears. All of these are also prohibited by the WGOM Groundfish Closure restrictions.

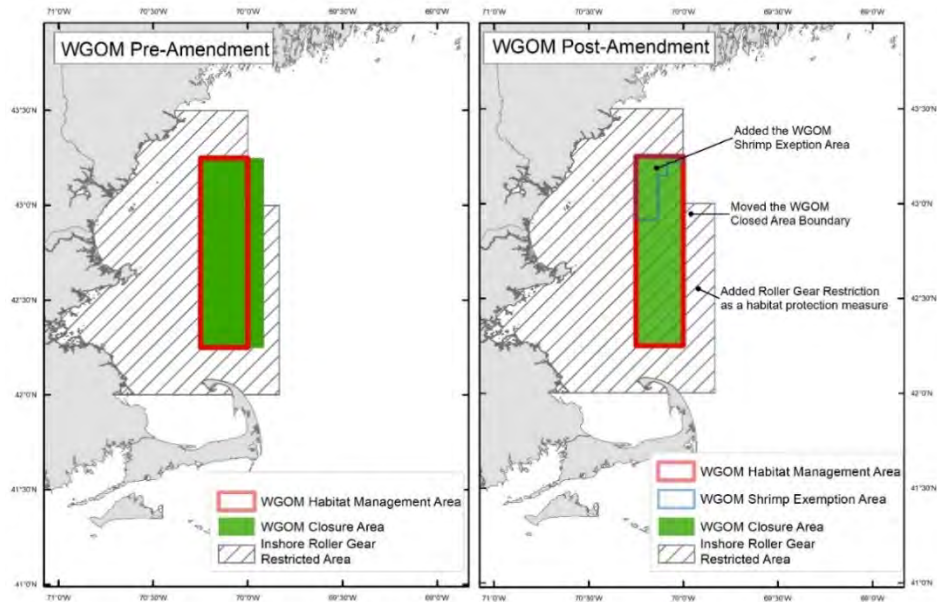


Figure 56: Pre- and post-habitat and groundfish management areas in the WGOM

Cashes Ledge Habitat and Groundfish Closure Areas

Prior to the Amendment, in the central GOM (CGOM), the boundaries of the Cashes Ledge Habitat Closure Area fell within the boundaries of the Cashes Ledge Groundfish Closure Area (Figure 57); during this time, the following management measures applied:

- Cashes Ledge Habitat Closure Area: Bottom trawl, scallop dredge, and clam dredge gears prohibited. Pot/trap, sink gillnet, mid-water trawl, purse seine, and bottom long-line gears permitted.
- Cashes Ledge Groundfish Closure Area: Sink gillnet, bottom trawl, scallop dredge, and bottom longline gears prohibited. Pot/trap, clam dredge, mid-water, purse seine gears permitted.

Prior to the Amendment, bottom trawl gear, followed by gillnet gear, is the primary gear type fished around the Closure Areas in the CGOM. Pot/trap effort was also common throughout the CGOM (both within and outside of the Closure Areas), with the number of traps per square mile estimated to be approximately ≤ 10 traps per square mile (Fig. 4.1.3.a in NMFS 2020b).

The Amendment implemented the following management measures in the CGOM (Figure 57):

- Maintained Cashes Ledge Groundfish Closure Area. Gear restrictions and exemptions remain unchanged.
- Shifted the western boundary of the Cashes Ledge HMA slightly to the east. The Cashes Ledge Habitat Closure Area (now the HMA) still resides in the Cashes Ledge Closure Area. Gear restrictions and exemptions in the Cashes Ledge HMA remain unchanged.
- Established the Ammen Rock HMA. This HMA is located inside the Cashes Ledge HMA. With the exception of lobster pot/tap gear, fishing with all other gear types is prohibited.
- Established the Fippennies Ledge HMA. This HMA is located inside the Cashes Ledge Groundfish Closure Area. All mobile bottom tending gear is prohibited.

Jeffreys Ledge Habitat Closure Area

Prior to the Amendment, in the CGOM, Jeffreys Ledge Habitat Closure Area (Figure 57) existed north of the Cashes Ledge Habitat and Groundfish Closure Areas; restrictions to mobile bottom tending gear were the same as those provided in the Cashes Ledge Habitat Closure Area. The review of fishing data consistently showed bottom trawl gear and trap/pot gear (both within and outside of the Closure Areas) being the predominant gear type fished around the Closure Area prior to the Amendment. In this region of the GOM, the number of traps per square mile varies by distance from shore. In general, the number of traps per square mile decreases with increased distance from shore. Coastal or nearshore (i.e., < 3 miles from shore) waters contain approximately 100 to 1,000+ traps per square mile in this area of the GOM, while more offshore waters (i.e., 3-12 miles from shore) contain approximately 10 to 100 traps per square mile (NMFS 2020b). There was little to no effort with other gear types (i.e., sink gillnet, dredge) in this region of the GOM prior to the Amendment.

The Habitat Amendment implemented the following management measures in this area of CGOM (Figure 57):

- Modified the Jeffreys Bank Habitat Closure Area (now termed HMA) boundaries. Gear restrictions and exemptions remain unchanged; and,
- Established the (small) Eastern Maine HMA; All mobile bottom tending gear is prohibited.

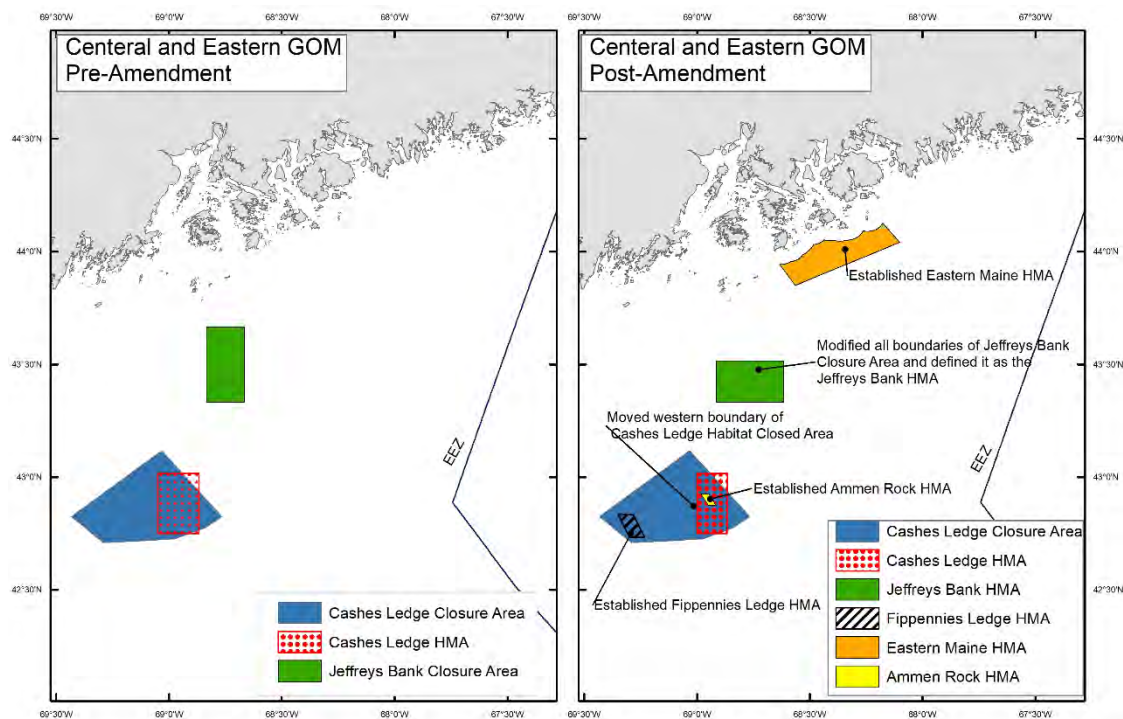


Figure 57: Pre- and post- habitat and groundfish management areas in the CGOM

7.8.1.2. Effort in the Gulf of Maine Pre- and Post- Amendment

There is the potential that the management measures implemented through the Amendment may change fishing effort in the GOM, relative to pre-existing conditions prior to the Amendment.

However, as described below and as provided in Appendix 2, little to no shifts and effort are expected.

The Amendment established the Stellwagen Bank DHRA, Ammen Rock HMA, Fippennies Ledge HMA, and EGOM HMA. The Amendment also modified the boundaries of the WGOM Groundfish Closure Area, Jeffreys Bank Closure Area (now termed HMA), and the Cashes Ledge HMA. The modification to these boundaries did not greatly change the overall footprint of these areas (Figure 56 and Figure 57); that is, they continue to fall within existing GOM closure areas or in portions of the GOM where the requirements implemented through the Amendment will have little to no effect to fisheries in this area. Given this, the management measures implemented by the Habitat Amendment provided little incentive for vessels to greatly change fishing behavior (e.g., area fished) or effort post-Amendment. For instance, VTR data showed that post-Amendment modification to the boundaries of the WGOM Groundfish Closure resulted in little to no change in distribution or level of gillnet or bottom trawl effort (see Appendix 2). Specifically, relative to pre-Amendment conditions, sink gillnet effort remained prevalent along the western and northeastern boundary of both the WGOM Habitat and Groundfish Closure Areas; bottom trawl effort also remained prevalent around all the boundaries of both areas. Overall, relative to pre-Amendment conditions in the WGOM, significant changes in gillnet or bottom trawl effort, post-Amendment, were not apparent (see Appendix 2). In addition, review of the VTR data showed that the designation of the Jeffreys Bank HMA resulted in a small shift in bottom trawl effort just to the west of the HMA (i.e., in the area once delineated as the Jeffrey's Bank Closure Area); however, even with this small shift, the overall level and distribution of bottom trawl effort remained relatively consistent with pre-Amendment conditions in the GOM, with little to no displacement of effort (see Appendix 2). To provide another example, in the area where the EGOM HMA is designated, fishing is primarily prosecuted with trap/pot and purse seine gear. Mobile bottom tending gear (e.g., shrimp/bottom trawl, clam dredge) is used minimally. As the EGOM HMA only restricts the use of mobile bottom tending gear, post-Amendment changes in fishing behavior or shifts in effort are not expected to occur in this area of the GOM.

Pot/trap operations in the GOM are also likely to remain similar to pre-Amendment conditions as the Amendment did not appear to create any incentive for effort to change. Pot/trap gear has never been restricted in the Habitat or Groundfish Closure Areas. Therefore, effort in these areas is expected to continue at levels similar to the effort pre-Amendment. In addition, as the fishing grounds for trap/pot fisheries are well established throughout the GOM and introduction of new effort would result in gear conflicts, it is not expected that post-Amendment, trap/pot fisheries will be forced to relocate from pre-existing fishing grounds due to other vessels (e.g., mobile bottom tending, sink gillnet) responding to the measures implemented by the Amendment. Similarly, given the established fishing grounds of trap/pot fisheries in the GOM, combined with the desire to avoid gear conflicts both within and outside of the fishery, any post-Amendment changes to habitat or groundfish management areas (i.e., opening or closing an area to bottom tending gear) are not expected to create incentive for large shifts in trap/pot effort within or around these affected areas or in the GOM overall. Should any shifts in pot trap effort occur post-Amendment, it is likely to be seen by those trap/pot vessels whose fishing grounds overlap with or are in close proximity to the management areas delineated or modified by the Amendment. Given this, any shifts in trap/pot effort are expected to be localized and not a result of a vessel attempting to gain access to an area that it previously had not fished.

Based on this analysis, there is no evidence that the measures implemented through the Habitat Amendment created incentive for vessels to change their operations. This is supported by: (1) the management measures implemented in the GOM through the Habitat Amendment resulted in little to no change in the overall footprint of pre-existing Groundfish or Habitat Closure Areas (Appendix 2) and (2) gear restrictions in the designated closure areas also remained relatively consistent. Relative to operating conditions prior to the Amendment, there was little to no change in area fished, quantity of gear set/towed, and/or placement of fishing gear (i.e., gillnet, trap/pot, bottom trawl) in the GOM (see Appendix 2).

7.8.1.3. Assessment of Risks to Protected Species

In the *Status of the Species* (see section 4.0), Table 42 identifies the ESA-listed species and critical habitat that occur in the action area and that may be adversely affected (e.g., there have been observed and documented interactions in the fisheries or with gear type(s) similar to those used in the fisheries) by the proposed action. Of the species identified in Table 42, only ESA listed species of large whales, sea turtles, Atlantic sturgeon, and Atlantic salmon are likely to occur in the GOM and overlap with the fisheries operating in this region. The following evaluation will considered gear interaction risks to these species. Based on this information, and our evaluation of fishing effort pre-and post-Amendment (see above), we then evaluate how these risks may have changed with the implementation of the Amendment.

Large Whales in the GOM: Occurrence and Gear Interaction Risks

As provided in the *Status of the Species*, North Atlantic right, fin, sei, and sperm whales are likely to occur in the GOM. North Atlantic right, fin, sei and sperm whales are likely to overlap with fisheries operating in the GOM. However, not all fisheries operating in this region pose an entanglement risk to these species. Based on more than 30 years of observed or documented interactions (see Marine Mammal SARs) between large whales and fishing gear in the Northwest Atlantic, the greatest entanglement risk to large whales is posed by fixed gear used in trap/pot or sink gillnet fisheries (Angliss and DeMaster 1998, Cassoff et al. 2011, Henry et al. 2017, Henry et al. 2015, 2016, Henry et al. 2020, Henry et al. 2019, Johnson et al. 2005, Knowlton and Kraus 2001, Sharp et al. 2019). Fin, sei, and North Atlantic right whales have died or been seriously injured from entanglement in fishing gear along the Gulf of Mexico Coast, U.S. East Coast, and Atlantic Canadian Provinces from 2012 to 2018; however, there have been no confirmed M/SI from entanglement in fishing gear for sperm whales since 2011⁵³ (Hayes 2019, Hayes et al. 2020, Henry et al. 2020, Henry et al. 2019, Waring et al. 2015, Waring et al. 2014).

In regards to other gear types fished in the GOM, such as bottom trawl and scallop dredge there have been no observed or documented interactions between North Atlantic right, fin, sei, and sperm whales and these gear types (Henry et al. 2017, Henry et al. 2015, 2016, Henry et al. 2020, Henry et al. 2019) (see also NMFS' Marine Mammal Stock Assessment Reports:

<https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock->

⁵³ A sperm whale was reported entangled in monkfish net on the Canadian Grand Banks in 2011, but was released alive and gear free (Ledwell 2012 as cited in Waring et al. 2015).

[assessment-reports-region](#)). Based on this, interactions between these gear types and listed species of whales are extremely unlikely.

Sea turtles in the GOM: Occurrence and Gear Interaction Risks

As described in the *Status of the Species*, hard-shelled and leatherback sea turtles arrive in the Gulf Maine in June and leave the area by the end of November. Fisheries operating in the GOM use gear types known to pose an interaction risk to sea turtles, including gillnet, trap/pot, scallop dredge, and bottom trawl gear (Murray 2015a, 2018, 2020) NEFSC observer/sea sampling database, unpublished data; GAR STDN, unpublished data). Although sea turtles are at risk of interacting with these gears, observed fishery interactions in this sub-region are rare. Review of observer records over the last 30 years show only two observed gear interactions with a sea turtle in the GOM (i.e., both loggerhead sea turtles and gillnet gear); near WGOM Closure areas (NEFSC observer/sea sampling database, unpublished data). There is also data available through the GAR STDN. Leatherback sea turtles are at risk of interacting with trap/pot gear, specifically the vertical lines associated with this gear type. Based on information provided by the GAR STDN (unpublished data), from 2009 through 2018, leatherback sea turtles have been reported entangled in vertical line gear, with multiple cases reported in the GOM and in Cape Cod Bay (GAR STDN, unpublished data). In addition, hard-shelled sea turtles can become entangled in the vertical lines associated with trap/pot gear; however, none have been reported in the GOM from 2009-2018 (GAR STDN, unpublished data).

Atlantic sturgeon in the GOM: Occurrence and Gear Interaction Risks

As described in the *Status of the Species*, Atlantic sturgeon (adult and sub-adult) from all DPSs, occur in the GOM, primarily inshore of the 164-ft (50-m) depth contour (Dunton et al. 2010, Laney et al. 2007, Stein et al. 2004a, b, Waldman et al. 2013, Wirgin et al. 2015b). However, they are not restricted to these depths and excursions into deeper (e.g., 250 ft (75 m) continental shelf waters have been documented (Collins and Smith 1997, Dunton et al. 2010, Erickson et al. 2011, Stein et al. 2004a, b, Timoshkin 1968).

Of the gear types used in the GOM, gillnet and bottom trawl gear pose the greatest interaction risk to this species. Numerous interactions between Atlantic sturgeon and gillnet or bottom trawl gear have been observed in the Northwest Atlantic, with many of these interactions observed in the GOM (NEFSC observer/sea sampling database, unpublished data). Observed or reported interactions between Atlantic sturgeon and other gear types fished in the GOM (i.e., trap/pot, scallop dredge) are rare to non-existent (NEFSC observer/sea sampling database, unpublished data); based on this, interactions between Atlantic sturgeon and these gear types are extremely unlikely.

Atlantic salmon in the GOM: Occurrence and Gear Interaction Risks

In general, smolts, post-smolts, and adult Atlantic salmon may be present in the GOM and coastal waters of Maine in the spring (beginning in April), and adults may be present throughout the summer and fall months. Therefore, Atlantic salmon are likely to overlap with fisheries operating in the GOM. Of the gear types used in the GOM, gillnet and bottom trawl gear pose the greatest interaction risk to this listed species. However, although interactions are possible with these gear types, observed interactions are rare (Kocik et al. 2014) (NEFSC observer/sea sampling database, unpublished data). Observed interactions between Atlantic salmon and other gear types fished in the GOM (i.e., trap/pot, scallop dredge) are non-existent (NEFSC

observer/sea sampling database, unpublished data); based on this, interactions between these gear types and Atlantic salmon are extremely unlikely.

Summary of Co-occurrence and Gears that Pose a Risk to Listed Species

Given the information above, ESA-listed species of large whales, sea turtles, and fish are at risk of interacting with several gear types fished in the GOM, with some gear types posing more or less of an interaction risk than others. Table 78 provides a summary of those gear types that pose the greatest entanglement risk to listed species of large whales, sea turtles, and fish.

Table 78: Fishing gear types that pose the greatest entanglement risk to ESA-listed species of large whales, sea turtles, and fish.

Listed Species Group	Gear Types
Large whales	Sink Gillnet; Pot/Trap
Sea turtles	Sink Gillnet; Bottom Trawl; Scallop Dredge; Pot/Trap
Atlantic sturgeon and Atlantic salmon	Sink Gillnet; Bottom Trawl

7.8.1.4. Assessment of Risk with the Implementation of the Habitat Amendment

The species considered in this Opinion overlapped with these gear types prior to the Amendment; therefore, pre-Amendment fishing conditions in the GOM (i.e., pre-Amendment) posed some level of gear interaction risks to listed species occurring in the GOM. Here, we evaluate whether these risks changed when the Amendment was implemented. Although the measures implemented resulted in changes to management areas in the GOM, there is no indication that these changes created incentive for fishing behavior or effort to change from pre-existing operating conditions. Relative to conditions prior to the Amendment, the management measures implemented in the GOM through the Habitat Amendment resulted in very little change to the overall footprint of pre-existing Groundfish and Habitat Closure Areas. At most, small localized shifts in effort were seen post-Amendment; however, overall there was little to no difference in the distribution (locally or regionally) and magnitude (e.g., quantity of gear fished and gear soak/tow duration) of effort in the GOM after implementation of the Habitat Amendment. There is also no evidence to suggest that the measures in the Amendment created an incentive for changes in effort to occur in the future.

Species occurrence and distribution may respond and adapt to changes in the marine environment (e.g., changes to prey availability, water temperature changes); however, the overall occurrence and broad scale distribution of these species in the GOM has remained relatively consistent from pre-Amendment to post-Amendment. Given the above, the degree of overlap between listed species and gear in future fishing years is expected to remain similar to the overlap prior to the Amendment. Although the measures implemented through the Amendment are not expected to remove or reduce interaction risks to listed species, they are also not expected to result in new or increased interaction risks to these species relative to conditions in the GOM prior to the Amendment.

7.8.1.5. Measures on Georges Bank (GB)

Prior to the Habitat Amendment, the following Habitat and/or Groundfish Closure Areas existed on GB; this information will serve to establish pre-existing fishing effort on GB, particularly in and around these Closure Areas:

Closed Area I (CA I) Habitat and Groundfish Closure Areas

Prior to the Amendment, the CA I Habitat and Groundfish Closure Areas were located at the western end of GB. At this time, the boundaries of the CA I Habitat Closure Area fell within the boundaries of the CA I Groundfish Closure Area (Figure 58). Prior to the Amendment, the following management measures applied:

- CA I (North and South) Habitat Closure Area: Mobile bottom-tending gear (e.g., bottom trawl, scallop dredge) prohibited. Pot/trap, sink gillnet, mid-water trawl, purse seine, and bottom longline gear permitted.
- CA I Groundfish Closure Area: Pot/trap, purse seine, and mid-water trawl gears permitted. With the exception of NE Multispecies vessels participating in special access programs (SAPs), all other vessels fishing with gear types capable of catching groundfish (e.g., sink gillnet, bottom trawl, bottom longline) or with clam dredge gear prohibited. Through SAPs, bottom longline gear was allowed to be set in portions of the Groundfish Closed Area. Scallop dredge gear was also allowed in specified portions of the Closed Area; specifically the area designated by the Scallop FMP's scallop rotational management program as the CA I Access Area.

Scallop dredge, gillnet, bottom trawl, and trap/pot gear were commonly used in this area of GB prior to the Amendment. The review of available fishing data consistently showed a predominance of scallop dredge gear in the waters surrounding the western boundary of the Closure Areas (e.g., Great South Channel). As noted above, scallop dredge gear can operate in the area designated by the Scallop FMP as the CA I Access Area (located within the central portion of the CA I Groundfish Closure Area) at certain times. Prior to the Amendment: (1) sink gillnet gear was predominant at the tip of the Northwestern corner of the CA I North Habitat Closure Area and extended northwest to the eastern shore of Cape Cod's National Shoreline (e.g., waters off of Chatham, Massachusetts); (2) bottom trawl gear was predominant on all of the CA I boundaries and was common in the waters between the CA I and CA II Closure Area; and (3) trap/pot effort was fished both within and outside of the Closure Areas, with the number of traps per square mile in this region of GB estimated to be approximately ≤ 10 traps per square mile (Figure 4.1.3.a in NMFS 2020b).

CA II Habitat and Groundfish Closure Areas

Prior to the Amendment, the CA II Habitat and Groundfish Closure Areas were located at the eastern end of GB. The boundaries of the CA II Habitat Closure Area fell within the boundaries of the CA II Groundfish Closure Area (Figure 58). Prior to the Amendment, the following management measures applied:

- CA II Habitat Closure Area: bottom trawl, scallop dredge, and clam dredge gears prohibited. Pot/trap, mid-water trawl, and purse seine permitted.
- CA II Groundfish Closure Area: Pot/trap, purse seine, and mid-water trawl gears permitted. With the exception of NE Multispecies vessels participating in a SAP, all other vessels fishing with gear types capable of catching groundfish (e.g., sink gillnet, bottom trawl, bottom longline) or clam dredge were prohibited. Through SAPs, bottom trawl and bottom longline gears could also be used in portions of the Closed Area. Scallop dredge gear was also allowed in specified portions of the Closed Area; specifically the area designated by the scallop FMPs scallop rotational management program as the CA II Access Area.

Prior to the Amendment, scallop dredge, bottom trawl, and trap/pot gear were commonly fished on GB; gillnet gear was used to a lesser extent. Review of available fishing data showed that prior to the Amendment, there was a predominance of scallop dredge gear in the waters surrounding the southern boundary of the Closure Areas, as well as within the southeastern corner of the CA II Groundfish Closure Area; this latter area is designated by the Scallop FMP as the CA II Access Area.⁵⁴ Prior to the Amendment, bottom trawl effort was common in the waters off the western and southern boundaries of the CA II Closure Areas and in the waters between the CA I and CA II Closure Areas. Pot/trap effort occurred both within and outside of the Closure Area (Figure 4.1.3 in NMFS 2020b), with the number of traps per square mile estimated to be approximately ≤ 10 traps per square mile. There was limited gillnet effort off the western boundary of the Closure Area prior to the Amendment.

Relative to pre-Amendment conditions in this area of GB, the Amendment implemented the following management measures:

- Removed CA I Habitat and Groundfish Closure Areas.⁵⁵
- Established CA I North Seasonal Spawning Closure (formerly CA I North Habitat Closure). Between February 1 to April 15, the area is closed to commercial and recreational gears capable of catching groundfish (e.g., bottom trawl, sink gillnet). Fishing with scallop dredge gear is permitted year round;
- Established the GB DHRA (formerly CAI South Habitat Closure). This area is closed to mobile bottom-tending gears for at least three years and could be opened after a review of the research activities in the area;
- Established the Great South Channel HMA. With the exception of clam dredge gear, mobile bottom-tending gear is restricted throughout the HMA. Pursuant to 85 FR 29870 (May 19, 2020), three dredge exemption areas were established within the Great South Channel HMA: McBlair, Old South, and Fishing Rip. McBlair and Fishing Rip dredge exemption areas will be open to fishing for surfclams year round. Old South Dredge Exemption Area will be open for surfclam fishing from May 1 through October 31.
- Maintained the CA II Habitat and Groundfish Closure closures, with the same gear restrictions (Figure 58). The Council recommended modifications to both areas, but NMFS disapproved those changes (83 FR 15240, April 9, 2018).

⁵⁴ Under Scallop FMP's rotational management, Access Areas are either opened or closed annually to fishing based on scallop health, size, and biomass in specific Access Areas. Consideration of these factors are necessary to assess the potential distribution and level of scallop fishing effort on a year to year basis.

⁵⁵ Pursuant to a October 28, 2019, [Court Order](#), NMFS issued a rule (84 FR 68798, December 17, 2019) suspending the Amendment's opening of the Closed Area I Groundfish Closure Area to gillnet fishing and restoring prior regulations prohibiting gillnet gear from fishing in this area until further notice.

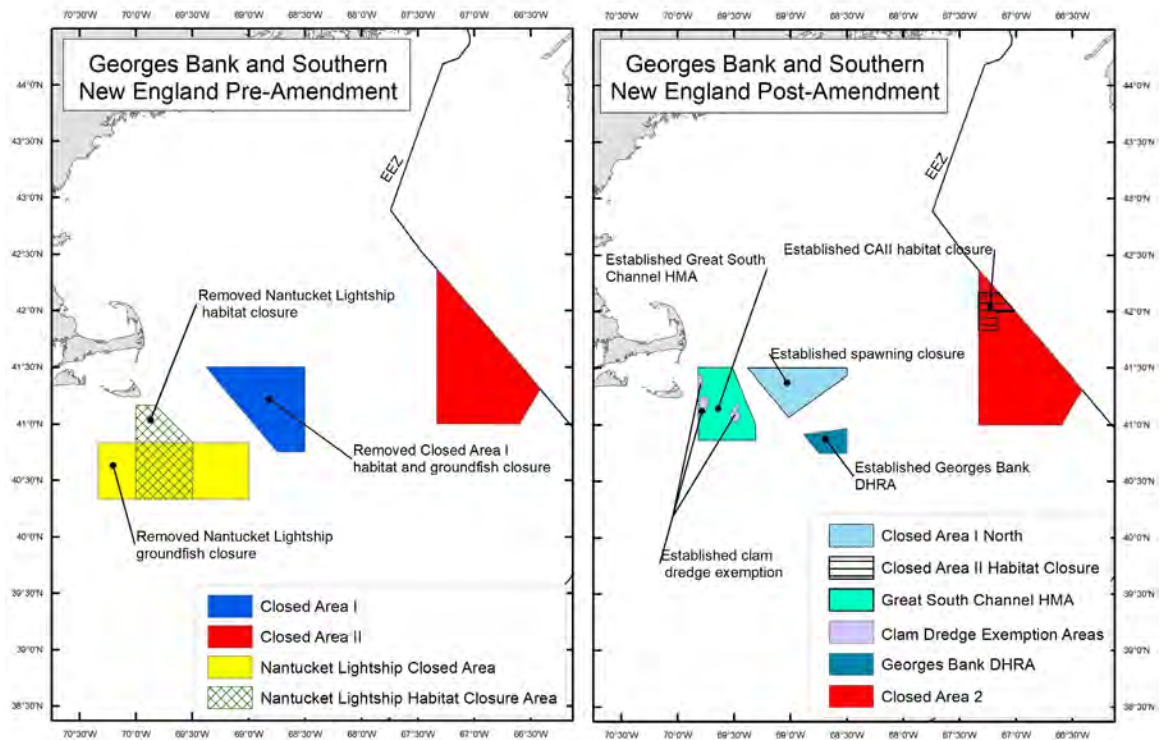


Figure 58: Pre- and post- habitat management and groundfish areas on GB (and SNE)

7.8.1.6. *Effort on Georges Bank Pre- and Post- Amendment*

The Habitat Amendment removed the CA I Habitat and Groundfish Closure Areas. The Amendment implemented the CA I North Seasonal Spawning Closure Area in the area formerly designated as the CA I North Habitat Closure and the GB DHRA in the area formerly designated as the CA I South Habitat Closure. There is the potential that the management measures implemented through the Amendment may change fishing effort in this area of GB. Figures provided in Appendix 2 depict the distribution of trips using sink gillnet, bottom trawl, or scallop dredge on GB pre- and post- Amendment.⁵⁶

The removal of the CA I Habitat and Groundfish Closure Areas resulted in a shift of scallop dredge effort into the newly opened area post-Amendment. With this shift, the VTR data showed an increase in effort, particularly in the former CA I North Habitat Closure Area (Figure 59). As scallop dredge vessels were previously restricted from accessing the CA I Habitat Closure Areas, the opening of these areas post-Amendment created incentive for scallop dredge vessels to redirect effort into formerly closed areas. This opening; however, is not unrestricted. The Scallop FMP manages the scallop fishery through an Access Area (i.e., NLS, Mid-Atlantic, CA I, and

⁵⁶ On November 1, 2019, in preparation for the rule to re-close the NLS Groundfish Closure Area to gillnet fishing, NMFS notified gillnetters operating in the (former) NLS Groundfish Closure Area that all gillnet gear needed to be removed from the Closure Area. As a result, VTR data on gillnet vessels operating in this area between November 1, 2010 and December 16, 2019, was not considered as there was no active gillnet fishing in this area. The April 1, 2018, through October 31, 2019 time frame was considered in this analysis.

CAII) rotational management program to maximize scallop yield. This program restricts the level of effort in Access Areas on a year-to-year basis. Subsequent to the Habitat Amendment, the Scallop FMP expanded the CA I Access Area to encompass the western part of the CA I Closure that was removed by the Habitat Amendment.

When comparing the pre- to the post-Amendment maps provided in Figure 59, there is a shift in scallop dredge effort into the area formerly designated as the CA I North Habitat Closure.⁵⁷ Pre-Amendment (i.e., September 1, 2016, through March 31, 2018), the CA I Access Area was closed to scallop fishing (i.e., no allocated trips to the Access Area; 81 FR 26727 (May 4, 2016) and 82 FR 15144 (March 27, 2017)). This, combined with the prohibition of scallop dredge gear in the CA I North and South Habitat Closures resulted in scallop dredge effort outside of the CA I Closure and Access Area boundaries and concentrating primarily along the western boundaries of these areas. Post-Amendment, the removal of the CA I Closure Areas, combined with the (expanded) CA I Access Area being opened to scallop fishing, an increase in effort was seen in the area formerly designated as the CA I North Habitat Closure. While a localized increase in effort was seen in the area formerly designated as the CA I North Habitat Closure, there was no apparent increase in overall scallop dredge effort on GB in response to measures implemented post-Amendment.

In addition to the removal of the CAI Habitat and Groundfish Closure Areas, the Amendment also implemented the Great South Channel (GSC) HMA in a portion of GB that was accessible to mobile bottom tending gear, such as scallop dredges, pre-Amendment. As the HMA restricts the use of scallop dredge gear, existing scallop dredge vessels are likely to shift effort to: (1) just outside the boundaries of the HMA (accessing the available resources around the HMA's boundaries); and/or, (2) other pre-existing fishing grounds in portions of SNE (e.g., waters around or in NLS-Access Area (if opened) or CA I-Access Area (if opened; see above); this is supported by maps provided in Figure 59. However, as provided above, scallop fishing effort is overwhelmingly dictated by the Scallop FMPs rotational management program, which is based on annual scallop abundance estimates. Given this, where scallop vessels may shift to, as a result of the implementation of the GSC HMA, will be highly influenced by scallop abundance and resultant management measures implemented by the Scallop FMP. Below, the analysis assesses whether these changes in effort subsequent to the Habitat Amendment resulted in increased risks to protected species.

⁵⁷ Between 2016 and 2019, the Scallop FMP's CA 1 Access Area was closed to scallop fishing in 2016 (80 FR 22119, April 21, 2015) and 2017 (82 FR 15155, March 27, 2017), and open to scallop fishing in 2018 (83 FR 17300, April 19, 2018) and 2019 (84 FR 11436, March 27, 2019).

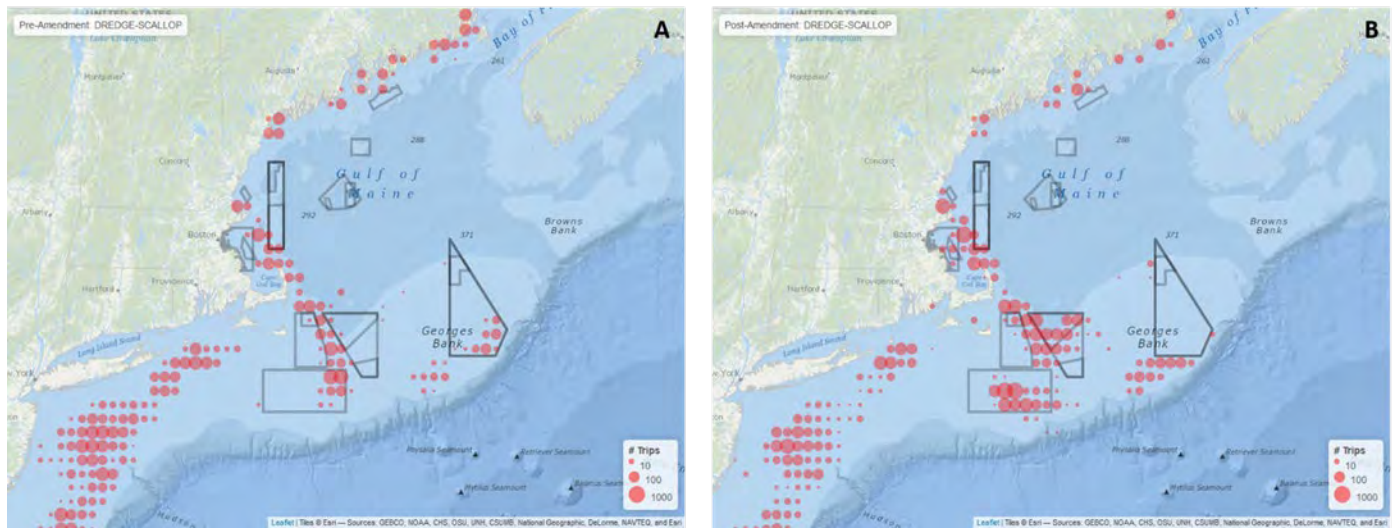


Figure 59: Scallop dredge VTRs pre-and post- Habitat Amendment. Figure A=Pre-Amendment (September 1, 2016-March 31, 2018) and Figure B=Post Amendment (April 1, 2018-October 31, 2019) (see Appendix 2)⁵⁸

Sink gillnet gear is also fished to some extent on western GB. Pre-Amendment, gillnet gear was predominantly set near the northwestern corner of the CA I North Habitat Closure Area and extended west to the eastern shore of Cape Cod's National shoreline (e.g., waters off of Chatham, MA). Implementation of the GSC HMA did not restrict use of gillnet gear in the HMA. Therefore, this measure did not affect the distribution or level of effort with this gear type in this portion of GB. As result, the remainder of this assessment will focus on the effects of the Amendment's removal of the CA I Closure Areas on gillnet effort.

While the Habitat Amendment's removal of the CA I Closure Area has the potential to result in a shift in sink gillnet effort relative to conditions prior to the Amendment, large shifts are not expected. Depending on the health of target stocks in the area, there may be little incentive to shift into the newly opened areas. In general, vessels often concentrate gear along the boundaries of a restricted/closed area to take advantage of any spillover of a healthy target stock. The limited boundary effects seen by sink gillnet vessels in the region prior to the Amendment suggests that targeted stocks may be limited within the CA I Closure Areas, thereby discouraging gillnet effort around the Closed Area boundaries. Given that there may be limited availability of the target stock, the opening the CA I Closure Areas may provide little incentive for vessels to shift into this area of GB. In addition, with the expansion of the scallop CA I Access Area and the designation of the CA I North Seasonal Spawning Closure (formerly CA I North Habitat Closure), there may be little incentive to shift or sink gillnet effort into the now "opened" areas given the seasonal gear restrictions in the CA I North Spawning Closure and the potential for

⁵⁸ Figure 59 does not depict the boundaries of the Scallop FMP's Rotational Management Areas. The boundaries delineating the (prior) CA I Habitat and Groundfish Management Area are, in general, reflective of the area encompassed by the CA I Scallop Rotational Area. For details on the Scallop FMP's Rotational Management Area, see <https://www.fisheries.noaa.gov/resource/map/atlantic-sea-scallop-managed-waters-fishing-year-2020>.

gear conflicts associated with scallop dredge effort in the scallop CA I Access Area. This is supported by the VTR data (Figure 60).

Review of VTR data showed no apparent change in the distribution of sink gillnet effort in the GB region post-Amendment. Specifically, there was no large shift of gillnet effort locally or regionally (i.e., from other sub-regions) into the area formerly designated as CA I Habitat and Groundfish Closure Areas. If a large shift in effort had occurred post-Amendment, it is likely that this gear type would be more concentrated on GB, particularly in and around the former CA I Closure Areas. Review of the VTR data also showed no apparent increase in overall gillnet effort on GB post-Amendment. However, the VTR data did show a localized increase in gillnet effort in the waters just off Chatham, Massachusetts. As provided above, pre- or post-Amendment, this area has consistently been a site on GB where gillnet effort is predominant. During the time effort increased, there were several fishery management measures (described below) independent of this action that applied to gillnets in this area. These fishery management changes would have occurred whether or not the Habitat Amendment was implemented. Although the VTR data (Figure 60) capture a limited period of time post-Amendment, it is likely the pattern of fishing effort shown in the maps are reflective of future effort in the area.

Taking into consideration the above information, implementation of the Amendment resulted in small, localized shifts in effort by gillnet gear on GB; however, large shifts in effort from other regions outside of GB were not apparent. While a localized increase in gillnet effort was apparent on GB post-Amendment, review of the VTR data showed no evidence that overall gillnet effort increased as a result of the management measures implemented through the Habitat Amendment. Below, the analysis assesses whether the implementation of the Amendment resulted in increased risks to protected species.

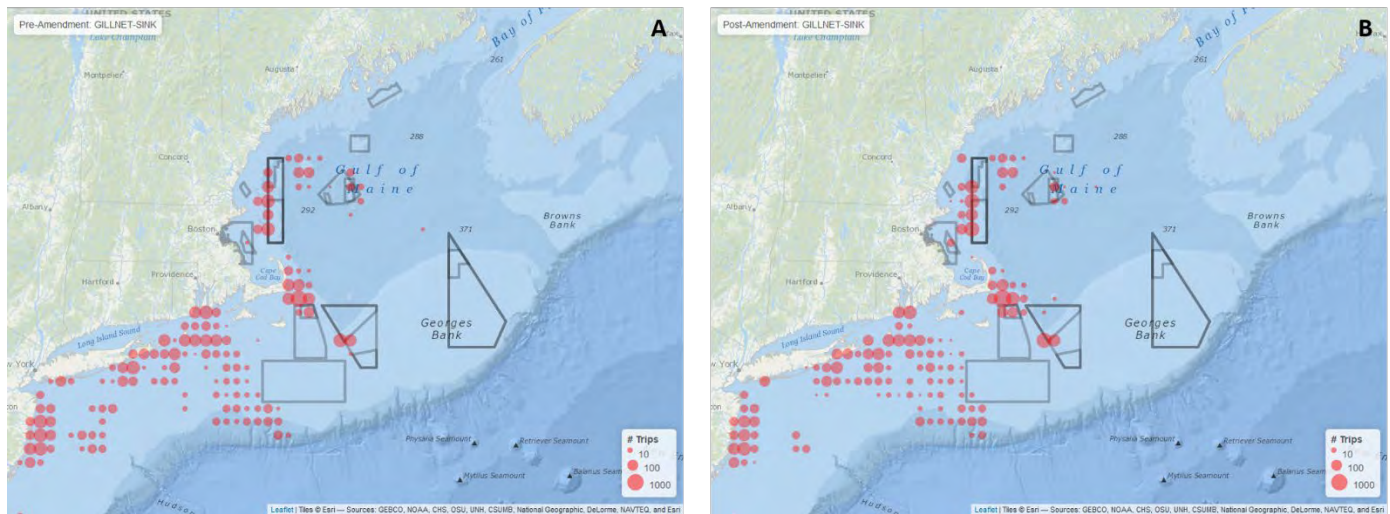


Figure 60: Sink gillnet VTRs pre-and post- Habitat Amendment. Figure A=Pre-Amendment (September 1, 2016-March 31, 2018) and Figure B=Post Amendment (April 1, 2018-October 31, 2019) (see Appendix 2)

Bottom trawl gear is also commonly fished on GB. Implementation of the GSC HMA through the Amendment restricted mobile bottom tending gear, such as bottom trawls, from areas on GB they could access pre-Amendment. Therefore, the Amendment's implementation of the GSC HMA and removal of the CA I Closure Areas has the potential to result in a shift in bottom trawl effort, however, relative to overall bottom trawl operating conditions prior to the Amendment,

large shifts in effort are not expected. Specifically, any changes in bottom trawl fishing effort are likely to be localized, with existing bottom trawl effort redistributing into the now “opened” area, resulting in a change in the distribution of bottom trawl gear. This is supported by the VTR data (Figure 61). Prior to the Amendment, bottom trawl effort was concentrated along the northern boundaries of the CA I Closure Areas (Figure 61A), extending into the Great South Channel waters to the west of the Closure Area (i.e., area currently designated as the GSC HMA). Post-Amendment (Figure 61B), this effort shifted into the “opened” area, resulting in bottom trawl effort becoming more dispersed instead of concentrated in any one area of GB. Aside from this small, localized shift in effort, there is also no detectable shift in bottom trawl effort from other sub-regions (e.g., GOM, mid-Atlantic) post-Amendment as the VTR data (Figure 61) do not show an increased concentration of effort on GB. There is no evidence that the management measures implemented through the Habitat Amendment created an incentive to increase effort in this or other areas of GB.

Although VTR data post-Amendment (Figure 61B) captures a limited period of time, it is likely this pattern of bottom trawl fishing behavior and effort will remain similar to this in the future. However, as with other gears, the incentive to shift will be highly dependent on: (1) the status of the target stock(s) in the area; (2) competition for access to fishing grounds with vessels (e.g., scallop) that had pre-existing access to the area; and, (3) seasonal (i.e., CA I North Seasonal Spawning Closure) or year-long (i.e., GB DHRA) restrictions of when bottom trawl fishing can occur. Taking into consideration this information and the information provided in Figure 61, implementation of the Habitat Amendment resulted in small, localized shifts in bottom trawl effort on GB; however, large shifts in effort from other regions outside of GB were not apparent. In addition, any shifts in bottom trawl effort are not expected to equate to more bottom trawl gear and/or longer duration trawl tows than previously experienced in and around this area of GB.

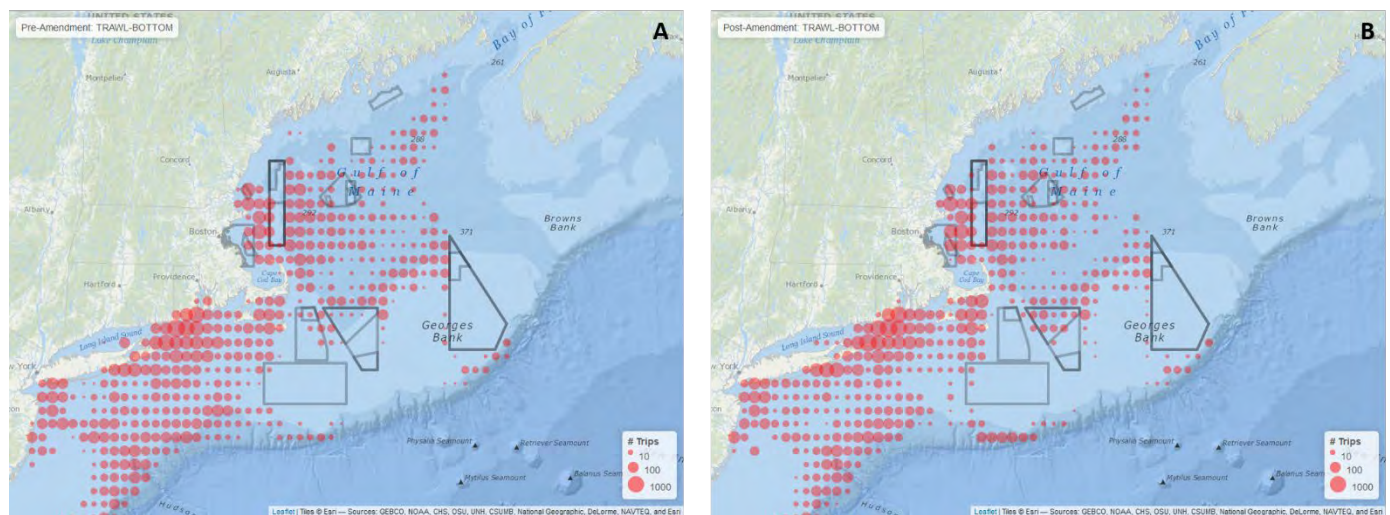


Figure 61: Bottom trawl VTR pre-and post- Habitat Amendment. Figure A=Pre-Amendment (September 1, 2016-March 31, 2018) and Figure B=Post Amendment (April 1, 2018-October 31, 2019) (see Appendix 2).

Pot/trap gear, the other gear type commonly found on GB, has never been restricted in Closed Areas designated on GB. As the GSC HMA did not restrict the use of trap/pot gear in the HMA and fishing with trap/pot gear was never restricted in the former CA I Closure Areas, it is not expected that the management measures implemented through the Amendment will result in any changes in the distribution or level (i.e., number of traps/trawls set) of trap/pot effort in this area

of GB relative to pre-Amendment conditions. In addition, as the fishing grounds for trap/pot fisheries are well established on GB, to avoid introducing new gear conflicts, it is not expected that post-Amendment, trap/pot fisheries will be forced to relocate from pre-existing fishing grounds as a result of other vessels (using other gear types) responding to the management measures implemented by the Amendment. Similarly, given the established fishing grounds of trap/pot fisheries on GB, combined with the desire to avoid gear conflicts both within and outside of the fishery, any post-Amendment changes to habitat or groundfish management areas (i.e., opening or closing an area to bottom tending gear) are not expected to create incentive for large shifts in trap/pot effort within or around these affected areas, or on GB overall. Should any shifts in pot trap effort occur post-Amendment, it is likely to be seen by those trap/pot vessels whose fishing grounds overlap with or are in close proximity to the management areas delineated or modified by the Amendment. Given this, any shifts in trap/pot effort are expected to be localized and not a result of a vessel attempting to gain access to an area that it previously had not fish.

To summarize, given the relatively consistent distribution and level of effort seen on GB pre-and post-Amendment, there was no detectable shift in effort onto GB from other regions (e.g., GOM, Mid-Atlantic). Based on this and the information provided above, post-Amendment fishing operations on GB for most gears are likely to remain similar to pre-Amendment conditions, and therefore, the management measures implemented under the Habitat Amendment did not appear to create any incentive for effort with most gear types to increase on GB. There does appear to be a localized shift in gillnet, bottom trawl, and scallop dredge effort following the implementation of the Amendment. As described in more detail below, the increase in gillnet effort resulted from management measures other than the implementation of the Amendment, and trawl effort remained the same overall but dispersed locally. Therefore, effort across the region only appeared to increase for scallop dredge. The impacts of these changes on protected species will be considered below.

7.8.1.7. Assessment of Risks to Protected Species

In the *Status of the Species* (section 4.0), Table 42 identifies the ESA-listed species and critical habitat that occur in the action area and that may be adversely affected (e.g., there have been observed and documented interactions in the fisheries or with gear type(s) similar to those used in the fisheries) by the proposed action. Of the species identified in Table 42, ESA listed species of large whales, sea turtles, and Atlantic sturgeon are likely to occur on GB and overlap with the fisheries operating in this region. Given the distribution and migration patterns of Atlantic salmon (see *Status of the Species*), it is extremely unlikely this species will occur and overlap with fisheries operating on GB. In addition, as manta rays have only been observed as far north as New Jersey, this species is not expected to occur on GB. Based on this information and the information provided in the *Status of the Species*, the following evaluation will only consider gear interaction risks to listed species of large whales, sea turtles, and Atlantic sturgeon. Taking into consideration this information, and our evaluation of fishing effort pre-and post-Amendment (see above), we evaluate how these risks may have changed with the implementation of the Amendment.

Large Whales on GB: Occurrence and Gear Interaction Risks

As provided in *Status of the Species*, North Atlantic right, fin, sei, and sperm whales are likely to occur on and around GB. North Atlantic right, fin, sei and sperm whales are likely to overlap

with fisheries operating on GB; however, not all fisheries operating in this region pose an entanglement risk to these species. As described above, the greatest entanglement risk to large whales is posed by fixed gear used in trap/pot or sink gillnet fisheries (see section 7).

Observed or documented interactions between ESA-listed large whales and other gear types fished on GB, such as bottom trawl and scallop dredge are non-existent (Henry et al. 2017, Henry et al. 2015, 2016, Henry et al. 2020, Henry et al. 2019). Based on this, interactions between these gear types and North Atlantic right, fin, sei, and sperm whales are extremely unlikely to occur.

Sea turtles on GB: Occurrence and Gear Interaction Risks

As described in the *Status of the Species*, sea turtles arrive in this region in the summer (around June) and leave the area in the fall (generally by the end of November). Of the gear types fished on GB, gillnet, trap/pot, scallop dredge, and/or bottom trawl gear pose the greatest interaction risk to sea turtles (Murray 2011, 2015a, b, 2018, 2020, Murray and Orphanides 2013, Warden 2011a, b), NEFSC observer/sea sampling database, unpublished data; STDN, unpublished data). Although sea turtles are at risk of interacting with these gears, relative to the Mid-Atlantic, observed or reported fishery interactions in this region are infrequent (Murray 2011, 2015a, b, 2018, 2020, Murray and Orphanides 2013, Warden 2011a, b), NEFSC observer/sea sampling database, unpublished data; STDN, unpublished data). The infrequency of observed or reported sea turtle interactions on GB may, in part, be due to the degree of overlap between sea turtles and fisheries operating in this sub-region. Encounter rates of hard-shelled species of sea turtles are higher in the Mid-Atlantic relative to the GOM and GB (Murray 2018, 2020).

Atlantic sturgeon on GB: Occurrence and Gear Interaction Risks

As provided in the *Status of the Species*, Atlantic sturgeon (adult and sub-adult) from any DPS have the potential to occur on GB. However, the level of overlap between Atlantic sturgeon and fisheries operating in this region is likely low given that the species is more likely to occur inshore of the 164 ft (50 m) depth contour. Of the gear types used on GB, gillnet and bottom trawl gear pose the greatest interaction risk to this species. Numerous interactions between Atlantic sturgeon and gillnet or bottom trawl gear have been observed in the Northwest Atlantic (NEFSC observer/sea sampling database, unpublished data). However, relative to sub-regions such as the GOM or SNE, observed interactions between Atlantic sturgeon and gillnet or bottom trawl gear on GB are infrequent (NEFSC observer/sea sampling database, unpublished data); this is likely due to Atlantic sturgeon's preference for waters inshore of the 164 ft (50 m) depth contour. Observed or reported interactions between Atlantic sturgeon and other gear types fished on GB (i.e., trap/pot, scallop dredge) are rare to non-existent (NEFSC observer/sea sampling database, unpublished data); based on this, interactions between these gear types and Atlantic sturgeon are extremely unlikely.

Summary of Co-occurrence and Gears that Pose a Risk to Listed Species

Given the information above, ESA-listed species of large whales, sea turtles, and Atlantic sturgeon are at risk of interacting with several gear types fished on GB, with some gear types posing more or less of an interaction risk than others. Table 79 provides a summary of those gear types that pose the greatest entanglement risk to listed species of large whales, sea turtles, and Atlantic sturgeon.

Table 79: Fishing gear types that pose the greatest entanglement risk to ESA-listed species of large whales, sea turtles, and Atlantic sturgeon

Listed Species Group	Gear Types
Large whales	Sink Gillnet; Pot/Trap
Sea turtles	Sink Gillnet; Bottom Trawl; Scallop Dredge; Pot/Trap
Atlantic sturgeon	Sink Gillnet; Bottom Trawl

7.8.1.8. *Assessment of Risk with the Implementation of the Habitat Amendment*

As described above, there is no evidence that the Habitat Amendment changed fishing behavior or effort for trap/pot gear fished on GB. Relative to operating conditions on GB prior to the Amendment, there is little to no change in the area fished or the quantity of fishing gear set on GB post-Amendment. Species occurrence and distribution may respond and adapt to changes in the marine environment (e.g., changes to prey availability, water temperature changes); however, the overall occurrence and broad scale distribution of these species on GB has remained relatively consistent from pre-Amendment to post-Amendment. As the degree of overlap between listed species and these gear types on GB in future fishing years is expected to remain similar to the overlap prior to the Amendment, pre- or- post Amendment, the likelihood of an interaction occurring in any area of GB is expected to be the same.

Post-Amendment, fishing data did show a change in bottom trawl fishing effort on GB. Bottom trawl fisheries on GB overlapped with ESA-listed species prior to the Amendment, posing a level of interaction risk to these species. The changes in effort observed post-Amendment, therefore, have the potential to modify the preexisting level of risk. Specifically, listed species potentially affected by any post-Amendment changes in bottom trawl effort on GB are sea turtles and Atlantic sturgeon (Table 79). As described above, bottom trawl gear became more dispersed post-Amendment. While there were localized shifts in bottom trawl effort, overall bottom trawl effort on GB did not increase. Given that bottom trawl vessels are fishing the same general area as they had pre-Amendment, changes in bottom trawl operations (i.e., increase the amount of bottom trawl gear fished or increase the gear tow duration), due to implementation of the Amendment, are not expected. As described above, the overall occurrence and broad scale distribution of listed species of sea turtles and Atlantic sturgeon on GB has remained relatively consistent from pre-Amendment to post-Amendment. Therefore, the degree of overlap between listed species and bottom trawl gear in future fishing years is expected to remain similar to the overlap prior to the Amendment. While these species may move between areas of Georges Bank, the interaction risk is relatively constant across the area. Therefore, the local movements do not change the likelihood of an interaction.

Post-Amendment, fishing data showed that, although the overall magnitude of gillnet effort did not change on GB, there was a localized increase in gillnet effort in the waters off Chatham, Massachusetts. This area off Chatham is an established gillnet fishing ground for numerous fisheries targeting stocks such as monkfish, skate, and spiny dogfish. Vessels fishing with gillnet gear on GB overlapped with ESA-listed species prior to the Amendment, posing a level of interaction risk to these species. The changes in effort observed post-Amendment, therefore, have the potential to modify this pre-existing level of risk. Specifically, listed species potentially affected by any post-Amendment changes in gillnet effort on GB are large whales, sea turtles,

and Atlantic sturgeon (Table 79). With respect to the removal of the CA I Closure Area and the implementation of the GSC HMA, the review of fishing data showed no indication that these changes caused a shift in gillnet effort, locally or regionally, and the relative distribution and overall magnitude of gillnet effort remained similar to pre-Amendment conditions. The localized increase in gillnet effort detected in the VTR data post-Amendment occurred in an area of GB that had never been closed to fishing, and in an area that has been, and continues to be, predominantly fished with gillnet gear. Given these factors, the cause for the localized increase in effort is not expected to be due to the measures implemented under the Amendment; this determination was further confirmed by policy analysts with NMFS Sustainable Fisheries Division. Between 2017 and 2018, numerous fishery management actions were authorized and implemented. Many of these actions (e.g., extra-large mesh gillnet sector exemptions from the Multispecies FMP, modifying the management uncertainty buffer in the Monkfish FMP, inclusion of a new stock in the Skate FMP) provided gillnet fishermen more opportunity to target and land managed fish stocks, specifically monkfish, skate, and dogfish, whose total stock biomass was high. As monkfish, skate, and spiny dogfish commonly occur in the waters off Chatham, Massachusetts, these waters are important fishing grounds for vessels operating out of nearby ports. Given this, it is likely that the fishery management regulations implemented between 2017 and 2018 provided incentive for existing vessels to take additional gillnet trips in this area of GB given the increased opportunity to land, rather than discard, these targeted species. Although there was an apparent increase in effort in this area of GB, given the increased biomass of these managed fish stocks and increased opportunity to land these species, it is likely that fishing efficiency increased in these waters. Rather than reflecting an increase in gear in the water, an increase in fishing efficiency can indicate a decrease in gillnet soak time as catch per unit effort (CPUE) increases with the increase in stock biomass. This, in turn, can result in an increase in trips taken to the fishing grounds to tend (haul back) gear and land fish; this is supported by the VTR data reviewed over this timeframe. An increase in CPUE and a decrease in gillnet soak duration reduces the potential for sea turtles, large whales, or Atlantic sturgeon to encounter and interact with this gear type. Given the fishery management measures taken in 2017 and 2018, the localized increase in gillnet effort on GB would have occurred regardless of the measures implemented under the Amendment.

While there were localized shifts gillnet effort post-Amendment, overall gillnet effort on GB did not increase as a result of the management measures implemented under the Habitat Amendment. The overall distribution of gillnet gear remained relatively the same, with small (insignificant) shifts in or around pre-Amendment fishing grounds on GB. Given that gillnet vessels are fishing the same general area as they had pre-Amendment, changes in gillnet operations (i.e., increase the amount of gillnet gear fished) or increases in the gear soak duration due to implementation of the Amendment are not expected. As described above, the overall occurrence and broad scale distribution of listed species of large whales, sea turtles, and Atlantic salmon on GB has remained relatively consistent from pre-Amendment to post-Amendment. Given the above, the degree of overlap between listed species and gillnet gear in future fishing years is expected to remain similar to the overlap prior to the Amendment. While these species may move between areas of Georges Bank, the interaction risk is likely relatively constant across the area. Therefore, the local movements do not change the likelihood of interactions.

Post-Amendment, fishing data also showed a localized change in scallop dredge effort on GB. Scallop vessels fishing with dredge gear overlapped with ESA-listed species prior to the

Amendment, posing a level of interaction risk to these species. The changes in effort observed post-Amendment, therefore, have the potential to modify this preexisting level of risk. Specifically, listed species potentially affected by any post-Amendment changes in scallop dredge effort on GB are sea turtles and Atlantic sturgeon, the only listed species known to interact with this gear type. In addition, there appeared to be an increase in the number of trips in the area formerly designated as the CA I North Habitat Closure (currently designated as the CA I Access Area under the Scallop FMP). Given the duration of time this area was closed to the scallop fishery pre-Amendment, a healthy biomass of scallops became established in the former CA I North Habitat Closed Area. Once opened via the scallop rotational area management program, vessels redirected effort into the area to harvest these scallops. With a high biomass of harvestable scallops, there is likely to be a decrease in a scallop dredge vessel's area swept as the catch per unit effort is higher. A decrease in area swept equates to scallop dredge gear being present for less time in the water/on the bottom, which in turn, reduces the potential for sea turtles or Atlantic sturgeon to encounter and interact with this gear type. As described above, the shift in effort post-Amendment was local with pre-existing effort located outside the boundaries of the former CA I Closure Area shifting inside the former Closure Areas. These are areas with similar likelihood of interaction. As a result, the observed shift is not expected to result in changes in encounter rates between listed species and gear, and therefore, sea turtle or Atlantic sturgeon bycatch on GB are likely to remain similar pre- and post-Amendment. In addition, species occurrence and distribution may respond and adapt to changes in the marine environment (e.g., changes to prey availability, water temperature changes); however, the overall occurrence and broad scale distribution of these species on GB has remained relatively consistent from pre-Amendment to post-Amendment. Given the above, the degree of overlap between listed species and gear in future fishing years is expected to remain similar to the overlap prior to the Amendment.

7.8.1.9. Measures in Southern New England (SNE)

Prior to the Habitat Amendment, the following Habitat and/or Groundfish Closure Areas existed in SNE; this information will serve to establish pre-existing fishing behavior and effort in SNE, particularly in and around these Closure Areas.

Nantucket Lightship (NLS) Habitat and Groundfish Closure Areas

Prior to the Amendment, the NLS Habitat and Groundfish Closure Areas were located south of Nantucket, MA, with a portion of the NLS Habitat Closure Area occurring within the boundaries of the NLS Groundfish Closure Area (Figure 62). Prior to the Amendment, the following management measures applied:

- NLS Habitat Closure Area: Bottom trawl, scallop dredge, and clam dredge gears prohibited. Pot/trap, sink gillnet, mid-water trawl, purse seine, and bottom longline gear permitted.
- NLS Groundfish Closure Area: Pot/trap, purse seine, clam dredge, and mid-water trawl gears permitted. With the exception of vessels belonging to the NE Multispecies sector program, all other vessels fishing with gear types capable of catching groundfish prohibited (e.g., sink gillnet, bottom trawl, bottom longline). Through sector exemptions

authorized by NMFS since 2013⁵⁹, sink gillnet, bottom trawl, and bottom longline gears could be set in portions of the Groundfish Closed Area (outside of the area overlapping the Habitat Closure). Clam and scallop dredge gear could also operate in specified portions of the Closed Areas (i.e., outside of the area overlapping the Habitat Closure).

Prior to the Amendment, scallop dredge, bottom trawl, sink gillnet, and trap/pot gears were commonly used in areas of SNE. Scallop dredge effort was concentrated within the Northeast corner of the NLS Groundfish Closure Area (which is a scallop Access Area) and in waters north of the NLS Closure Areas (i.e., Great South Channel, waters off the western boundary of CA I Closure Areas). Bottom trawl effort was common in waters off Rhode Island, southern Massachusetts (e.g., Nantucket Sound, waters south of Martha's Vineyard and Nantucket), and in waters to the west and south (i.e., along the continental shelf edge) of the Closure Areas; some effort was located along the Northwest corner of the Closure Areas. Sink gillnet effort was common along the western and south-western boundary of the NLS Groundfish Closed Area. In addition, through sector exemptions (see above), limited sink gillnet effort occurred within the boundaries of the NLS Groundfish Closed Area prior to the Amendment. Pot/trap effort was common in this area of SNE (both within and outside of the Closure Areas), with the number of traps per square mile in this area of SNE estimated to be approximately ≤ 10 traps per square mile (Fig. 4.1.3.a in NMFS 2020b).

Relative to pre-Amendment conditions in this area of SNE, the Amendment implemented the following management measures (Figure 62).

- Removed the NLS Habitat and Groundfish Closure Areas.⁶⁰

⁵⁹ For sector exemptions authorized since 2013, see: 78 FR 25591, May 2, 2013; 78 FR 53363, August 29, 2013; 78 FR 76077, December 16, 2013; 79 FR 22043, April 21, 2014; 79 FR 23278, April 28, 2014; 80 FR 25143, May 1, 2015; 82 FR 39363, August 18, 2017 ; 82 FR 19618, April 28, 2017; 83 FR 18965, May 1, 2018; 83 FR 34492, July 20, 2018; 84 FR 17916, April 26, 2019; 85 FR 23229, April 27, 2020.

⁶⁰ Pursuant to a October 28, 2019, [Court Order](#), NMFS issued a rule (84 FR 68798, December 17, 2019) suspending the Amendment's opening of the NLS Groundfish Closure Area to gillnet fishing and restoring prior regulations prohibiting gillnet gear from fishing in this area until further notice

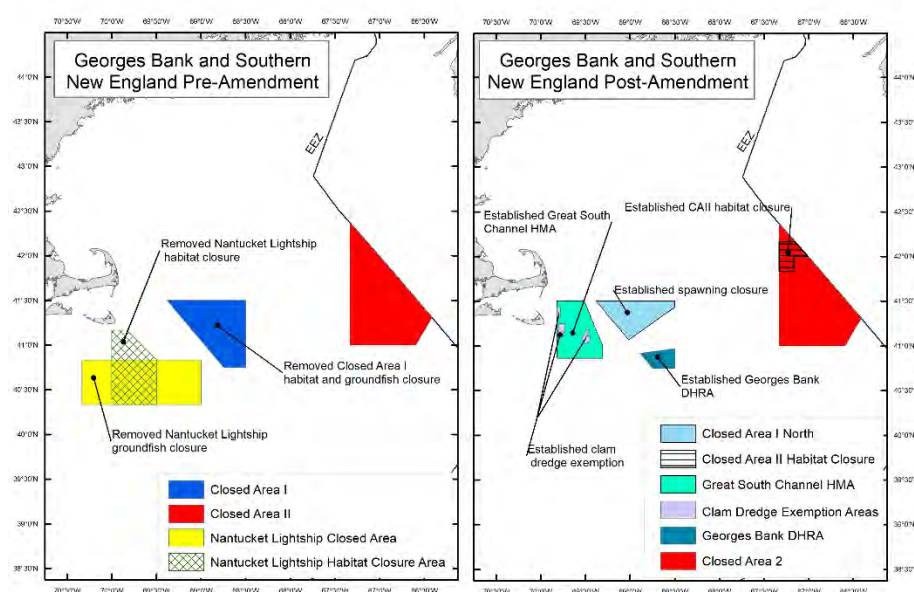


Figure 62: Habitat and groundfish management Areas in SNE (and on GB) pre- and post-Habitat Amendment

In addition, subsequent to changes in SNE from the Habitat Amendment, the Scallop FMP, adjusted and/or expanded the boundaries of the NLS Access Area post-Amendment (83 FR 17300, April 19, 2018; 84 FR 11436, March 27, 2019; 85 FR 17754, March 31, 2020). However, to date, the overall footprint of the Access Area has remained relatively the same. Relative to pre-existing operating conditions, there is the potential that the management measures implemented through the Amendment (and further changed by the Scallop FMP) may change fishing effort/behavior in this area of SNE. Figures provided in Appendix 2 depict the distribution of trips using sink gillnet, bottom trawl, and scallop dredge gear in SNE pre- and post- Amendment.

The removal of the NLS Habitat and Groundfish Closure Areas post-Amendment resulted in a shift of scallop dredge effort into the newly opened areas. VTR data (Figure 63) suggests that, with this shift, there was also an increase in effort, particularly in the former NLS Habitat Closure Area. As scallop dredge vessels were previously restricted from accessing the NLS Habitat Closure Area, the opening post-Amendment created an incentive for scallop dredge vessels to redirect effort into formerly closed areas. This opening; however, is not unrestricted as the level of scallop dredge effort is constrained by the Scallop FMP's rotational management program (e.g., expanding, and opening or closing an Access Area)⁶¹.

In the pre-Amendment maps, the NLS Access Area was opened to scallop fishing. This, combined with the gear prohibitions in the NLS Habitat and Groundfish Closure Areas, explains the distribution of scallop dredge effort in and around the boundaries of these management areas

⁶¹ Between 2016 and 2019, the Scallop FMP's NLS Access Area was closed to scallop fishing in 2016 (80 FR 22119, April 21, 2015) and opened to scallop fishing in 2017 (82 FR 15155, March 27, 2017), 2018 (83 FR 17300, April 19, 2018), and 2019 (84 FR 11436, March 27, 2019).

over this timeframe. The combination of opening the areas and the subsequent scallop actions likely resulted in the shift in scallop dredge effort to this area of SNE post-Amendment (Figure 63B). Given the proximity of the newly established GSC HMA to SNE, there may also be some localized shifts in effort from the GSC HMA to areas south of this HMA where there are pre-existing fishing grounds located around and, when open under the scallop rotational management program, in the NLS-Access Area; this is supported by maps provided in Figure 63. While there was an increase in effort in the area formerly designated as the NLS Groundfish Closure Area post-Amendment, there was no apparent increase in overall scallop dredge effort in SNE. Below, the analysis assesses whether this change in effort subsequent to the Habitat Amendment resulted in increased risks to protected species.

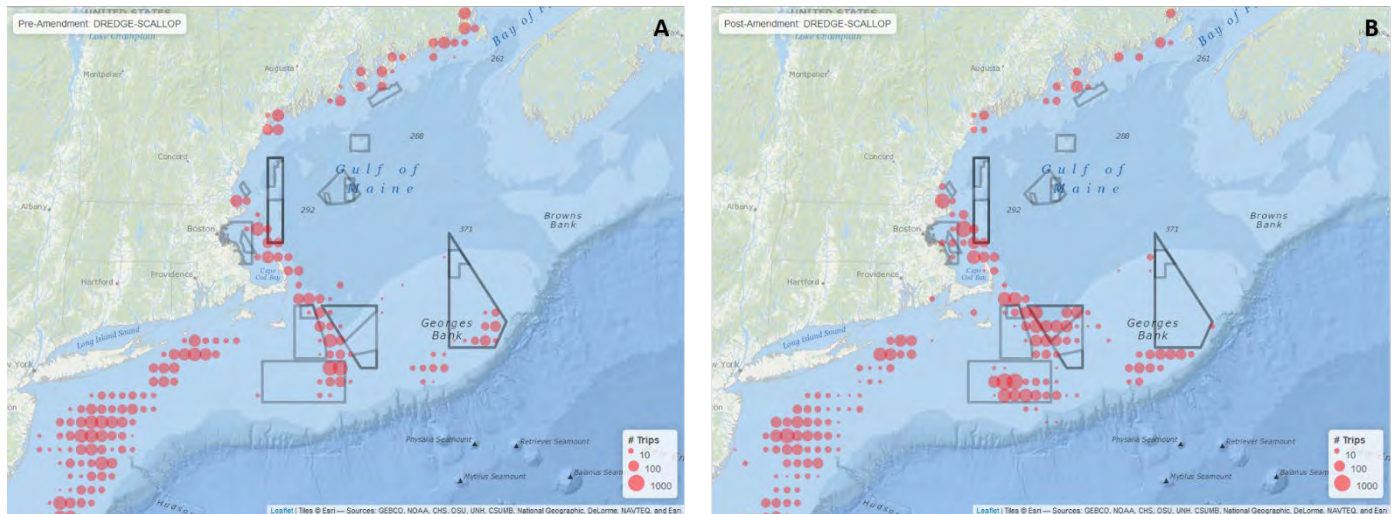


Figure 63: Scallop dredge VTRs pre-and post- Habitat Amendment. Figure A=Pre-Amendment (September 1, 2016-March 31, 2018) and Figure B=Post Amendment (April 1, 2018-October 31, 2019) (see Appendix 2)⁶²

Prior to the Amendment, gillnet gear was commonly set along the western and southwestern boundary of the NLS Groundfish Closure Area. There were also exemptions to the NLS Groundfish Closure Area that allowed gillnet vessels, through sector exemptions, to fish in these areas prior to the Amendment. While the Amendment's removal of the NLS Closure Areas has the potential to result in a shift in gillnet effort, any shift is likely to be minor relative to overall gillnet operating conditions prior to the Amendment. Specifically, any changes in gillnet fishing effort are likely to be localized, with existing gillnet effort redistributing into the now "opened" area, resulting in a change in the distribution of gillnet gear. However, the incentive to shift effort will be highly dependent on: (1) the status of the target stock(s) in the area; and (2) competition for access to fishing grounds with vessels (e.g., scallop, trap/pot) that have pre-existing fishing access to the area. This is supported by the VTR effort data (Figure 64). Based

⁶² This figure does not depict the boundaries of the Scallop FMP's Rotational Management Areas. The boundaries delineating the (prior) NLS Habitat and Groundfish Management Area in Figure 63 are, in general, reflective of the area encompassed by the NLS Scallop Rotational Area. For details on the Scallop FMP's Rotational Management Area, see <https://www.fisheries.noaa.gov/resource/map/atlantic-sea-scallop-managed-waters-fishing-year-2020>.

on these maps, there is little difference in the distribution or magnitude of sink gillnet effort in SNE. There was no large shift of gillnet effort from within or outside of the region into the area formerly designated as the NLS Habitat and Groundfish Closure Areas. If a large shift in gillnet effort had occurred post-Amendment, it is likely that gillnet gear would be more concentrated in SNE, particularly in and around the former NLS Closure Areas. As provided in Figure 64, this did not occur. Based on this, the removal of the NLS Closure Areas provided little incentive to change gillnet effort in SNE. Although the effort post-Amendment (Figure 64B) captures a limited period of time, it is likely the pattern of fishing behavior and effort shown in the map is reflective of future effort in the area. Taking into consideration this information and the information provided in Figure 64, implementation of the Habitat Amendment resulted in small, localized shifts in gillnet effort in SNE; large shifts in effort from other regions outside of SNE were not apparent.

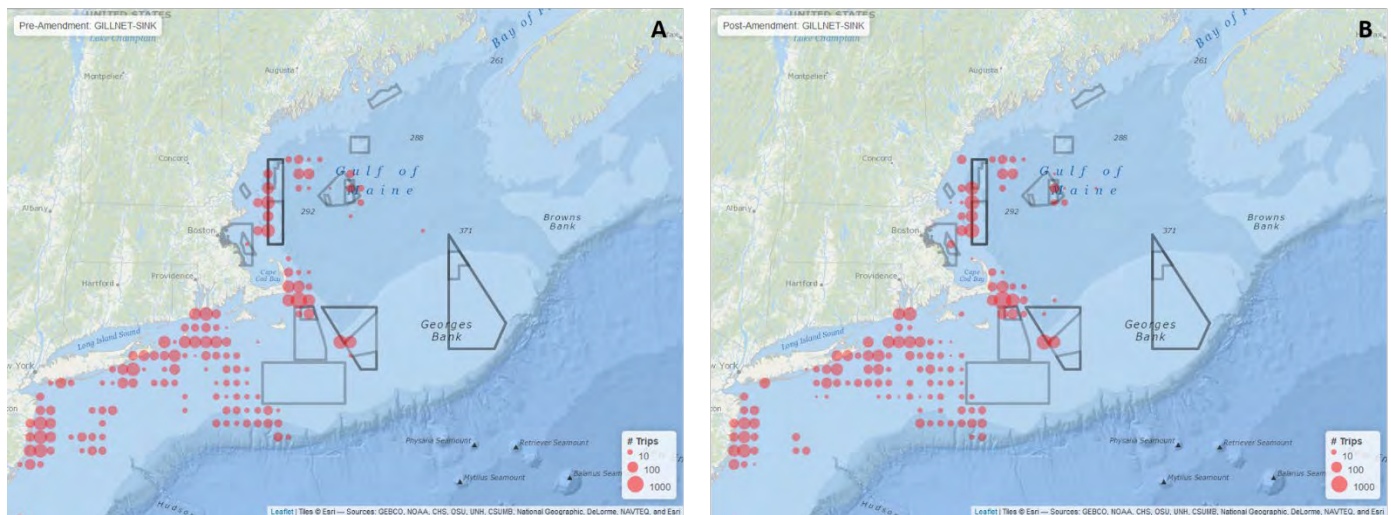


Figure 64: Sink gillnet VTRs pre-and post-Habitat Amendment. Figure A=Pre-Amendment (September 1, 2016-March 31, 2018) and Figure B=Post Amendment (April 1, 2018-October 31, 2019) (see Appendix 2)

Prior to the Amendment, while there was some bottom trawl effort along the Northwest corner of the Closure Area (Appendix 2), most effort appeared to be concentrated in waters off Rhode Island, southern Massachusetts (e.g., Nantucket Sound, waters south of Martha's Vineyard and Nantucket) and to waters west and south (i.e., along the continental shelf edge) of the NLS Closure Areas. While the Amendment's removal of the NLS Closure Areas has the potential to result in a shift in bottom trawl effort, any shift is likely to be minor relative to operating conditions prior to the Amendment. Specifically, changes in bottom trawl fishing effort are likely to be localized, with existing bottom trawl effort redistributing into the now "opened" area, resulting in a change in the distribution, but not quantity, of bottom trawl gear towed in SNE. However, the incentive to shift effort is highly dependent on: (1) the status of the target stock(s) in the area; and (2) competition for access to fishing grounds with vessels (e.g., scallop, trap/pot) that fished the area pre-Amendment. This is supported by the VTR data (Figure 65) which show little difference, pre- and post-Amendment, in the distribution or level of bottom trawl effort in SNE, specifically within the area formerly designated as the NLS Closure Areas. Based on this, the removal of the NLS Closure Areas provided little incentive to change bottom trawl effort in SNE. Although the post-Amendment effort (Figure 65B) captures a limited period of time, it is likely the pattern of fishing behavior and effort shown in the map is reflective of future effort in

the area. Although a limited time was available for this analysis, it is long enough to detect even modest shifts in effort as described above for effort off Chatham. Taking into consideration this information and the information provided in Figure 65, implementation of the Habitat Amendment resulted in small, localized shifts in bottom trawl effort in SNE; however, large shifts in effort from other regions outside of SNE were not apparent.

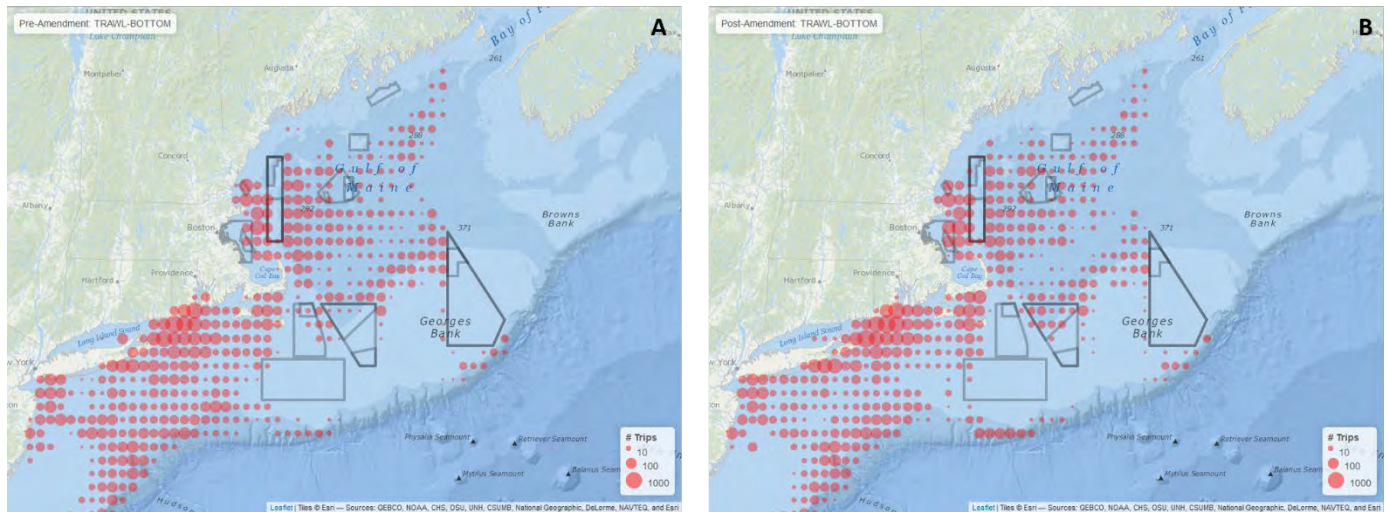


Figure 65: Bottom trawl VTRs pre-and post- Habitat Amendment. Figure A=Pre-Amendment (September 1, 2016-March 31, 2018) and Figure B=Post Amendment (April 1, 2018-October 31, 2019)

Pot/trap gear, the other gear type commonly found in SNE, has never been restricted in the area previously designated as the NLS Habitat and Groundfish Closure Areas. Trap/pot fisheries have operated throughout the region both inside and outside of the Closed Areas. Given that access to areas for this gear has not changed, the management measures implemented through the Amendment are not expected to provide incentive for the distribution or level (i.e., number of traps/trawls set) of trap/pot effort in this area of SNE to change relative pre-Amendment conditions. Specifically, as the fishing grounds for trap/pot fisheries are well established in SNE, post-Amendment, trap/pot fisheries are not expected to be forced to relocate from pre-existing fishing grounds as a result of other vessels (using other gear types) responding to the management measures implemented by the Amendment. Similarly, given the established fishing grounds of trap/pot fisheries in SNE, combined with the desire to avoid gear conflicts both within and outside of the fishery, any post-Amendment changes to habitat or groundfish management areas (i.e., opening or closing an area to bottom tending gear) are not expected to create incentive for large shifts in trap/pot effort within or around these affected areas, or in SNE overall. Should any shifts in pot trap effort occur post-Amendment, it is likely to be seen by those trap/pot vessels whose fishing grounds overlap with or are in close proximity to the management areas delineated or modified by the Amendment. Given this, any shifts in trap/pot effort are expected to be localized and not a result of a vessel attempting to gain access to an area that it previously had not fish.

In conclusion, small, localized changes in effort were seen for bottom trawl, scallop dredge, and gillnet gear, and risk to ESA-listed species from these changes will be described below. Fishing in SNE with all other gear types remained similar to pre-Amendment conditions; for these gear types, any changes in area fished, quantity of gear set/towed, and/or placement of fishing gear in SNE are not expected. There was also no detectable shift in effort into SNE from other

surrounding sub-regions (e.g., GOM, Mid-Atlantic) for any gear type as a result of the management measures implemented under the Amendment.

7.8.1.10. Assessment of Risks to Protected Species

In the *Status of the Species* (see section 4), Table 42 identifies the ESA-listed species and critical habitat that occur in the action area and that may be adversely affected (e.g., there have been observed and documented interactions in the fisheries or with gear type(s) similar to those used in the fisheries) by the proposed action. Of the species identified in Table 42, ESA listed species of large whales, sea turtles, and Atlantic sturgeon are likely to occur in SNE and overlap with the fisheries operating in this region. Given the distribution and migration patterns of Atlantic salmon (see *Status of the Species*), it is extremely unlikely this species will occur and overlap with fisheries operating in SNE. In addition, as manta rays have only been observed as far north as New Jersey, this species is not expected to occur in SNE. Based on this information and the information provided in the *Status of the Species*, the following evaluation will only considered gear interaction risks to listed species of large whales, sea turtles, and Atlantic sturgeon. Taking into consideration this information, and our evaluation of fishing effort pre-and post-Amendment (see above), we then evaluate how these risks may have changed with the implementation of the Amendment.

Large Whales in SNE: Occurrence and Gear Interaction Risks

As provided in the *Status of the Species*, ESA-listed species of North Atlantic right, fin, sei, and sperm whales are likely to occur in SNE. North Atlantic right and fin whales, accounting for some seasonal variability, can consistently be found throughout this region (Hayes et al. 2019 Hayes et al. 2020, NOAA Right Whale Advisory Sighting System⁶³; OBIS-SEAMAP⁶⁴; WhaleMap⁶⁵). For North Atlantic right whales, a review of recent opportunistic sighting, acoustic, and aerial survey data indicate a high use area in SNE, specifically, the region south of Martha's Vineyard and Nantucket Islands (Davis et al. 2017, Hayes et al. 2020, Hayes et al. 2019, Leiter et al. 2017), NOAA Right Whale Advisory Sighting System, WhaleMap). Sei and sperm whales commonly occur in the deep waters off of SNE, predominantly in areas along the shelf edge, shelf break, and/or in ocean basins between banks; however, depending on season, incursions onto the continental shelf of SNE do occur, primarily when there is suitable prey availability (Hayes et al. 2020), OBIS-SEAMAP).

Given the above information, North Atlantic right, fin, sei and sperm whales are likely to overlap with fisheries operating in SNE; however, not all fisheries operating in this region pose an entanglement risk to these species. The greatest entanglement risk to large whales is posed by fixed gear used in trap/pot or sink gillnet fisheries. Fin, sei, and North Atlantic right whales have died or been seriously injured from entanglement in fishing gear along the Gulf of Mexico Coast, U.S. East Coast, and Atlantic Canadian Provinces from 2012 to 2018; however, there have been no confirmed M/SI from entanglement in fishing gear for sperm whales since 2011⁶⁶ (Hayes et

⁶³ <https://fish.nefsc.noaa.gov/psb/surveys/MapperiframeWithText.htm>

⁶⁴ <http://seamap.env.duke.edu/>

⁶⁵ <https://whalemap.ocean.dal.ca/WhaleMap/>

⁶⁶ A sperm whale was reported entangled in monkfish net on the Canadian Grand Banks in 2011, but was released alive and gear free Ledwell and Huntington 2012 as cited in Waring et al. 2015.

al. 2020, Hayes et al. 2019, Henry et al. 2020, Henry et al. 2019, Waring et al. 2015, Waring et al. 2014).

There have been no observed or documented interactions between large whales and other gear types fished in SNE, such as bottom trawl and scallop dredge (Henry et al. 2017, Henry et al. 2015, 2016, Henry et al. 2020, Henry et al. 2019), see also NMFS' Marine Mammal Stock Assessment Reports: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region>). Based on this, interactions between these gear types and North Atlantic right, fin, sei, and sperm whales are extremely unlikely.

Sea turtles in SNE: Occurrence and Gear Interaction Risks

As described in the *Status of the Species*, sea turtles occur in continental shelf waters of SNE, arriving in this region between late spring and summer (May to June) and leave the area in the fall (approximately by the end of November). Gillnet, scallop dredge, and bottom trawl fisheries operating in SNE use gear types known to pose an interaction risk to sea turtles, and interactions with these gear types have been observed (NEFSC observer/sea sampling database, unpublished data). There have been no observed or documented interactions between leatherback sea turtles and scallop dredge gear in this sub-region (NEFSC observer/sea sampling database, unpublished data). Based on information provided by the GAR STDN (unpublished data), from 2009 through 2018, leatherback sea turtle have been reported entangled in vertical line gear, with multiple cases reported in SNE. In addition, based on data provided by the GAR STDN (unpublished data), hard-shelled sea turtles can become entangled in the vertical lines associated with trap/pot gear, with only one case reported in SNE.

Atlantic sturgeon in SNE: Occurrence and Gear Interaction Risks

As provided in *Status of the Species*, Atlantic sturgeon (adult and sub-adult), from any DPS, are likely to occur in SNE, primarily inshore of the 164-ft (50 m) depth contour. (Dunton et al. 2010, Laney et al. 2007, Stein et al. 2004a, b, Waldman et al. 2013, Wirgin et al. 2015b). However, excursions into deeper (e.g., 246 ft (75 m)) continental shelf waters have been documented (Collins and Smith 1997, Dunton et al. 2010, Erickson et al. 2011, Stein et al. 2004a, b, Timoshkin 1968). Of the gear types used in SNE, gillnet and bottom trawl gear pose the greatest interaction risk to this species. Numerous interactions between Atlantic sturgeon and gillnet or bottom trawl gear have been observed in the Northwest Atlantic, with many of these interactions observed in SNE (NEFSC observer/sea sampling database, unpublished data). Observed or reported interactions between Atlantic sturgeon and other gear types fished in SNE (i.e., trap/pot and scallop dredge) are rare to non-existent (NEFSC observer/sea sampling database, unpublished data); based on this, interactions between these gear types and Atlantic sturgeon are extremely unlikely.

Summary of Co-occurrence and Gears that Pose a Risk to Listed Species

Given the information above, ESA-listed species of large whales, sea turtles, and Atlantic sturgeon are at risk of interacting with several gear types fished in SNE, with some gear types posing more or less of an interaction risk than others. Table 80 provides a summary of those gear types that pose the greatest entanglement risk to listed species of large whales, sea turtles, and Atlantic sturgeon.

Table 80: Fishing gear types that pose the greatest entanglement risk to ESA-listed species of large whales, sea turtles, and Atlantic sturgeon.

Listed Species Group	Gear Types
Large whales	Sink Gillnet; Pot/Trap
Sea turtles	Sink Gillnet; Bottom Trawl; Scallop Dredge Pot/Trap
Atlantic sturgeon	Sink Gillnet; Bottom Trawl

7.8.2. *Assessment of Risk with the Implementation of the Habitat Amendment*

As described above, there is no evidence that the Habitat Amendment changed fishing behavior or effort for trap/pot gear fished in SNE. Relative to operating conditions in SNE prior to the Amendment, there is little to no change in the area fished or the quantity of fishing gear set or towed in SNE post-Amendment. Species occurrence and distribution may respond and adapt to changes in the marine environment (e.g., changes to prey availability, water temperature changes); however, the overall occurrence and broad scale distribution of these species in SNE has remained relatively consistent from pre-Amendment to post-Amendment. As the degree of overlap between listed species and trap/pot gear in SNE in future fishing years is expected to remain similar to the overlap prior to the Amendment, pre- or- post Amendment, the likelihood of an interaction occurring in any area of SNE is expected to be the same.

Post-Amendment fishing data did show some change in bottom trawl and gillnet fishing effort in SNE. Bottom trawl and gillnet fisheries in SNE overlapped with ESA-listed species prior to the Amendment, posing a level of interaction risk to these species. The changes in effort observed post-Amendment, therefore, have the potential to modify this pre-existing level of risk. Specifically, listed species potentially affected by any post-Amendment changes in bottom trawl effort in SNE are sea turtles and Atlantic sturgeon; for gillnet gear, the listed species potentially affected are sea turtles, Atlantic sturgeon, and large whales (Table 80). While there were localized shifts in bottom trawl and gillnet effort post-Amendment, overall bottom trawl and gillnet effort in SNE did not increase. Bottom trawl gear became more dispersed post Amendment. The overall distribution of gillnet gear remained relatively the same, with small (insignificant) shifts in or around pre-Amendment fishing grounds in SNE. Given that vessels are fishing the same general area as they had pre-Amendment, changes in bottom trawl or gillnet operations (i.e., increase the amount of gillnet or bottom trawl gear fished) or increases in the gear soak or tow duration due to implementation of the Amendment are not expected. In addition, the overall occurrence and broad scale distribution of these species in SNE has remained relatively consistent from pre-Amendment to post-Amendment. Given the above, the degree of overlap between listed species and gear in future fishing years is expected to remain similar to the overlap prior to the Amendment. While these species may move between areas of SNE, the interaction risk is relatively constant across the area.

Post-Amendment fishing data also showed a change in scallop dredge effort in SNE. Prior to the Amendment, scallop vessels fishing with scallop dredge gear posed a level of interaction risk to listed species that overlapped with the scallop fishery. The changes in effort observed post-Amendment, therefore, have the potential to modify this pre-existing level of risk. Specifically, listed species potentially affected by any post-Amendment changes in scallop dredge effort in SNE are sea turtles and Atlantic sturgeon, the only listed species known to interact with this gear

type. Review of fishing data showed localized shifts in scallop dredge effort post Amendment; however, with this shift, there also appeared to be an increase in effort in the area formerly designated as the NLS Habitat Closure, and currently designated as the NLS Access Area under the Scallop FMP. Effort in this area is not unrestricted as accessibility is limited by the Scallop FMP's rotational management program. Given the duration of time this area was closed to the scallop fishery pre-Amendment, a healthy biomass of scallops became established in the former NLS Habitat Closed Area. Once opened, vessels redirected effort into the area to harvest these harvestable scallops. With a high biomass of harvestable scallops, there is likely to be a decrease in a scallop dredge vessel's area swept. A decrease in area swept equates to scallop dredge gear being present for less time in the water/on the bottom, which in turn, equates to a reduction in the potential for sea turtles or Atlantic sturgeon to interact with this gear type. In addition, as described above, the shift in effort post- Amendment was local; that is, pre-existing effort located outside the boundaries of the former NLS Habitat Closed Area, now shifted inside the former Closed Area. As a result, the observed shift is not expected to result in changes in encounter rates between listed species and gear, and therefore, sea turtle or Atlantic sturgeon bycatch in SNE are likely to remain similar pre- and post-Amendment. In addition, species occurrence and distribution may respond and adapt to changes in the marine environment (e.g., changes to prey availability, water temperature changes); however, the overall occurrence and broad scale distribution of these species in SNE has remained relatively consistent from pre-Amendment to post-Amendment. Given the above, the degree of overlap between listed species and gear in future fishing years is expected to remain similar to the overlap prior to the Amendment.

7.8.3. EFH and Habitat Areas of Particular Concern

The Magnuson-Stevens Act defines EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” The Habitat Amendment designated EFH for monkfish, numerous species of skates, the Atlantic sea scallop, Atlantic herring, the deep sea red-crab, Atlantic salmon, and numerous species from the Northeast multispecies complex (NEFMC 2016b). EFH designations do not implement additional fishing restrictions on their own. The Council took a comprehensive approach to minimizing to the extent practicable the adverse effects of fishing EFH across all species and life stages, focusing on those habitats most vulnerable to fishing impacts. In designating EFH, per 50 CFR part 600 (subpart J), the Amendment described and identified habitats or habitat types determined to be EFH for each life stage of the managed species. This included providing information on the physical, biological, and chemical characteristics of the EFH and, if known, how these characteristics influence the use of EFH for the species/life stage. With this information, the Amendment identified the specific geographic location and extent of the EFH for each species.

The Amendment also identified multiple Habitat Areas of Particular Concern (HAPC). HAPCs highlight specific types or areas of habitat within EFH that are particularly vulnerable to human impacts (e.g., fishing and non-fishing impacts), and therefore, may need some manner of protection. However, the designation of a HAPC itself does not necessitate the implementation of specific management measures, such as gear restrictions, to protect the area. No management measures were implemented as part of the HAPC designations in the Amendment (NEFMC 2016b), although many of the habitat management areas described above cover HAPCs that were designated because of its vulnerability to fishing impacts.

As the designation of EFH and HAPCs in the GOM, GB, and SNE did not implement any management measures, these designation are not expected to have an effect on fisheries

operating within these regions. As provided above, interaction risks with listed species are strongly associated with the quantity of gear in the water (e.g., number of vertical lines, gillnets, trawls), gear soak/tow duration, and the temporal and spatial overlap of the gear and protected species. Taking into consideration this and the information provided above, relative to operating conditions prior to the Amendment, the Habitat Amendment's designation of EFH or HAPC will not effect: (1) temporal and spatial overlap between gear and listed species of sea turtles, fish and whales; (2) quantity of gear set or towed, and/or, (3) gear soak or tow duration. Based on this, the designation of EFH or HAPC through the Habitat Amendment is not expected to result in new or elevated interaction risks to any listed species in the GOM, on GB, or in SNE.

7.8.3.1. *Spawning Protection Areas*

Prior to the Habitat Amendment, the following spawning protection areas existed in the GOM or on GB:

- GOM Cod Spawning Protection Area (i.e., Whaleback; Figure 66)⁶⁷: From April 1 through June 30 of each year, this area was closed to all fishing and fishing vessels except for: (1) Vessels that did not have a federal Northeast Multispecies permit and are fishing exclusively in state waters; (2) charter and party or recreational vessels; and, (3) vessels fishing with exempted gears (e.g., pots and traps, purse seines, surfclam/quahog dredge gear, pelagic hook and line).
- GB Seasonal Spawning Closure Area (Figure 67)⁶⁸: From May 1 to May 31, no fishing vessel or person on a fishing vessel could enter, fish, or be in the area except for vessels fishing: (1) with exempted gears (e.g., pots and traps, purse seines, mid-water trawl, surfclam/quahog dredge gear, pelagic hook and line); (2) with scallop dredge gear under a scallop DAS; (3) in the CA I Hook Gear Haddock Access Area; (4) under the restrictions and conditions of an approved NE Multispecies sector operations plan; and (5) under the provisions of a Northeast multispecies Handgear A or B permit.

⁶⁷ 76 FR 23042 (May 1, 2011) designated the GOM Cod Spawning Protection Area.

⁶⁸ 79 FR 21658 (April 24, 2000) designated the GB Seasonal Spawning Closure Area.

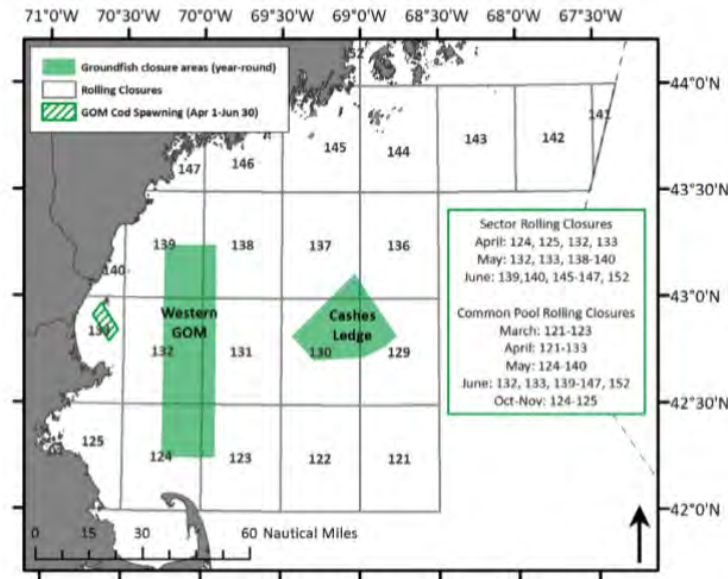


Figure 66: GOM Cod Spawning Protection Area

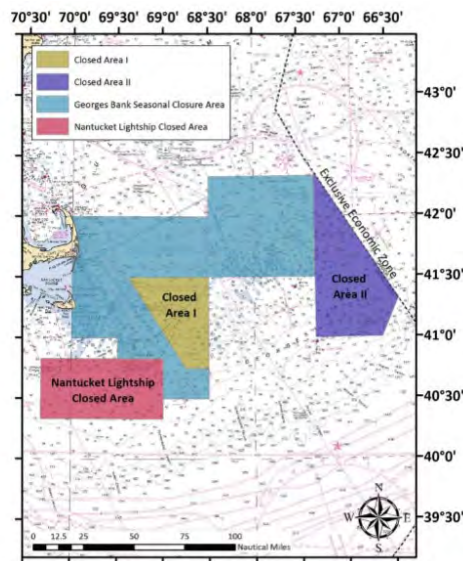


Figure 67: GB Seasonal Spawning Closure Area

Given the: (1) gear restrictions in the GOM or GB Spawning Protection/Closure Areas; (2) duration of time in which both Closed Areas have remained in place (i.e., ≥ 9 years); and, (3) implementation of sequential (later termed rolling) closures to protect GOM cod since 1998, with the most recent adjustment in 2015 (63 FR 15326, March 31, 1998; 80 FR 25110, May 1, 2015), fishing behavior and effort was well established in this area of the GOM and on GB prior to the Amendment. Fishing in or around the Closed Areas was predominately by vessels using bottom trawl, sink gillnet, scallop dredge, and/or trap/pot gear; other gear types fished in or around the Closed Areas included clam dredge, mid-water trawl, bottom longline, and purse seine.

Relative to pre-Amendment conditions in this area of the GOM or GB, the Amendment implemented the following management measures:

- Maintained the GOM Cod Spawning Protection Area (i.e., Whaleback). Gear restrictions and exemptions remain unchanged.
- Established the Winter Massachusetts Bay Spawning Closure. From November 1–January 31 of each year, the area is closed to all fishing vessels, with the same exemptions as those specified in the GOM Spawning Protection Area (i.e., Whaleback).
- Established the Spring Massachusetts Bay Spawning Protection Measure. From April 15–April 30), within statistical area 125, this area is closed to all vessels, except for vessels that are: (1) fishing in state waters that do not have a federal Northeast multispecies permit; (2) fishing with exempted gears; (3) in the midwater trawl and purse seine exempted fisheries; (4) fishing with scallop dredges on a scallop day-at-sea; (4) fishing in the scallop dredge exemption area; and, (5) charter, party, and recreational.
- Removed the GB Seasonal (May) Spawning Closure Area.

Prior to the Amendment, the GB Seasonal Spawning Closure restricted fishing access to the area during the month of May; however, there were exemptions to this rule as scallop dredge, purse seine, mid-water, trap/pot, and hydraulic clam dredge gears were permitted to operate in the area. In addition, vessels belonging to the NE Multispecies sector program or operating under the provisions of a Northeast multispecies Handgear A or B permit were exempted from the seasonal closure. The majority of fishing effort under the Northeast Multispecies FMP is by vessels enrolled in groundfish sectors. For example, during the NEFMC's April 2020 meeting, the groundfish working group provided a review of the groundfish catch share program. Review of the working group's report indicated that between fishing years 2016 and 2018, active sector vessels comprised the majority of the groundfish fleet (see Working Group Report: <https://www.nefmc.org/library/april-2020-groundfish-report>). Specifically, the report showed that between fishing years 2016 through 2018, there were between 190 to 215 active sector vessels, compared to 45 to 48 active common pool vessels. In addition, data from limited access groundfish vessels show that during each year from 2010-2015, more than 97 percent of annual groundfish revenue was earned by sector vessels and more than 80 percent of annual groundfish trips were taken by sector vessel (Murphy et al. 2018). Data also show that during each year from 2016-2019, more than 63 percent of active common pool vessels were issued Handgear A or Handgear B permits. During this period, more than 36 percent of common pool trips and more than 21 percent of groundfish landings were attributed to these vessels annually (permit and DMIS data as of 5/29/20; GARFO; run on June 17, 2020). Given the predominance of vessels enrolled in the sector program, few vessels belonging to the NE Multispecies FMP were restricted from fishing in this area prior to the Amendment. Therefore, the GB Seasonal Spawning Closure affected a relatively small number of vessels and likely had a limited overall impact on the distribution of fishing effort in the Georges Bank region.

Relative to operating conditions prior to the Amendment, there was little to no changes in the distribution or level of fishing effort in this area of GB, as a result of the Amendment's removal of the GB Seasonal Spawning Closure; this is supported by figures provided in Appendix 2. Specifically, vessels that were permitted to operate in the former Closed Area will continue to do so. For the limited number of vessels previously affected by the May Closure, there is no evidence that the removal of the closure created any incentive for effort to change or redistribute in a manner that differed from pre-Amendment operating conditions in the region (see Appendix 2). At most, these vessels will likely remain in the area instead of shifting effort to other regions during the month of May.

In the GOM, specifically the WGOM, the Amendment implemented two new Spawning Protection/Closure Areas, in addition to maintaining the Spawning Protection Area known as “Whaleback.” The introduction of two additional spawning closures is likely to result in vessels that fished in these areas year-round shifting just outside of the closure’s boundaries or to other waters of the WGOM. However, this is limited by the relatively small size of the newly designated spawning protection areas in relation to available fishing grounds in the GOM and the restricted duration of time operational management measures are in place. There is no evidence that the management measures implemented through the Amendment resulted in an overall change in fishing behavior or effort in this region of the GOM, relative to operating conditions prior to the Amendment (see Appendix 2). At most, relative to fishing behavior/effort in the GOM prior to the Amendment, changes in fishing behavior or effort, as result of the Amendment’s implementation of additional Spawning Protection/Closure Areas in the GOM, were small and localized.

7.8.4. *Framework Adjustments and Monitoring*

The Habitat Amendment identified several administrative measures associated with the review and regulatory adjustment of habitat management measures outlined in the Amendment. Implementation of the Habitat Amendment resulted in the authorization of these measures. Specifically, the designation or removal of HMAs and changes to fishing restrictions within HMAs may be considered in a framework adjustment. Processes to evaluate the performance of habitat and spawning protection measures, as well as for the Council to identify and periodically revise research priorities to improve habitat and spawning area monitoring, were established through the Amendment.

Taking into consideration the above information, the administrative measures implemented through the Amendment are procedural and therefore, in and of themselves, will not cause the operation of the fisheries (e.g., effort, behavior) in the GOM, on GB, or in SNE to change relative to operating conditions prior to the Amendment. Given this, the implementation of these measures are not expected to result in direct or indirect effects to listed species.

7.8.5. *Conclusion: Overall Impacts of the Habitat Amendment to ESA-listed species*

Fisheries operating in the GOM, on GB, or in SNE pose an interaction risk to listed species of sea turtles, large whales, Atlantic sturgeon, and/or Atlantic salmon both pre- and post-Amendment. The level of risk is affected by: (1) the quantity of gear in the water (e.g., number of vertical lines, gillnets, trawls), (2) gear soak/tow duration, and (3) the temporal and spatial overlap of the gear and a protected species. Although the Habitat Amendment removed, established, or maintained Habitat Management Areas, EFH and HAPCs, and Spawning Protection/Closure Areas in the GOM, on GB, or in SNE, as provided in the analyses above, the measures implemented through the Amendment did not result in increased risk to ESA-listed species.

Based on these analyses, there were no large shifts in the magnitude or distribution of effort and no evidence that the management measures implemented through the Habitat Amendment caused new or elevated interaction risks to ESA-listed species. Albeit it to varying degrees, a pre-existing level of risk to listed species of sea turtles, whales and fish existed in the sub-regions. As provided above, interaction risks with listed species are strongly associated with the quantity of gear in the water (e.g., number of vertical lines, gillnets, trawls), gear soak/tow duration, and the temporal and spatial overlap of the gear and protected species. While minor

shifts in effort and small increases were observed for some gears in some regions, these changes are not expected to increase the risk to protected species in any region for the reasons described above. Any shifts in effort observed were local and from areas with similar bycatch rates (i.e., the overlap of gear and species is similar). The small changes in effort that occurred from the implementation of the Habitat Amendment were restricted to changes within particular regions and for particular gears. As changes across regions were not observed, we would not expect the impact to protected species across all regions to differ from that which was assessed within a region. That is, all impacts to effort were localized. Based on these analyses, although the measures implemented through the Amendment are not expected to remove or reduce interaction risks to listed species, they are also not expected to result in new or increased interaction risks to these species relative to pre-existing conditions in the GOM, on GB, or in SNE. Given this, interactions risks to ESA-listed species of sea turtles, whales, and fish under post-Amendment operating conditions are not expected to differ from that which has been observed and considered by NMFS in its assessment of fishery interaction risks to these listed species (NMFS 2002a, 2012b, 2013b, 2014b) or in the analysis of effects above. Specifically, in the sections addressing the effects to listed species from gear interactions (sections 7.2 (large whales), 7.3 (sea turtles), 7.4 (Atlantic sturgeon), and 7.5 (Atlantic salmon), it was determined that the operation of the fisheries are likely to adversely affect ESA listed species.

In summary, after analyzing the relevant studies and data from nearly two seasons of post Habitat Amendment fishing activities, we have determined that the Amendment resulted in little to no change in fisheries behavior. Post Habitat Amendment data represent the best available science for determining the short term effects of this action as well as for predicting any potential future effect. We recognize that two seasons of data represents a limited study window; however, our analysis indicates that this time frame was sufficient to detect even modest shifts in effort (as we noted for the increased localized effort near Chatham). Because the measures implemented under the Habitat Amendment resulted in little to no change in the overall operation of the fisheries relative to pre-Amendment conditions, it is extremely unlikely that the number or severity of interactions to listed species will be different from what was estimated in these effects sections. Taking into consideration this and the information provided above, we have determined that effects to ESA-listed species following the implementation of the Habitat Amendment do not differ from the effects resulting from the authorization of the fisheries considered in this Opinion (see section 7) or the effects in underlying consultations on fisheries outside of this Opinion (e.g., Atlantic sea scallop).

8. CUMULATIVE EFFECTS

“Cumulative effects” are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR §402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

This section attempts to identify the likely future changes and their impact on ESA-listed species and their critical habitats in the action area. This section is not meant to be a comprehensive socio-economic evaluation, but a brief outlook on future changes in the environment. Projections are based upon recognized organizations producing best available information and reasonable

rough-trend estimates of change stemming from these data. However, all changes are based upon projections that are subject to error and alteration by complex economic and social interactions.

During this consultation, we searched for information on future state, tribal, local, or private (non-federal) actions reasonably certain to occur in the action area. We did determine that the implementation of the measures in the ALWTRP proposed rule is reasonably certain to reduce the risk of M/SI to right whales in state fisheries. As described in the *Environmental Baseline*, we estimate that an annual average of 3 right whale M/SI will be the result of entanglement with state fishing gear.

As described in the Proposed Action, NMFS is proposing federal regulatory measures to modify the ALWTRP. In addition to the proposed federal measures, modifications to the ALWTRP would include risk reduction measures implemented by the states of Maine and Massachusetts in exempted or state waters. In waters currently exempted from regulations under the ALWTRP, the Maine Department of Marine Resources will require weak insertions. Maine has already implemented gear marking requirements consistent with gear marking modifications proposed in the proposed rule. In 2021, Massachusetts Division of Marine Fisheries implemented a series of new regulations (322 CMR 12) to protect right whales. These measures expand upon the existing practices described in the *Environmental Baseline*. The new measures include: a February 1st through May 15th seasonal closure of all Massachusetts waters to trap gear fishing; a January 1st through May 15th closure of Cape Cod Bay and certain adjacent waters to gillnet gear; and a March 1st through April 30th speed limit for small vessels operating in Cape Cod Bay and certain adjacent waters. Each of these seasonal restrictions may be extended beyond their end date in response to the continued presence of right whales in Massachusetts waters. Massachusetts will also restrict buoy line diameters within state waters to restrain the introduction of stronger line into the fishery. As described in the DEIS for the ALWTRP proposed rule, the combined federal and state measures, which include the state measures described here, will achieve a 60 percent reduction in risk to right whales.

Using results from the DST (see section 7.2), we determined the proportion of reductions in M/SI due to the ALWTRP measures that would occur in state fisheries vs. federal fisheries. As described in section 7.2.1, an annual average of 7.57 right whale entanglements are expected to result in M/SI as a result of entanglement in U.S. trap/pot gear. The DST shows that 39.6 percent of the risk to right whales in the U.S. occurs in state waters. Therefore, we determined that an annual average of 3 right whale M/SI were the result of entanglement in gear used in the state fisheries. The measures implemented under the ALWTRP proposed rule will reduce risk of right whale M/SI entanglements in trap/pot gear in state waters by 31.5 percent. A 31.5 percent reduction of the annual estimate of total U.S. entanglements in trap/pot gear (7.57) results in a reduction of 2.39 M/SI entanglements in state waters. We subtract this reduction (2.39) from the total estimated M/SI entanglements in gear used in the state fisheries (3) resulting in 0.61 M/SI entanglements remaining in the U.S. state fisheries. Given that we are reasonably certain this risk reduction to right whales will occur in the state fisheries, we have determined that an annual average of 0.61 M/SI right whale entanglements will occur as a result of gear used in the state fisheries (Table 62).

Other than the U.S. state fisheries, we did not find any information about non-federal actions other than what has already been described in the *Environmental Baseline* (see section 5), most of which we expect will continue in the future. An increase in these activities could similarly

increase their effect on ESA-listed species and, for some, an increase in the future is considered reasonably certain to occur. Given current trends in global population growth, threats associated with climate change, pollution, fisheries bycatch, aquaculture, vessel strikes and approaches, and sound are likely to continue to increase in the future, although any increase in effect may be somewhat countered by an increase in conservation and management activities. For the remaining activities and associated threats identified in the *Environmental Baseline* and *Climate Change* sections, and other unforeseen threats, the magnitude of increase and the significance of any anticipated effects remain unknown. The best scientific and commercial data available provide little specific information on any long-term effects of these potential sources of disturbance on ESA-listed species populations. Thus, with the exception of the risk reduction to right whale M/SI in state fisheries from measures implemented under the ALWTRP, this consultation assumes effects in the future would be similar to those in the past and, therefore, are reflected in the anticipated trends described in the *Status of the Species* (see section 4), *Environmental Baseline* (see section 5), and *Climate Change* (see section 6) sections.

9. INTEGRATION AND SYNTHESIS OF EFFECTS

The *Status of Species*, *Environmental Baseline*, *Climate Change*, and *Cumulative Effects* sections of this Opinion discuss the natural and human-related factors that caused right, fin, sei, and sperm whales; Northwest Atlantic DPS of loggerhead, leatherback, Kemp's ridley, and North Atlantic DPS of green sea turtles; the five DPSs of Atlantic sturgeon; the GOM DPS of Atlantic salmon; and giant manta rays to become endangered or threatened and may continue to place those species at risk of extinction. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The present section of this Opinion applies that definition by examining the effects of the proposed action in the context of information presented in the *Status of the Species* (see section 4), *Environmental Baseline* (see section 5), *Climate Change* (see section 6) and *Cumulative Effects* (see section 8) sections to determine: (a) if the effects of the proposed action would be expected to reduce the reproduction, numbers, or distribution of the previously listed cetaceans, sea turtles, and fish, and (b) if any reduction in the reproduction, numbers, or distribution of these species causes an appreciable reduction in the species' likelihood of surviving and recovering in the wild.

In the 1998 NMFS/U.S. Fish and Wildlife Consultation Handbook, "survival" is defined as:

For determination of jeopardy/adverse modification: the species' persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species' entire life cycle, including reproduction, sustenance, and shelter.

"Recovery" is defined as "[i]mprovement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act."

The analytical process we undertake to make jeopardy determinations is described in regulation as:

Add[ing] the effects of the action and cumulative effects to the environmental baseline and in light of the status of the species and critical habitat, formulate the Service's opinion as to whether the action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. (50 CFR 402.14(g))

Our task then, when making a jeopardy determination, is to consider the biological significance of proposed action's effects on ESA-listed species and to assess whether the proposed action appreciably reduces the survival or recovery of a listed species.

We evaluate this in the context of the recovery plans for each species. Recovery plans include criteria, which, when met, would result in downlisting (changing the listing from endangered to threatened) or in a determination that the species be removed from the List of Endangered and Threatened Wildlife. Recovery criteria can be viewed as targets, or values, by which progress toward achievement of recovery objectives can be measured. Recovery criteria may include such things as population numbers and sizes, management or elimination of threats by specific mechanisms, and specific habitat conditions. In newer recovery plans, recovery criteria are often framed in terms of population parameters (Demographic Recovery Criteria) and the five listing factors (Listing Factor Recovery Criteria). For some species, the plans have not been recently updated and do not include specific Demographic and Listing Factor Recovery Criteria. Regardless of whether these are included, we evaluate each species in the context of the criteria and objectives in its recovery plan.

This Opinion has identified in the Effects of the Proposed Action (section 7) that the proposed action may adversely affect right, fin, sei, and sperm whales as a result of entanglement in gear fished in the fisheries. No other effects to ESA-listed cetaceans are expected as a result of the activity. This Opinion has also identified that the proposed action may adversely affect Northwest Atlantic DPS of loggerhead, leatherback, Kemp's ridley, and North Atlantic DPS of green sea turtles; the Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs of Atlantic sturgeon; giant manta rays; and the GOM DPS of Atlantic salmon because of interaction with gear used in the fisheries and, for sea turtles, strikes from vessels used in the fisheries. No other effects to designate ESA-listed sea turtles, Atlantic sturgeon, giant manta rays, or Atlantic salmon are expected as a result of this activity. Nor do we expect adverse effects to any designated critical habitat. The discussion below provides NMFS' determinations of whether there is a reasonable expectation that right, fin, sei, and sperm whales; loggerhead, leatherback, Kemp's ridley, and green sea turtles; Atlantic sturgeon; Atlantic salmon; and giant manta rays will experience reductions in reproduction, numbers, or distribution in response to these effects, and whether any reductions in the reproduction, numbers, or distribution of these species can be expected to appreciably reduce the species' likelihood of surviving and recovering in the wild.

9.1. North Atlantic Right Whale

The North Atlantic right whale population faces a high risk of extinction. The population size is small enough for the death of any individuals to have measurable effects in the projections on its population status, trend, and dynamics. As described above, our task is to consider the biological

significance of the proposed action's effects on North Atlantic right whales. We evaluate, based on the totality of the circumstances affecting the species and the best available scientific and commercial information, the nature and magnitude of the proposed action's effects, to determine whether such effects of the proposed action, while measureable, are consequential enough to appreciably reduce the species' likelihood of survival and recovery.

To evaluate whether the proposed is likely to jeopardize the continued existence of North Atlantic right whales, we qualitatively assessed the best available scientific and commercial data on right whales and developed a population projection model to quantitatively predict the female population trajectory over 50 years (Linden 2021). To determine if the proposed action is expected to appreciably reduce the likelihood of both the survival and the recovery of right whales in the wild, we must evaluate the effects of the fisheries as now proposed (section 7.2) considered in context of the *Status of the Species* (section 4), *Environmental Baseline* (section 5), *Climate Change* (section 6), and *Cumulative Effects* (section 8). Here, we review the information considered and provide the details of our analysis.

Information from the Status of the Species, Environmental Baseline, Climate Change, and Cumulative Effects Considered in the Analysis

As discussed in the *Status of the Species* section of this Opinion, North Atlantic right whales follow a general pattern of foraging at high latitudes (e.g., southern New England and Canadian waters) in the spring and summer months and calving at lower latitudes (i.e., off Florida) in the winter months. The North Atlantic right whale population has been declining since 2010 (Pace et al. 2017). Recent modeling efforts indicate that low female survival, a male biased sex ratio, and low calving success are contributing to the population's current decline (Pace et al. 2017). Using the methods in Pace et al. (2017), the most recent estimate is 368 (95 percent credible interval range of 356-378) individuals as of January 2019 (Pace 2021). The species has low genetic diversity, as would be expected based on its low abundance, and the species' resilience to future perturbations is expected to be very low (Hayes et al. 2018a). Furthermore, entanglement in fishing gear appears to have had substantial health and energetic costs that affect both survival and reproduction of right whales (van der Hoop et al. 2017a). Vessel strikes and entanglement of right whales in U.S. and Canadian waters continue to occur.

As described in the *Environmental Baseline* and *Climate Change* sections, ongoing effects in the action area (e.g., global climate change, decreased prey abundance, vessel strikes, and entanglements in U.S. state and federal fisheries) have contributed to concern for the species' persistence. Sublethal effects from entanglement cannot be separated out from other stressors (e.g., prey abundance, climate variation, reproductive state, vessel collisions) which co-occur and affect calving rates.

As described in the *Effects of the Proposed Action* section, the information documented for some right whale interaction cases contains evidence that allowed attribution of the event to a country and/or a specific cause (i.e., gear entanglement, vessel strike); other cases are of unknown origin and/or unknown cause. As described in section 7.2, gear analysis and sightings data allowed us to partition total M/SIs to the United States and Canada. For the cases attributed to the United States, we were able to further partition them between entanglements and vessel strikes. Data are not available to partition the total mortality occurring in Canada between entanglement and vessel strike. Current estimates based on the best available scientific and commercial data indicate that the federal fisheries in this Opinion will entangle, on average annually, a total of

9.14 percent of the North Atlantic right whale population. As described in the *Effects of the Proposed Action* and in more detail below, given the reductions in entanglements that will result from the implementation of the North Atlantic Right Whale Conservation Framework for Federal Fisheries in the Greater Atlantic Region (Framework), we expect that substantially less than 9.14 percent of the population will become entangled following the implementation of measures described in the Framework. However, we cannot quantify how much less at this time.

We estimated that, from 2010-2018, an annual average of 4.7 right whale M/SI (4.57 in trap/pot gear and 0.125 in gillnet gear) were the result of entanglements in gear used in the federal fisheries in this Opinion. The implementation of Phase 1 of the Framework (the proposed ALWTRP measures) in the American lobster and Jonah crab fisheries is expected to reduce M/SI of right whale entanglements in trap/pot gear in federal waters by 44 percent⁶⁹. That is, after implementation of the current ALWTRP rulemaking, an annual average of 2.69 ($=4.7 - (0.44 \times 4.57)$) right whale M/SI entanglements are expected to occur in federal waters. In 2023, Phase 2 of the Framework is expected to reduce M/SI of right whale entanglement in other federal trap/pot fisheries and gillnet fisheries by 60 percent. After implementation of these measures, 2.61 ($=2.69 - (0.6 \times 0.125)$), on average annually, right whale M/SI entanglements are expected to occur in federal waters. In 2025, Phase 3 of the Framework will be implemented and further reduce M/SI of right whale entanglement in federal waters by an additional 60 percent. After the implementation of the Phase 3 measures, an annual average of 1.04 ($=2.61 - (0.6 \times 2.61)$) right whale M/SI entanglements expected to occur in federal waters (Table 81). In 2030, Phase 4 of the Framework will further reduce M/SI of right whale entanglement in federal waters by an additional 87 percent. After the implementation of the Phase 4 measures, an annual average of 0.136 ($=1.04 - (0.87 \times 1.04)$) right whale M/SI entanglements are expected to occur in federal waters, which equals approximately one M/SI every 7 years (Table 81).

Table 81: Framework actions and associated reductions in M/SI

Action	M/SI reductions in federal fisheries	M/SI in federal fisheries prior to the action,:	M/SI in federal fisheries after the action,
Phase 1 (current TRT rulemaking Action)	Reduce M/SI in trap/pot gear by 44 percent	4.7 (4.57 in trap/pot and 0.125 in gillnet)	2.69 (2.56 in trap/pot and 0.125 in gillnet)
Phase 2	Reduce M/SI in gillnet gear by 60 percent	2.69 (2.56 in trap/pot and 0.125 in gillnet)	2.61 (2.56 in trap/pot and 0.05 in gillnet)
Phase 3	Reduce M/SI in fixed gear fisheries by 60 percent	2.61 (across the gillnet and trap/pot fisheries)	1.04 (across the gillnet and trap/pot fisheries)
Phase 4	Reduce M/SI in fixed gear fisheries by 87 percent	1.04 (across the gillnet and trap/pot fisheries)	0.136 (across the gillnet and trap/pot fisheries)

⁶⁹ The results of the DST show that 60.4 percent of the risk of M/SI from pot/trap gear to right whales in the U.S. occurs in federal waters. The DST also showed that of the 58.1 percent risk reduction in M/SI due to the ALWTRP proposed rule, 26.6 percent of that risk reduction occurs in federal waters. This results in a 44 percent reduction in risk of M/SI from pot/trap gear to right whales in federal waters.

As described above, each phase of the Framework reduces M/SI in federal fisheries by a fixed percentage. With these reductions, we anticipate that there will be, on average annually, 2.69 M/SI during Phase 1, 2.61 during Phase 2, 1.04 during Phase 3, and 0.136 during Phase 4. Given the length of each phase, we would anticipate a total of 8.07 M/SI in Phase 1, 5.22 in Phase 2, and 5.2 in Phase 3 due to the federal fisheries included in this Opinion. Phase 4 would reduce M/SI to 0.136 starting in year 11, resulting in 5.44 additional M/SI in years 11 through 50. Based on this, we estimate that 18.49 whales will die or be seriously injured in the 10 years before the Framework is fully implemented, and 5.44 in the following 40 years. This results in an estimated total of 23.93 entanglements resulting in M/SI in gear used by the federal fisheries over the course of 50 years.

As described in the *Cumulative Effects* section, we did not find any additional information, with the exception of measures to reduce risk from the U.S. state fisheries through the Massachusetts Division of Marine Fisheries regulations (322 CMR 12) and the ALWTRP proposed action, about future effects to right whales that would be reasonably certain to result from non-federal actions beyond what was described in the *Environmental Baseline*. Most of the effects described in the *Environmental Baseline* are expected to continue in the future. The implementation of the measures under the ALWTRP is reasonably certain to occur in state waters and is estimated to reduce the risk of M/SI to right whales in the lobster and Jonah crab fisheries by 31.5 percent. This reduction is expected to reduce the risk of the annual average right whale M/SI entanglements in trap/pot gear in state waters (currently estimated at 3) by 2.39, resulting in an estimated annual average of 0.61 right whale M/SI in the state fisheries after the implementation of the current ALWTRP rulemaking.

Jeopardy Assessment

In this assessment, we evaluate whether the level of fishery interactions during and following full implementation of the Framework allows the right whale population to maintain a status where the action is not jeopardizing the continued existence of the species, and the population maintains the ability to achieve recovery. We evaluate this by comparing how the population would fare with no impact from the proposed action (i.e., no entanglements in federal waters) to how the population would fare with anticipated impacts from the action (i.e., entanglements and M/SI in federal waters). Below is a description of the quantitative and qualitative information that we consider in our jeopardy analysis.

Population Projection Model

NMFS developed a population projection model to predict the female right whale population trajectory over 50 years (Linden 2021). As with any model, there is uncertainty in the population projections. Linden (2021) describes the methodology used for the population projections and explores a range of scenarios. The projections included in the Appendix underwent peer review by the Center for Independent Experts in 2020. As described in Linden (2021), the full posterior distributions of parameters from updated fitting of the Pace et al. (2017) model were used (as matrix inputs) in the projections. This means that uncertainty in the demographic parameter estimates was fully propagated. Also discussed by Linden (2021) is that the source of the reductions in M/SI is immaterial from a population perspective. However, it is important for management purposes and is an important caveat with the data used. The population projection model does not depict absolute population trends, but rather shows relative outcomes under various management strategies to allow for the comparison of potential future outcomes (D.

Linden, pers. comm.). As described above, we used the best available information, including peer-reviewed information when available, to apportion M/SI when the source (either country and/or cause) of the M/SI was unknown.

Fifty years was chosen as the appropriate timeframe as it provides sufficient time for any reductions in M/SI to be reflected in the trajectories and provides a long enough period to assess the long-term trend. The population consequences of different actions are difficult to distinguish when they are only allowed to manifest for a few years, while any environmental projections beyond 10-20 years are subject to large amounts of uncertainty. Climate change is one of the factors influencing future conditions. We believe that 50 years achieves this balance and periods longer than 50 years (e.g. 100 years) would introduce too much uncertainty to be confident in the trends. We believe using this period for the projections provides the best available information to determine the future population trend of female right whales.⁷⁰

The Framework reduces M/SI in the federal fisheries over four-phases, allowing interactions to continue to occur at a higher level in the earlier phases of the Framework before attaining the final reductions to an annual average of 0.136 M/SI in the federal fisheries. The reductions in M/SI specified under the Framework are considered in the population projections using a per capita mortality rate, and the actual number of M/SI can change based on stochasticity in the projected population size in a given year and the random draw of actual deaths in a given year (see Linden 2021). The projections consider how the projected size and per capita rates interact across time. The reductions in mortalities due to the implementation of the Framework will contribute positively to the parameters included in the model as they will survive and contribute to the population. Given these interactions, the estimates of mortalities due to the federal fisheries described above differ from model predictions. As described in Appendix 3, Linden (2021) evaluated multiple hypothetical risk reduction scenarios. However, the scenarios used for the analysis in this Opinion examine the outcome of the mitigation measures as described in the Conservation Framework.

The projections use information on right whale survival and calving to forecast changes in population size and provide insight on future population growth. The initial female right whale population size used in the projections was 179, split among calves (3), juveniles (22), and mature adults (154). The starting population size of females (179) is an average of 2010-2019 to represent an approximation of the age structure. Each scenario evaluated a different level of reduction in human-caused mortalities. To examine the influence of anthropogenic mortality reduction on survival and recovery of the species, we ran 5,000 simulations for each risk reduction scenario. For each scenario, we calculated the median population trajectory and probability of decline. We summarize the projection model here; for detailed methods, see Appendix 3 (Linden 2021).

⁷⁰ We projected the female population forward because females are the limiting factor for population growth given they contribute new individuals through reproduction. Anthropogenic threats or environmental conditions are not known to affect males and female right whales differently beyond reproductive dynamics, so future population dynamics are adequately captured by females alone. It is important to note that the projections are just one of several prongs in our analysis, we considered impacts to both males and females in our qualitative analysis.

As described above, the projections consider the effects of the proposed action in the context of information provided in the *Status of the Species*, *Environmental Baseline*, *Climate Change*, and *Cumulative Effects* sections. The factors discussed in each of those sections have impacted, and continue to impact, the calving and survival of right whales and are included in the calving numbers and survival estimates used as inputs to the projections. As described in the *Effects of the Proposed Action*, the survival estimates are based on data available from 2010-2018. A total mortality estimate is not available for 2019; therefore, we do not consider the 2019 observed data in the survival estimates. Given that the starting population is based on 2010-2019 data, the projections include calving data from the same time period. Therefore, by using data from 2010-2019, the projections implicitly consider the effects of all sources of M/SI on right whales and consider impacts to calving rates due to sublethal effects from entanglement, prey availability, and other stressors.

Using the DST as the best available information, the ALWTRP action will reduce M/SI in U.S. waters by at least 58.1 percent across lobster and Jonah crab fisheries. Additionally, implementation of the Framework will reduce M/SI by at least 60 percent in gillnet and other trap/pot fisheries in 2023, reduce M/SI by at least an additional 60 percent in fixed gear in federal waters in 2025, and by an additional 87 percent in fixed gears in federal waters in 2030. As previously described, using estimates of right whale M/SI in U.S. waters, the DST allows us to quantify the number of right whale M/SI occurring in U.S. state and federal waters. Additionally, the DST allows us to quantify the relative risk reduction that will occur in federal and state waters in the United States due to the implementation of the current ALWTRP proposed rule. This represents the best available data for estimating reductions in risk from state and federal fisheries. We then developed scenarios which would reduce M/SI from entanglement in gear used in the U.S. state and federal fisheries. The projections simulate how the population trajectory may change under these scenarios.

To estimate the demographic rates, a state-space mark-recapture model was fit to North Atlantic right whale sightings data collected from 1990-2019 to generate posterior distributions for stage-based population sizes, deaths, and survival rates. The projections included stochastic simulations that re-sampled demographic rates from observed calving records and sighting histories of cataloged individuals to assess the influence that simple and per capita reductions in anthropogenic mortality might have on population trajectories. The projections used a subset of the estimated demographic rates to focus inferences in two ways: 1) only females were projected, given they are the primary driver of population growth dynamics; and 2) projections used rates from the 2010-2019 time period to capture the post-2010 ecological conditions that are considered most representative of current conditions and coincide with the recent population decline. Using these female calving (2010-2019) and survival rates (2010-2018), the approach predicts the future right whale female population.

Resolving Data Uncertainties for Model Inputs

As noted above, this population projection model is designed to compare potential future trajectories of the right whale population. Given the uncertainties and the model's general design, it is incapable of predicting the actual future population trend of right whales. When dealing with data uncertainties (e.g, a range of potential calving rates, or unquantified benefits from conservation measures), we utilized metrics representing the worst case scenario. Consequently, model outputs very likely overestimate the likelihood of a declining population.

For example, in 2017, the Government of Canada introduced measures designed to protect North Atlantic right whales from both the fishing and shipping industries (section 4.2.1). Following the implementation of mitigation measures, ten right whale mortalities were confirmed to have occurred in Canadian waters in 2019. Canada has modified their measures annually to reduce M/SI. In 2020 and 2021, they implemented additional measures. Given the limited time these measures have been in effect as well as annual changes to and the dynamic nature of the measures, there is no way to quantitatively or qualitatively assess the benefit at this time. Since we have determined that a quantitative prospective assessment of risk reduction from future mitigation measures in Canada is not feasible, we assumed a worst case scenario where the estimated number of right whale M/SIs due to vessel strike and entanglement that occurred in Canada between 2010 and 2018 will continue to occur in the future. Similarly, even though the United States has taken actions to reduce future vessel strikes, we assume that M/SI resulting from vessel strikes in U.S. waters continue to occur in the future at the same level as 2010-2018. Also, even though we anticipate a reduction in the percentage of entangled right whales through implementation of the Conservation Framework (these reductions cannot be quantified as they are confounded by other stressors (e.g., environmental factors)), the projection outputs do not consider any increase in the female right whale population trajectories due to a reduction in sublethal effects (i.e., ALWTRP proposed rule, any future risk reduction measures). Lastly, although calving rates were generally higher pre-2010, given the uncertainty of future calving rates, we used post-2010 calving rates in the population projections as they were considered most representative of current conditions.

While uncertainty surrounds the population trajectories for this species, the results of the projections coupled with qualitative assessments of other factors, described in detail below, represent the best available information to determine whether the effects of the proposed action appreciably reduce the likelihood of survival and recovery.

The results of the projections assessed in our evaluation include the median population trajectory, the probability of a declining female right whale population, and the estimated number of females in the future. The median population trajectories are used to calculate resulting growth rates, represented by a λ value. In population biology, λ is the finite rate of increase over some time interval (e.g., Year A to Year B); it is the ratio of the population size at the end (Year B) to the population size at the start (Year A). The following equation was used to calculate the geometric mean annual λ for the interval of length T: $(\text{Year B}/\text{Year A})^{(1/T)}$. When λ is greater than 1, the population is growing; when λ is less than 1, the population is declining. The growth rate was calculated for the 50-year period, the Framework implementation period (through year 10), and following full implementation (year 11-50).

The projections predicted the future female right whale population trajectory of the proposed action, which includes the implementation of the Framework. To support our determination of whether the proposed action is appreciably reducing in the likelihood of the survival and recovery of right whales, we first compare the population trajectory with no impact from the proposed action (i.e., no entanglements in federal waters) to the population trajectory that includes the anticipated impacts from the action (i.e., entanglements in federal waters). Theoretical projections are provided in the figure below to illustrate how the likelihood of jeopardy is assessed (Figure 68). In conducting our jeopardy analysis, we evaluate the difference between the trajectories in the absence of the action (yellow line) to the trajectory with the action occurring (black line). The projections assume calving in future years is similar to calving from

2010 to 2019. We use the calculated reductions in M/SI from entanglements in U.S. waters to analyze how increases in survival change the trajectory. All other impacts (e.g., U.S. and Canadian vessel strikes, Canadian entanglements) affecting survival over the 9-year period, and calving over the 10-year period, were presumed to continue unchanged into the future.



Figure 68: Theoretical population projections illustrating how each inform the jeopardy analysis and conclusion

Population Projection Results

Scenario 1: Female population trajectory *without* anticipated impacts of the proposed action (no federal fisheries scenario)

Scenario 1 evaluates how the female right whale population would fare in the future without M/SI caused by U.S. federal fisheries, while ongoing actions outside the scope of this Opinion continue and future non-federal actions that are reasonably certain to occur (i.e., risk reduction measures in state fisheries through the ALWTRP) are in place. With respect to the survival inputs, Scenario 1 includes all mortality sources except entanglements in the federal fisheries. That is, the scenario assumes no M/SI from federal fisheries, providing a trajectory to which we will compare to the trajectory of the proposed action. As described in section 7.2, the operation of the U.S. federal fisheries results in an annual average of 4.7 right whale M/SI due to entanglement. For Scenario 1, we assume that the 4.7 whales (average annual) that would have been seriously injured or have died in the federal fishery will survive.

Scenario 1 also considers reductions in M/SI in future years from actions outside the Opinion. As described in the *Cumulative Effects* section and above, the implementation of the ALWTRP proposed rule will reduce M/SI to right whales from entanglements in state waters by an annual average of 2.39 right whales. Therefore, Scenario 1 predicts the future population of female right whales if an annual average of 7.09 (= 4.7 in federal waters+2.39 in state waters) right whale M/SI ceased to occur. All other impacts contributing to the decline of the right whale population are considered to continue at the same rate experienced between 2010 and 2018.

The results of the Scenario 1 estimate the median right whale abundance will be 163 females in 10 years, which is a loss of 16 females over the first 10 years. In 50 years, the results of the Scenario 1 projection estimate the median right whale abundance to be 108 females, a loss of 71 females over the 50 years. This indicates that even in the absence of the U.S. federal fisheries,

the female right whale population will decline (Figure 69), with a λ of 0.989742 ($= (108/179)^{(1/49)}$) over the 50 year time period. The projection shows 97.72 percent of the simulations resulted in a declining female right whale population 50 years into the future (Figure 70).

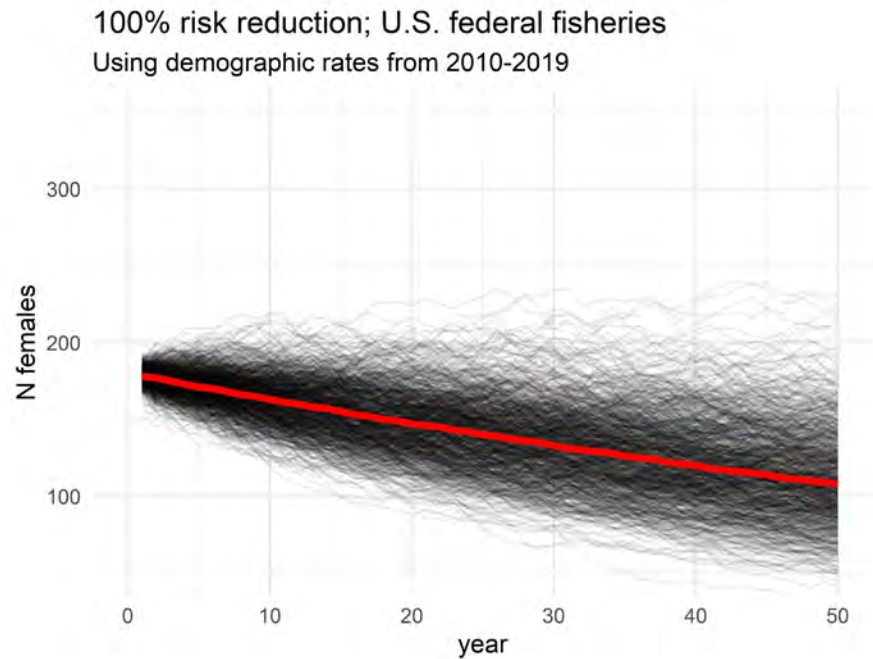


Figure 69: Population projections (n=5000) of North Atlantic right whale females using demographic rates from 2010–2019. Median population size and resulting growth rate (λ) in red. The risk reduction from no federal fisheries and the risk reduction from U.S. state waters with ALWTRP proposed measures in place.

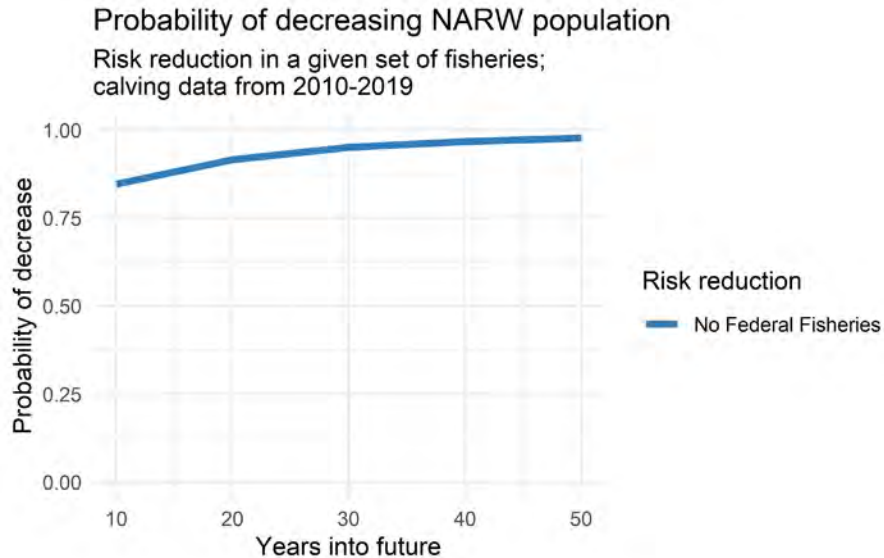


Figure 70: Probability of a decreasing NARW female population size using calving rates from 2010–2019 with no M/SI in the federal fisheries and the risk reductions in state waters with ALWTRP proposed measures in place.

Scenario 2: Female population trajectory *with* anticipated impacts of the proposed action (proposed action scenario)

Scenario 2 evaluates how the female right whale population would fare over the next 50 years with anticipated reductions in M/SI in U.S. federal fisheries with the implementation of the Framework. Phase 1 of the Framework (the current proposed ALWTRP rule) is assumed to be implemented at year 0, Phase 2 (60 percent reduction in M/SI in other federal trap/pot and gillnet fisheries) at year 3, Phase 3 (further 60 percent reduction in M/SI in federal fisheries) at year 5, and Phase 4 (further 87 percent reduction in M/SI in federal fisheries) at year 10. As with Scenario 1, ongoing actions outside the scope of this Opinion continue and future actions (i.e., risk reduction measures in state fisheries) that are reasonably certain to occur are in place.

As described above, we estimate that currently there are an annual average of 4.7 right whale M/SI due to entanglement in the federal fisheries in this Opinion. As described in the *Environmental Baseline*, we also determined that the operation of the U.S. state fisheries currently results in an annual average of 3 right whale M/SI due to entanglement in trap/pot gear. The implementation of Phase 1 of the Framework will reduce the annual average of M/SI in the federal fisheries from 4.7 to 2.69. Following the implementation of Phase 2 of the Framework, we anticipate that an annual average of 2.61 M/SI will continue to occur in the federal fisheries. Within 5 years, an additional 60 percent reduction in M/SI will be implemented under Phase 3 of the Framework. For the model, we assume that this implementation occurs at year 5, resulting in an annual average of 1.04 M/SI in federal fixed gear fisheries. Within 10 years, an additional 87 percent reduction in M/SI will be implemented under Phase 3 of the Framework. For the model, we assume that this implementation occurs at year 10, resulting in an annual average of 0.136 M/SI in the federal fixed gear fisheries from year 10 forward. Therefore, Scenario 2 predicts the future population of female right whales if the annual average right whale M/SI was reduced by 4.4 (reduced by 2.39 in state waters and 2.01 in federal waters) in years 0-3; 4.48 (reduced by 2.39 in state waters and 2.09 in federal waters) in years 3-5; 6.04 (reduced by 2.39 in state waters

and 3.65 in federal waters) in years 6-10; and 6.95 (reduced by 2.39 in state waters and 4.56 in federal waters) in years 10-50. This results in an annual average of 0.61 ($=3-2.39$) right whale M/SIs in state trap/pot gear and 0.136 ($=4.7-4.56$) in federal fixed gear after the implementation of the Framework. All other impacts contributing to the decline of the right whale population are considered to be continuing at the same rate experienced between 2010 and 2018. As described above, there is a loss of females even in the absence of the federal fisheries. Therefore, the losses described below in the results of Scenario 2 are not solely due to the operation of the federal fisheries.

The results of the Scenario 2 (Figure 71) estimate the median right whale abundance to be 102 females in 50 years, which is a loss of 77 females over the 50 years. The λ over this period is 0.988588 ($((102/179) ^ (1/49))$). This indicates that with the operation of the U.S. federal fisheries after implementation of the Framework, the female population decreases. The projection shows 98.8 percent of the simulations resulted in a declining female right whale population 50 years into the future (Figure 72).

Given that the Framework is phased in under Scenario 2, it is important to evaluate the projection results before and after its full implementation. The results of the Scenario 2 projection estimate the median right whale abundance to be 157 females in 10 years, which is a loss of 22 females over the first 10 years. This indicates that the female population declines with the operation of the U.S. federal fisheries during the implementation of the first two phases of the Framework (Figure 71). The λ is 0.985535 ($=(157/179) ^ (1/9))$.

After the Framework is fully implemented (at year 10), the median right whale abundance is 157 females. (Table 82). The results of the Scenario 2 projection estimate the median right whale abundance to be 102 females in 50 years, which is a loss of 55 females over years 10-50. The λ is 0.989003 ($=(102/157) ^ (1/39))$ over years 10-50. This indicates that the female population declines more slowly with the operation of the U.S. federal fisheries after the implementation of the full Framework (Figure 71).

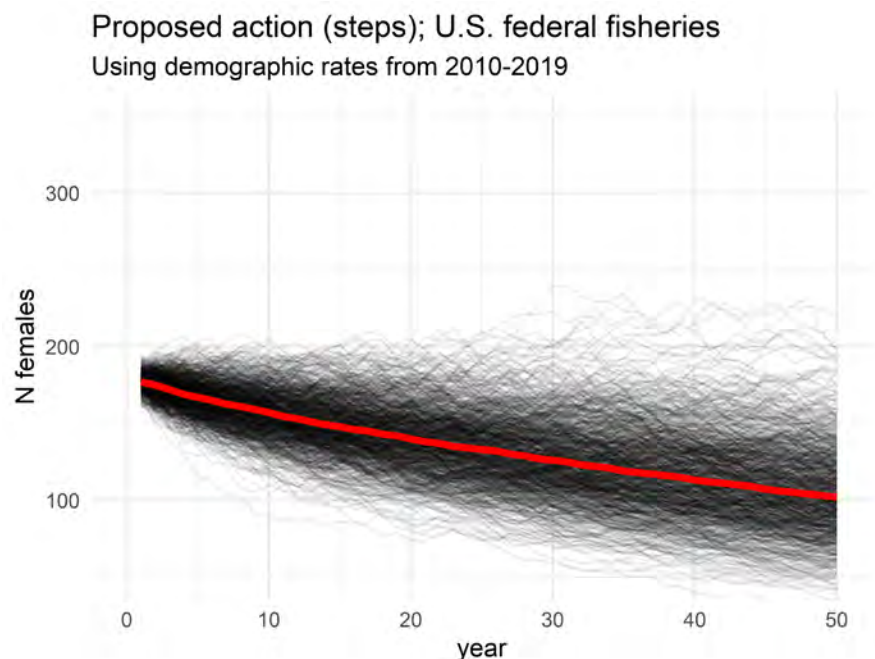


Figure 71: Population projections (n=5000) of North Atlantic right whale females using demographic rates from 2010–2019. Median population size in red. The risk reduction from federal fisheries is with the Framework in place, and the risk reduction in U.S. state waters is with ALWTRP proposed measures in place.

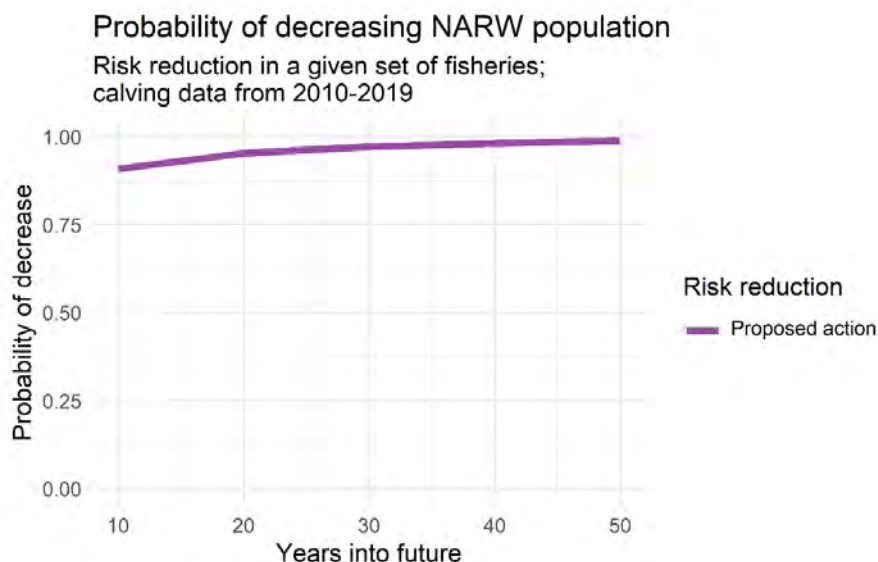


Figure 72: Probability of a decreasing NARW female population size using calving rates from 2010–2019. The risk reduction from federal fisheries is with the Framework in place. The risk reduction from U.S. state is with measures in ALWTRP proposed rule in place.

Assessment of the Population Projections

As part of our jeopardy analyses, we compared the population trajectory without the action (Scenario 1) to the trajectory with the action (Scenario 2) (Figure 73). This is indicative of the

extent federal fisheries considered in the Opinion are contributing to the declining trajectory. We evaluated this in the context of whether the difference represents a reduction in the likelihood of survival and recovery of North Atlantic right whales that is biologically meaningful.

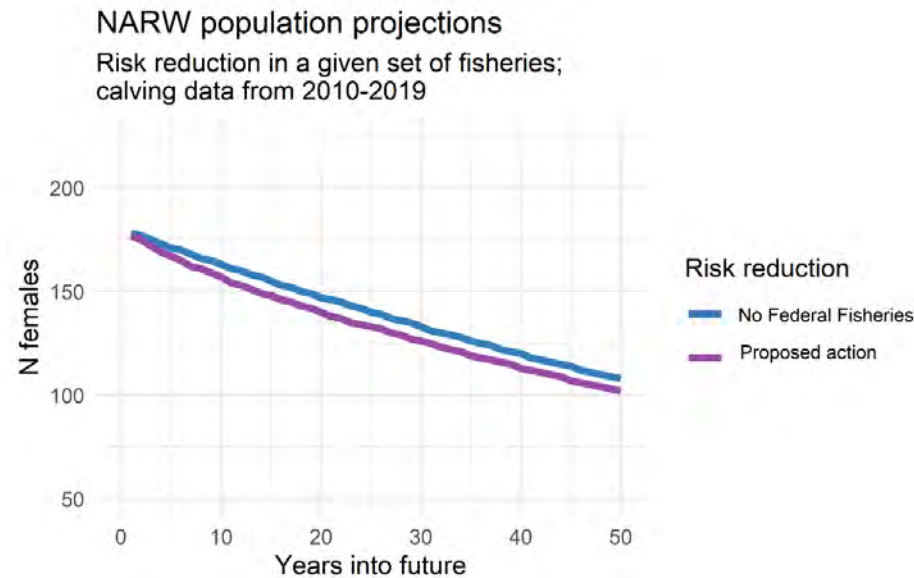


Figure 73: Median North Atlantic right whale female population size from population projections (N=5,000) using demographic rates from 2010–2019. The proposed action (in purple) includes the risk reduction from the Framework in federal waters and in U.S. state waters with ALWTRP proposed measure. The projection with no risk from federal fisheries (in blue) includes the risk reduction from the future ALWTRP reductions in state waters.

Table 82: Comparison of population projection results with proposed action and without proposed action.

	Geometric mean female population growth rate (λ)	Percent of simulations showing a declining trend (%)	Number of females (initial estimate = 179)	Percent of population entangled (lethal or non-lethal) (%)
Proposed action years 0-50	0.988588	98.8	102	Less than 9.14, but % unknown
Proposed action years 0-10	0.985535	N/A	157	9.14
Proposed action years 10-50	0.989003	N/A	102	Less than 9.14, but % unknown
No federal fisheries	0.989742	97.72	108	0

Entanglement mortalities affect successful reproduction by reducing the number of sexually mature individuals producing viable offspring. Although lifetime reproductive success can be highly variable, based on historic calving intervals (Pettis et al. 2017), a healthy female can produce up to 11 calves in 50 years. Small populations are inherently at risk of extinction, in

part, because of the unequal reproductive success of individuals within the population, such that some individuals produce more offspring than others (Coulson et al. 2006). Random chance can also affect the sex ratio and genetic diversity of a small population, leading to lowered reproductive success of the population as a whole. The smaller the population, the more weight an individual's reproductive success has on the population's growth or decline and a greater chance that random variation will result in too few individuals to maintain the population (Coulson et al. 2006). Additionally, years with a small number of births can contribute to a declining trend or a halt in growth rate for multiple years indicating reproductive variability has a noticeable effect on species viability (Hayes et al. 2018a, Pace et al. 2017). However, the projections use the calving rates from 2010-2019 and assume these rates will continue into the future. This gives the benefit of the doubt to the species by using years with a low number of births.

The projections show, even in the absence of the federal fisheries, a declining right whale female population over the 50 year time period, with a 97.72 percent chance of a declining trend, and an estimated loss of 71 females (Table 82). With the implementation of the proposed action, including the Framework, the projections indicate that the female right whale population will decline initially and then continue to decline but at a slower rate that is comparable to the trajectory with no effects from the federal fisheries (Table 82). Under the proposed action, there is a 98.8 percent chance of a declining trend and an estimated loss of 77 females from the current female population (n=179) over the 50-year period. As there is a decrease of 71 whales over the 50 years in the absence of M/SI in federal fisheries, there is a difference of 6 females at year 50. The total loss of the females in both scenarios is due to the M/SI occurring from all sources, including M/SIs in the federal fisheries. As the population declines, the difference of 6 females remains over the next 40 years of the projections, fluctuating throughout the years between 6 and 8.

The population projections indicate that after 50 years there would be a difference of approximately 6 females between Scenario 1 (no federal fisheries) and Scenario 2 (proposed action). Assuming that females represent approximately 40 percent of the population, this results in a difference of approximately 15 (male and female) whales between the two trajectories. This differs from the estimate above that 23.93 whales will be seriously injured or die over 50 years (approximately 18.5 M/SI in the first 10 years) due to the operation of the fisheries and the implementation of the Framework. The projections indicate a lesser reduction than what was estimated from the data given that they use a per capita mortality rate and consider how the projected population size and per capita rates interact across time.

With the full implementation of the Framework, the reductions in the number of whales that die or are seriously injured contributes positively to the parameters included in the model as the whales that survive to contribute to the population. This is more reflective of what would be expected to occur with the implementation of the Framework as it accounts for these contributions to the population. Although the proposed action will likely reduce the number of individual right whales compared to the no federal fisheries scenario, the projections indicate the female population declines after the implementation of the Framework at a comparable rate to the no federal fisheries scenario. While M/SI associated with the proposed action occur at a higher rate during the first 10 years, the projections indicate that these M/SIs will not increase the population's rate of decline compared to the no federal fisheries scenario after the implementation of the full Framework.

Sublethal Effects Analysis

As described in the *Effects of the Proposed Action*, it is likely non-lethal entanglement in fishing gear may negatively affect the health or body condition of a whale. However, these effects cannot be separated out from the effects of multiple stressors (e.g., prey abundance, climate variation, reproductive state, exposure to harmful algal blooms, vessel collisions) that co-occur and, individually and cumulatively, can affect the health of animals, and, subsequently, the calving rate of the population. While we believe, based on the best available scientific and commercial data described below, some portion of the observed variability in right whale calving rates is due to the sublethal effects of entanglements, we cannot quantify the degree to which entanglements are affecting calving rates.

During the first 10 years of the proposed action, the operation of the federal fisheries is likely to contribute to decreased calving rates due to the sublethal effects. As described in the *Effects of the Proposed Action*, given that some of the risk reduction measures in Phase 1 and 2 are designed to reduce the severity of entanglements and not the likelihood, the federal fisheries are expected to entangle an annual average of 9.14 percent of the right whale population during the first 5 years. After the implementation of Phases 3 and 4, we expect that substantially less than 9.14 percent of the population will become entangled. However, we cannot quantify how much less without more information. Some animals will shed the gear themselves; others will continue to carry trailing gear, with some proportion of these being disentangled by trained responders. We anticipate that most of the right whales that do not die as a result of their injuries may experience varying levels of sublethal effects from the exposure to entanglement. These effects range from being temporary in nature such as elevated stress levels to more significant injuries that may heal over time but may affect the individual's lifetime fitness. These negative effects include increased energetic demands due to increased drag, foraging being impeded, and stress (Hayes et al. 2018a). Drag from fishing gear may also reduce the female reproductive energy budget, extending the time of gaining the energy needed for reproduction by months to years (van der Hoop et al. 2017a).

In order to achieve the risk reduction requirements in Phase 3 and 4 of the Framework, the federal fisheries will need to implement measures that will substantially reduce the co-occurrence of right whales and vertical lines. This reduction in co-occurrence is expected to not only reduce M/SI resulting from entanglements but also reduce entanglements that do not result in M/SI. As such, there would be fewer entanglements overall and, therefore, fewer sublethal effects to right whales. We also expect calving rates would likely improve following the implementation of the Framework (proposed action scenario) as sublethal effects will be reduced; however, the degree to which calving rates may change cannot be estimated. Similarly, we would expect that calving rates would increase in the absence of the fishery (no federal fisheries scenario). Although we currently cannot quantify the degree to which entanglements are affecting calving rates, average calving intervals have increased from 4 years in 2009 to 10 years in 2017, and this may be due, in some part, to stress from entanglement (Pettis et al. 2018). However, we believe that under current conditions, the entanglements that will occur due to the operation of the fisheries before the full implementation of the Framework will not reduce the calving rates beyond the levels observed from 2010-2019. After the full implementation of the Framework, we expect to see a decrease in the average calving interval and higher calving rates than the levels observed from 2010-2019. Given that this potential increase in calving is not considered in the population projections, both scenarios are conservative. That is, it is likely that

both projections are an underestimate, and the right whale population would fare better than the trajectories (Figure 73) indicate if calving rates increase.

Genetics Analysis

Population growth is important because of the influence of demographic and individual heterogeneity on a population's long-term viability (Fagan and Holmes 2006). The larger the population size, the greater the buffer against stochastic events. As the population decreases further, the population may be at risk of becoming so small that the genetic make-up of the remaining individuals is not the same as the initial population. This is known as a genetic bottleneck and when this occurs, the species becomes less resilient which can increase risk of extinction (Hayes et al. 2018a). The proposed action is expected to reduce the female right whale population by 6 compared to the federal fisheries scenario. However, 6 females represents 3.35 percent of the current female population. The loss of 3.35 percent of the female population, when examined individually, is not expected to be responsible for a genetic bottleneck in the population. The proposed action implements the Framework early enough for the population's trajectory to essentially match the rate of decline to the no federal fisheries scenario after the initial losses while the Framework is implemented. Similar population trajectories after year 10 indicate that the proposed action would not substantially contribute to the loss of genetic heterogeneity to the point of the population being at risk of a genetic bottleneck.

Quasi-Extinction

We also considered whether a quasi-extinction threshold could be used to help assess whether the proposed action is appreciably reducing the likelihood of survival and recovery of the species. There is no defined threshold for quasi-extinction of North Atlantic right whales. As described in the *Status of the Species*, the western population may have numbered fewer than 100 individuals in 1935, when international protection for right whales came into effect (Kenney et al. 1995). Additionally, right whale abundance was estimated to be 162 animals in 1980 and 270 animals in 1990, and abundance increased by approximately 2.8 percent per year from 1990 until 2011 (Pace et al. 2017). Although the current estimate of 368 individuals in the population is extremely low, these prior estimates suggest the population is capable of recovering at lower levels than the current estimate. Using the population projection model, we evaluated whether prior estimates could be used as a quasi-extinction threshold given that after reaching these levels, the right whale population was capable of achieving an increasing trajectory, showing that recovery from these numbers was possible with the environmental conditions and anthropogenic risks present during that period. The female population in 1980 was estimated to be 63 females (total population 162:63 females, 82 males, 17 unknown). We evaluated the likelihood that the populations would reach this level in 50 years. Under the proposed action, there is a 5.6 percent probability the population will reach this level in 50 years. Under the no federal fisheries scenario, there is a 3.5 percent probability the population will reach this level in 50 years. Therefore, the likelihood of reaching this level is similar between the two scenarios and is low. Our analysis suggests that with or without the proposed action, it is extremely unlikely that in 50 years, the female right whale population would decline to the level of the 1980 female population estimate. However, we determined that our analysis could not rely on this threshold as the level from which right whales would maintain their ability to recover given that the environmental conditions and anthropogenic risks have changed since that time.

Current Conditions

Current conditions that continue to act on the species, like the effect of Canadian fisheries and vessel strikes in the United States and Canada, puts this population at high risk of extinction, and as a result the continuing declining trend, with or without the action, is of particular concern. We ran the population projection model to assess the level of overall risk reduction needed to result in an increasing population trajectory. The results indicate that even with a very high level of risk reduction in the United States, the population trajectory will not increase if right whale mortalities continue to occur at current levels in Canadian waters.

We evaluated the population trajectory if, in addition to the proposed action, similar reductions in M/SI to those in the Framework are implemented to reduce M/SI from all sources in Canada. As we cannot partition out vessel strikes and fishery entanglements in Canada, we first calculated the percent reduction for all U.S. sources (state and federal fisheries, vessels strikes) at each phase. We then assumed that this percent reduction would be applied to all M/SI in Canada at the same time as the implementation of the phases in the Framework. We then projected the population trajectory with total M/SI in Canadian waters (from all sources) given these reductions in Canada and in the United States fisheries. The figure below (Figure 74) depicts the population trajectory if both the United States and Canada reduce mortalities at the same level. Under this scenario, the reductions would result in an increasing population trajectory, with a 37.96 percent probability of a declining trend, and an increase of 13 females over 50 years. All scenarios are expected to result in an increase in calving. This increase is not considered in the population projections; therefore, the three scenarios representing the implementation of measures to reduce M/SI are conservative. That is, it is likely that the projections underestimate the likelihood of an increasing right whale population and that the actual right whale population will likely fare better than the trajectories indicate.

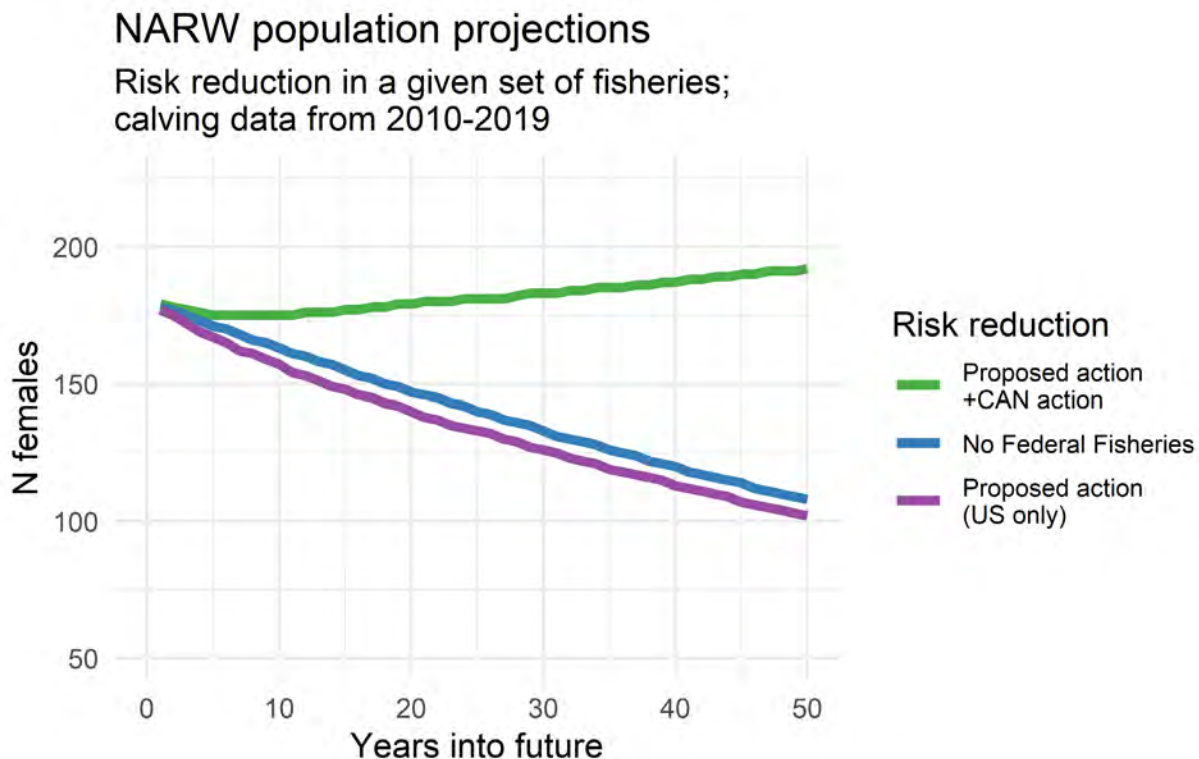


Figure 74: Population projections (n=5000) of North Atlantic right whale females using demographic rates from 2010–2019. The projections include the proposed action and hypothetical, equivalent measures in Canada. The 100 percent U.S. federal projection is with no risk from federal fisheries (in blue) and includes the risk reduction from the future ALWTRP reductions in state waters. The proposed action (U.S. only) (in purple) includes risk reduction from federal fisheries with implementation of the ALWTRP proposed measures/Framework and risk reduction in U.S. state waters with the ALWTRP proposed measures in place. The proposed action +CAN action (in green) includes risk reduction from federal fisheries with the ALWTRP proposed measures/Framework in place, risk reduction in U.S. state fisheries with ALWTRP proposed measures in place, and identical risk reduction percentages in Canada from all sources.

Determination

Based on our analysis, we expect that with the proposed action, the status and trend of the population of right whales would decline during the first 10 years and with the implementation of the Framework, continue to decline but at a rate comparable to the no federal fisheries scenario. The proposed action simulations show that a declining trend is 1.08 percent more likely compared to no federal fisheries scenario over the 50 year time period (Table 82), and results in 6 fewer females. The difference between these two scenarios is caused by M/SI during the first 10 years, and the rate of decline after year 10 in both scenarios is essentially the same. Our projections show that the probability of the species continuing to decline, with or without the proposed action, is extremely high (98.8 percent and 97.72 percent) respectively. Additionally, the projections indicate a difference of 6 females (15 right whales) between the proposed action and no federal fishery over 50 years, which is not expected to be responsible for a genetic bottleneck in the population. However, as discussed above, the model was designed to facilitate relative comparisons of potential futures under differing management regimes, and the

projections were generated utilizing worst case assumptions for several key variables, so these projections should not be interpreted as an accurate predictor of the actual future right whale population.

The results of the projections and information on how non-lethal entanglements may affect calving rates represent the best available information to determine whether the proposed action is likely or not likely to jeopardize the continued existence of right whales. Given that the projections show a similar decreasing population trend for both the proposed action and no federal fisheries scenarios, and that we expect calving rates to increase at a similar rate in both scenarios, we believe the proposed action will not have biologically meaningful impacts on the overall reproduction, numbers and distribution of right whales in the wild.

Based on our analysis, the nature and magnitude of the proposed action's effects, when considered together with the species status and all other threats acting on it, would have inconsequential impacts on the species' overall reproduction, numbers and distribution in the wild. Given all of the available data, we conclude that right whale entanglements due to the operation of the federal fisheries will not result in an appreciable reduction in the likelihood of survival and recovery of North Atlantic right whales compared to the no federal fishery scenario. Therefore, we believe that the proposed action, including the implementation of the Framework, is not likely to jeopardize the continued existence of North Atlantic right whales.

Recovery Assessment

In addition to analyzing the effects of the action on survival of right whales, we are required to consider what impacts it will have on recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer warranted. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The goal of the 2005 revised Recovery Plan for North Atlantic Right Whale is to recover North Atlantic right whales to a level sufficient to warrant their removal from the List of Endangered and Threatened Wildlife and Plants under the ESA. The intermediate goal is to reclassify the species from endangered to threatened. The revised Recovery Plan states that North Atlantic right whales may be considered for reclassifying to threatened when all of the following have been met:

1. the population ecology (range, distribution, age structure, and gender ratios, etc.) and vital rates (age-specific survival, age-specific reproduction, and lifetime reproductive success) of right whales are indicative of an increasing population.
2. the population has increased for a period of 35 years at an average rate of increase equal to or greater than 2 percent per year.
3. none of the known threats to NARWs (summarized in the five listing factors in the recovery plan) are known to limit the population's growth rate.

All of these address the need for an increasing population growth rate. While the proposed action does not result in an increasing growth rate, the full implementation of the Framework is

expected to further the objectives to obtain an increasing growth rate. We do not believe that the proposed action will impede progress on carrying out any aspect of the recovery plan or achieving the overall recovery strategy. Therefore, the effects of the action are not expected to appreciably impact the North Atlantic right whale population's ecology or vital rates. Over the 50 year time period, the federal fisheries are likely to have minimal impact on these aspects of the population. The removal of six female right whales during the first 10 years, followed by a comparable trend to the no federal fishery trajectory during the following 40 years is not expected to have consequential effects on the average right whale population trend.

The Recovery Plan also lists the objective that:

4. given current and projected threats and environmental conditions, the right whale population has no more than a 1 percent chance of quasi-extinction in 100 years.

Above, we determined that the mortality of North Atlantic right whales associated with the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the species, and we do not expect the proposed action to have consequential effects on NARW population potential for recovery. Although the current population estimate for right whales is extremely low, the population estimate has been much lower in the past, suggesting that the population is capable of recovering at lower levels than the current estimate. Therefore, we believe that the proposed action will not increase the chances of quasi-extinction in 100 years.

Conclusion

In conclusion, we believe that the lethal and nonlethal takes of North Atlantic right whales associated with the proposed action that includes implementation of the Framework, when considered together with the species status and all other threats acting on it, are not expected to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The impacts from the continued authorization of the fisheries will not appreciably affect the population's persistence into the future or its potential for recovery.

9.2. Fin Whale

As described in the *Effects of the Proposed Action*, we anticipate the annual average of 1.89 fin whale entanglements, of which, 1.08 are expected to result in M/SI. No vessel strikes of fin whales are anticipated. Entanglement in fishing gear and vessel strikes, as described in the *Environmental Baseline*, may occur in the action area. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different from those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in the *Climate Change* section, climate change may result in changes in the distribution or abundance of fin whales in the action area; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

An estimated 1.89 entanglements (1.08 lethal) annually as a result of the proposed action may reduce the number of fin whales in the population, compared to their numbers in the absence of the proposed action. This would result in a reduction in future reproduction, assuming the individual was a female and would have survived otherwise to reproduce. If it was a male, the genetic contribution from that individual would be lost. Whether this reduction in numbers and

reproduction would appreciably reduce the likelihood of survival of the fin whales depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

As described in further detail in the *Status of the Species*, of the three to seven stocks thought to occur in the North Atlantic Ocean, one occurs in U.S. waters, where NMFS' best estimate of abundance is 7,418 individuals (Hayes et al. 2020). According to the latest NMFS stock assessment report for fin whales in the Western North Atlantic, information is not available to conduct a trend analysis for this population (Hayes et al. 2020). Across the range, there are over 100,000 fin whales occurring primarily in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere. While uncertainty surrounds the population trend of this species, we must determine whether the takes under the proposed action are too high to allow survival and recovery of the species given its current status and uncertain population trajectory. We must evaluate whether the effects of the fishery as now proposed, considered in context of the environmental baseline and cumulative effects, are expected to appreciably reduce the likelihood of both the survival and the recovery of species in the wild. To try to answer this question, we examined the total population size relative to anticipated take levels, taking into account the period over which the take would occur.

As described in the *Effects of the Proposed Action*, although it is likely non-lethal entanglement in fishing gear may negatively affect the health or body condition of a whale, multiple stressors (e.g., prey abundance, climate variation, reproductive state, exposure to harmful algal blooms, vessel collisions) co-occur and, individually and cumulatively, can affect the health of animals, and, subsequently, the calving rate of the population. However, based on the best available scientific and commercial data, we believe sublethal effects of entanglement may contribute to a decrease in calving rates, but we cannot quantify the degree to which entanglements are affecting calving rates.

The operation of the federal fisheries may contribute to decreased calving rates due to the sublethal effects of entanglement. The federal fisheries are expected to entangle an annual average of 1.89 fin whales. Some animals will shed the gear themselves; others will continue to carry trailing gear. We anticipate that most of the fin whales that do not die as a result of their injuries may experience varying levels of sublethal effects from the exposure to entanglement. These effects range from being temporary in nature such as elevated stress levels to more significant injuries that may heal over time but may affect the individual's lifetime fitness. As described in section 7.2, non-lethal entanglements may negatively affect the health or body condition of a whale, increase energetic demands, reduce female's reproductive energy budget, impede foraging, and increase stress hormones (Hayes et al. 2018a, van der Hoop et al. 2017a). Although we currently cannot quantify the degree to which entanglements may affect calving rates, we expect that a portion of animals that survive entanglement may experience fitness level impacts that could lead to a decreased calving rate in the population. Even though some individual whales are expected to experience a reduction in fitness, we would not expect such impacts to have meaningful effects at the population level given the current status of the fin whale population that will be exposed. However, we believe the low number of entanglements that are anticipated will not reduce the calving rates of fin whales. For this reason, we do not anticipate that the sublethal effects to fin whales will result in changes in the number, distribution, or reproductive potential of fin whales in the North Atlantic.

The annual mortality of 1.08 fin whales from the proposed action would represent approximately 0.01 percent ($=1.08/7418 \times 100$) of the current estimate of 7,418 fin whales in the North Atlantic Ocean. This calculation does not account for any additional deaths of dependent calves that may result from mothers that were entangled and subsequently died. We did not have enough information on fin whale demographics within the U.S. and their entanglement rates to make assumptions regarding dependent calf deaths in the calculations. However, the estimated entanglement (see section 7.2) was based on calculations that used a conservative overestimate of apportionment of fin whale entanglements to the U.S. federal fisheries (e.g., unknown country of origin assumed to be U.S.). This conservative overestimate qualitatively provides some buffer to the impact of the action from the possible loss of a dependent calf. The M/SI of 1.08 fin whales (adult, juvenile, or adult/with calf) annually is very small and contributes only minimally to the overall mortality on the population. We believe that the resulting mortality of fin whales associated with the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the species, and we expect the fin whale population to remain large enough and to retain the potential for recovery. We believe entanglement in fishing gear is still a threat, and efforts to reduce interactions are key to conservation of the species. The effects of the proposed action will most directly affect the overall size of the population, which we believe is currently sufficiently large to withstand this very low level of impact, and the proposed action will not cause the population to lose genetic heterogeneity, broad demographic representation, or successful reproduction, nor affect the species ability to meet its lifecycle requirements, including reproduction, sustenance, and shelter.

The proposed action is not likely to affect the recovery potential of fin whales. The 2010 Recovery Plan for fin whales included two criteria for consideration for reclassifying the species from endangered to threatened:

1. Given current and projected threats and environmental conditions, the fin whale population in each ocean basin in which it occurs (North Atlantic, North Pacific and Southern Hemisphere) satisfies the risk analysis standard for threatened status (has no more than a 1 percent chance of extinction in 100 years) and has at least 500 mature, reproductive individuals (consisting of at least 250 mature females and at least 250 mature males) in each ocean basin. Mature is defined as the number of individuals known, estimated, or inferred to be capable of reproduction. Any factors or circumstances that are thought to substantially contribute to a real risk of extinction that cannot be incorporated into a Population Viability Analysis will be carefully considered before downlisting takes place.
2. None of the known threats to fin whales are known to limit the continued growth of populations. Specifically, the factors in 4(a)(1) of the ESA are being or have been addressed: A) the present or threatened destruction, modification or curtailment of a species' habitat or range; B) overutilization for commercial, recreational or educational purposes; C) disease or predation; D) the inadequacy of existing regulatory mechanisms; and E) other natural or manmade factors.

The proposed action will not result in any condition that impacts the time it will take to reach these goals or the likelihood that these goals will be met given that the proposed action will not affect the trend of the species or prevent or delay it from achieving an increasing population or the species growth rate and will not affect the chance of extinction.

Based on this analysis, the proposed action is not likely to result in an appreciable reduction in the likelihood of survival and recovery of fin whales in the wild. These conclusions were made in consideration of the endangered status of fin whales, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance and distribution of fin whales in the action area.

9.3. Sei Whale

As described in the *Effects of the Proposed Action*, we anticipate the annual average of one sei whale entanglement, which may result in M/SI. No vessel strikes of sei whales are anticipated. Entanglement in fishing gear and vessel strikes as described in the *Environmental Baseline*, may occur in the action area. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different than those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in the *Climate Change* section, climate change may result in changes in the distribution or abundance of sei whales in the action area; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

An estimated one entanglement annually as a result of the proposed action may reduce the number of sei whales in the population, compared to their numbers in the absence of the proposed action. This would result in a reduction in future reproduction, assuming the individual was a female and would have survived otherwise to reproduce. If it was a male, the genetic contribution from that individual would be lost. Whether this reduction in numbers and reproduction would appreciably reduce the likelihood of survival of the fin whales depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

As described in the *Status of the Species*, the best abundance estimate for the Nova Scotia stock of sei whales is 6,292 animals, though the abundance survey from which this estimate was derived excluded waters off the Scotian Shelf, an area encompassing a large portion of the stock's range (Hayes et al. 2020). According to the latest NMFS stock assessment report for sei whales in the western North Atlantic, there are insufficient data to determine population trends for sei whales (Hayes et al. 2020). Across its range, it is estimated that there are over 50,000 sei whales. In the North Pacific, an abundance estimate for the entire North Pacific population of sei whales is not available. However, in the western North Pacific, it is estimated that there are 35,000 sei whales (Cooke 2018a). In the eastern North Pacific (considered east of longitude 180°), two stocks of sei whales occur in U.S. waters: Hawaii and Eastern North Pacific. Abundance estimates for the Hawaii stock are 391 sei whales ($N_{\min}=204$), and for Eastern North Pacific stock, 519 sei whales ($N_{\min}=374$) (Carretta et al. 2019a). In the Southern Hemisphere, recent abundance of sei whales is estimated at 9,800 to 12,000 whales.

While uncertainty surrounds the population trend of this species, we must determine whether the takes under the proposed action are too high to allow survival and recovery given the current status of the species and uncertain population trajectory. We must evaluate whether the effects of the fishery as now proposed, considered in context of the environmental baseline and cumulative effects, are expected to appreciably reduce the likelihood of both the survival and the recovery of

species in the wild. To try to answer this question, we examined the total population size relative to anticipated take levels, taking into account the period over which the take would occur.

As described in the *Effects of the Proposed Action*, although it is likely non-lethal entanglement in fishing gear may negatively affect the health or body condition of a whale, multiple stressors (e.g., prey abundance, climate variation, reproductive state, exposure to harmful algal blooms, vessel collisions) co-occur and, individually and cumulatively, can affect the health of animals, and, subsequently, the calving rate of the population. However, based on the best available scientific and commercial data, we believe sublethal effects of entanglement may contribute to a decrease in calving rates, but we cannot quantify the degree to which entanglements are affecting calving rates.

The operation of the federal fisheries may contribute to decreased calving rates due to the sublethal effects of entanglement. The federal fisheries are expected to entangle an annual average of 1 sei whale. Some animals will shed the gear themselves; others will continue to carry trailing gear. We anticipate that most of the sei whales that do not die as a result of their injuries may experience varying levels of sublethal effects from the exposure to entanglement. These effects range from being temporary in nature such as elevated stress levels to more significant injuries that may heal over time but may affect the individual's lifetime fitness. As described in section 7.2, non-lethal entanglements may negatively affect the health or body condition of a whale, increase energetic demands, reduce female's reproductive energy budget, impede foraging, and increase stress hormones (Hayes et al. 2018a, van der Hoop et al. 2017a). Although we currently cannot quantify the degree to which entanglements may affect calving rates, we expect that a portion of animals that survive entanglement may experience fitness level impacts that could lead to a decreased calving rate in the population. Even though some individual whales are expected to experience a reduction in fitness, we would not expect such impacts to have meaningful effects at the population level given the current status of the sei whale population that will be exposed. However, we believe the low number of entanglements that are anticipated will not reduce the calving rates of sei whales. For this reason, we do not anticipate that the sublethal effects to sei whales will result in changes in the number, distribution, or reproductive potential of sei whales in the North Atlantic.

The annual mortality of 1 sei whale from the proposed action would represent approximately 0.01 percent ($=1/6292 \times 100$) of the current estimate of 6,292 sei whales in the North Atlantic Ocean. This calculation does not account for any additional deaths of dependent calves that may result from mothers that were entangled and subsequently died. We did not have enough information on sei whale demographics within the U.S. and their entanglement rates to make assumptions regarding dependent calf deaths in the calculations. However, the entanglement estimate (see 7.2.1.5) was based on calculations that used a conservative overestimate of apportionment of sei whale entanglements to the U.S. federal fisheries (e.g., likely undocumented events assumed to be U.S.). This conservative overestimate qualitatively provides some buffer to the impact of the action from the possible loss of a dependent calf. The M/SI of 1 sei whale (adult, juvenile, or adult/with calf) annually is very small and contributes only minimally to the overall mortality of the population. We believe that the resulting mortality of sei whales associated with the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the species, and we expect the sei whale population to remain large enough and to retain the potential for recovery. We believe entanglement in fishing gear is still a threat, and efforts to reduce interactions are key to conservation of the species. The

effects of the proposed action will most directly affect the overall size of the population, which we believe is currently sufficiently large to withstand this very low level of impact, and the proposed action will not cause the population to lose genetic heterogeneity, broad demographic representation, or successful reproduction, nor affect the species ability to meet its lifecycle requirements, including reproduction, sustenance, and shelter.

The proposed action is not likely to affect the recovery potential of sei whales. The 2011 Recovery Plan for sei whales included two criteria for consideration for reclassifying the species from endangered to threatened:

1. Given current and projected threats and environmental conditions, the sei whale population in each ocean basin in which it occurs (North Atlantic, North Pacific and Southern Hemisphere) satisfies the risk analysis standard for threatened status (has no more than a 1 percent chance of extinction in 100 years) and the global population has at least 1,500 mature, reproductive individuals (consisting of at least 250 mature females and at least 250 mature males in each ocean basin). Mature is defined as the number of individuals known, estimated, or inferred to be capable of reproduction. Any factors or circumstances that are thought to substantially contribute to a real risk of extinction that cannot be incorporated into a Population Viability Analysis will be carefully considered before downlisting takes place.
2. None of the known threats to sei whales are known to limit the continued growth of populations. Specifically, the factors in 4(a)(1) of the ESA are being or have been addressed: A) the present or threatened destruction, modification or curtailment of a species' habitat or range; B) overutilization for commercial, recreational or educational purposes; D) the inadequacy of existing regulatory mechanisms; and E) other natural or manmade factors (there are no criteria for Factor C, disease or predation).

The proposed action will not result in any condition that impacts the time it will take to reach these goals or the likelihood that these goals will be met. This is because the proposed action will not affect the trend of the species or prevent or delay it from achieving an increasing population or otherwise affect the number of individuals or the species growth rate and will not affect the chance of extinction.

Based on this analysis, the proposed action is not likely to result in an appreciable reduction in the likelihood of survival and recovery of sei whales in the wild. These conclusions were made in consideration of the endangered status of sei whales, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline* and *Cumulative Effects*, and any anticipated effects of climate change on the abundance and distribution of sei whales in the action area.

9.4. Sperm Whale

As described in the *Effects of the Proposed Action*, we anticipate the annual average of one sperm whale entanglement, which may result in M/SI. No vessel strikes of sperm whales are anticipated. Entanglement in fishing gear and vessel strikes as described in the *Environmental Baseline*, may occur in the action area. As noted in the *Cumulative Effects* section of this Opinion, we have not identified any cumulative effects different than those considered in the *Status of the Species* and *Environmental Baseline* sections of this Opinion, inclusive of how those activities may contribute to climate change. As described in the *Climate Change* section,

climate change may result in changes in the distribution or abundance of sperm whales in the action area; however, we have not identified any different or exacerbated effects of the action in the context of anticipated climate change.

An estimated one entanglement annually as a result of the proposed action may reduce the number of sperm whales in the population, compared to their numbers in the absence of the proposed action. This would result in a reduction in future reproduction, assuming the individual was a female and would have survived otherwise to reproduce. If it was a male, the genetic contribution from that individual would be lost. Whether this reduction in numbers and reproduction would appreciably reduce the likelihood of survival of the sperm whales depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

As described in the *Status of the Species*, the best abundance estimate for the North Atlantic stock is 4,349 individuals (Hayes 2019). There are no reliable estimates for sperm whale abundance across the entire Atlantic Ocean, however, the most recent global sperm whale population estimate is 360,000 whales (Whitehead 2009). While uncertainty surrounds the population trend of this species, we must determine whether the takes under the proposed action are too high to allow survival and recovery given the current status of the species and uncertain population trajectory. We must evaluate whether the effects of the fishery as now proposed, considered in context of the environmental baseline and cumulative effects, are expected to appreciably reduce the likelihood of both the survival and the recovery of species in the wild. To try to answer this question, we examined the total population size relative to anticipated take levels, taking into account the period over which the take would occur.

As described in the *Effects of the Proposed Action*, although it is likely non-lethal entanglement in fishing gear may negatively affect the health or body condition of a whale, multiple stressors (e.g., prey abundance, climate variation, reproductive state, exposure to harmful algal blooms, vessel collisions) co-occur and, individually and cumulatively, can affect the health of animals, and, subsequently, the calving rate of the population. However, based on the best available scientific and commercial data, we believe sublethal effects of entanglement may contribute to a decrease in calving rates, but we cannot quantify the degree to which entanglements are affecting calving rates.

The operation of the federal fisheries may contribute to decreased calving rates due to the sublethal effects of entanglement. The federal fisheries are expected to entangle an annual average of 1 sperm whale. Some animals will shed the gear themselves; others will continue to carry trailing gear. We anticipate that most of the sperm whales that do not die as a result of their injuries may experience varying levels of sublethal effects from the exposure to entanglement. These effects range from being temporary in nature such as elevated stress levels to more significant injuries that may heal over time but may affect the individual's lifetime fitness. As described in section 7.2, non-lethal entanglements may negatively affect the health or body condition of a whale, increase energetic demands, reduce female's reproductive energy budget, impede foraging, and increase stress hormones (Hayes et al. 2018a, van der Hoop et al. 2017a). Although we currently cannot quantify the degree to which entanglements may affect calving rates, we expect that a portion of animals that survive entanglement may experience fitness level impacts that could lead to a decreased calving rate in the population. Even though some individual whales are expected to experience a reduction in fitness, we would not expect such

impacts to have meaningful effects at the population level given the current status of the sperm whale population that will be exposed. However, we believe the low number of entanglements that are anticipated will not reduce the calving rates of sperm whales. For this reason, we do not anticipate that the sublethal effects to sperm whales will result in changes in the number, distribution, or reproductive potential of sperm whales in the North Atlantic.

The annual mortality of 1 sei whale from the proposed action would represent approximately 0.02 percent ($=1/4349 \times 100$) of the current estimate of 4,349 sperm whales in the North Atlantic Ocean. This calculation does not account for any additional deaths of dependent calves that may result from mothers that were entangled and subsequently died. We did not have enough information on sperm whale demographics within the United States and their entanglement rates to make assumptions regarding dependent calf deaths in the calculations. However, the entanglement (section 7.2) was based on calculations that used a conservative overestimate of apportionment of sperm whale entanglements to the U.S. federal fisheries (e.g., likely undocumented events assumed to be U.S.). This conservative overestimate qualitatively provides some buffer to the impact of the action from the possible loss of a dependent calf. The M/SI of 1 sperm whale (adult, juvenile, or adult/with calf) annually is very small and contributes only minimally to the overall mortality on the population. We believe that the resulting mortality of sperm whales associated with the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the species, and we expect the sperm whale population to remain large enough and to retain the potential for recovery. We believe entanglement in fishing gear is still a threat, and efforts to reduce interactions are key to conservation of the species. The effects of the proposed action will most directly affect the overall size of the population, which we believe is currently sufficiently large to withstand this very low level of impact, and the proposed action will not cause the population to lose genetic heterogeneity, broad demographic representation, or successful reproduction, nor affect the species ability to meet its lifecycle requirements, including reproduction, sustenance, and shelter.

The proposed action is not likely to affect the recovery potential of sperm whales. The 2010 Recovery Plan states that sperm whales may be considered for reclassifying to threatened when all of the following have been met:

1. Given current and projected threats and environmental conditions, the sperm whale population in each ocean basin in which it occurs (Atlantic Ocean/Mediterranean Sea, Pacific Ocean, and Indian Ocean) satisfies the risk analysis standard for threatened status (has no more than a 1 percent chance of extinction in 100 years) and the global population has at least 1,500 mature, reproductive individuals (consisting of at least 250 mature females and at least 250 mature males in each ocean basin). Mature is defined as the number of individuals known, estimated, or inferred to be capable of reproduction. Any factors or circumstances that are thought to substantially contribute to a real risk of extinction that cannot be incorporated into a Population Viability Analysis will be carefully considered before downlisting takes place.
2. None of the known threats to sperm whales is known to limit the continued growth of populations. Specifically, the factors in 4(a)(1) of the ESA are being or have been addressed: A) the present or threatened destruction, modification or curtailment of a species' habitat or range; B) overutilization for commercial, recreational or educational purposes; C) disease or predation; D) the inadequacy of existing regulatory mechanisms; and E) other natural or manmade factors.

The proposed action will not result in any condition that impacts the time it will take to reach these goals or the likelihood that these goals will be met. This is because the proposed action will not affect the trend of the species or prevent or delay it from achieving an increasing population or otherwise affect its growth rate and will not affect the chance of extinction.

Based on this analysis, the proposed action is not likely to result in an appreciable reduction in the likelihood of survival and recovery of sperm whales in the wild. These conclusions were made in consideration of the endangered status of sperm whales, other stressors that individuals are exposed to within the action area as described in the *Environmental Baseline and Cumulative Effects*, and any anticipated effects of climate change on the abundance and distribution of sperm whales in the action area.

9.5. Green Sea Turtle, North Atlantic DPS

The North Atlantic DPS of green sea turtles is listed as threatened under the ESA. As is the case with the other three sea turtle species addressed in this Opinion, North Atlantic DPS of green sea turtles face numerous threats on land and in the water that affect the survival of all age classes.

There are four regions that support high nesting concentrations in the North Atlantic DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo); United States (Florida), and Cuba. Using data from 48 nesting sites in the North Atlantic DPS, nester abundance which was estimated at 167,528 total nesters (Seminoff et al. 2015). The years used to generate the estimate varied by nesting site but were between 2005-2012. The largest nesting site (Tortuguero, Costa Rica) hosts 79 percent of the estimated nesting. It should be noted that not all female turtles nest in a given year (Seminoff et al. 2015). Nesting in the area has increased considerably since the 1970s, and nest count data from 1999-2003 suggested that 17,402-37,290 females nested there per year (Seminoff et al. 2015). In 2010, an estimated 180,310 nests were laid at Tortuguero, the highest level of green sea turtle nesting estimated since the start of nesting track surveys in 1971. This equated to somewhere between 30,052 and 64,396 nesters in 2010 (Seminoff et al. 2015). Nesting sites in Cuba, Mexico, and the United States were either stable or increasing (Seminoff et al. 2015). More recent data is available for the southeastern United States. Nest counts at Florida's core index beaches have ranged from less than 300 to almost 41,000 in 2019. The INBS is carried out on a subset of beaches surveyed during the SNBS and is designed to measure trends in nest numbers. The nest trend in Florida shows the typical biennial peaks in abundance and has been increasing (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>; Figure 37). The SNBS is broader but is not appropriate for evaluating trends. In 2019, approximately 53,000 green turtle nests were recorded in the SNBS (<https://myfwc.com/research/wildlife/sea-turtles/nesting/>). Seminoff et al. (2015) estimated total nester abundance for Florida at 8,426 turtles.

NMFS recognizes that the nest count data available for green sea turtles in the Atlantic indicates increased nesting at many sites. However, NMFS also recognizes that the nest count data, including data for green sea turtles in the Atlantic, only provides information on the number of females currently nesting, and is not necessarily a reflection of the number of mature females available to nest or the number of immature females that will reach maturity and nest in the future.

Green sea turtles have been observed to interact with both gillnet and bottom trawl gear used in the ten fisheries that are the focus of this Opinion. Based on information from Murray (2018,

2020), Linden (2020), and data from NEFOP, ASM, and the GAR STDN, we anticipate 42 green sea turtles will interact with gear utilized in the ten fisheries assessed in this Opinion every five years. Green sea turtles that interact with gear used in these fisheries (which for the purposes of this Opinion includes gillnet, bottom trawl, hook gear, and trap/pot gear only) are those that are captured or entangled in the gear. An estimated ten green sea turtles are expected to interact with gillnet gear every five years based on recent observer data from the NEFOP and ASM programs. An estimated 32 green sea turtles are expected to interact with bottom trawl gear every five years, based on the interaction rates in Murray (2020) and federal waters take apportionment (Linden 2020). No green sea turtles are expected to interact with trap/pot gear in the lobster, red crab, Jonah crab, black sea bass, and scup fisheries. An additional 15 sea turtles may interact with fishing vessels utilized in the ten fisheries every five years. For the purposes of assessing impacts to the North Atlantic DPS of green sea turtles, we assume all these interactions are with green sea turtles.

Based on the lengths of soak/tow times for gillnet and bottom trawl fisheries in the action area, captures of green sea turtles in these gears could result in serious injuries or mortalities due to forced submergence. Currently there are no regulatory controls on tow times in these bottom trawl fisheries and the only restriction on gillnet soak times is the 30-day limit under the ALWTRP regulations. However, TEDs are required in the mid-Atlantic summer flounder fishery to allow turtles to escape from trawl nets and to reduce bycatch related mortality. Serious injuries or mortalities could also occur as a result of entanglement in gillnet gear, which could hamper swimming, feeding, or surfacing behaviors and lead to asphyxiation or necrosis of body parts. Of the anticipated interactions, 78 percent (8) of the anticipated interactions in gillnet gear and 50 percent (16) of the interactions in bottom trawl gear are expected to lead to mortality in a 5-year period. In addition, 15 sea turtles of any species may be die from being struck by vessels operating in the fisheries over the 5-year period. While it is less likely that these will be green sea turtles, for assessing impacts on green sea turtles, we assume that all could be greens. Therefore, 39 of the 57 green sea turtles that interact with gear or vessels in these fisheries every five years are expected to die or sustain serious injuries leading to death or failure to reproduce. This results in the loss of 8 green sea turtles, on average, each year.

As described above, it is reasonable to expect that both benthic immature and sexually mature green sea turtles may be captured in gillnet and bottom trawl gear as a result of the operation of the fisheries. It is assumed that there is an equal chance of lethally capturing a male or female green sea turtle since available information suggests that both sexes occur in the action area. Lethal interactions would reduce the number of green sea turtles, compared to their numbers in the absence of the proposed actions, assuming all other variables remained the same.

Lethal interactions would also result in a potential reduction in future reproduction, assuming some individuals would be females and would have otherwise survived to reproduce. For example, an adult female green sea turtle lays three clutches of eggs, on average (Seminoff et al. 2015), every two to years (Troëng and Chaloupka 2007, Witherington and Ehrhart 1989, Zurita et al. 1994). Green turtle clutches range from 108 eggs in Costa Rica to 136 eggs in Florida (Seminoff et al. 2015, Tiwari et al. 2006, Witherington and Ehrhart 1989). A small percentage of the eggs are expected to survive to sexual maturity. A lethal capture of a female green sea turtle in gillnet or bottom trawl gear would remove reproductive output from the species. The anticipated lethal interactions are expected to occur anywhere in the action area, and green sea turtles generally have large ranges in which they disperse. Thus, no reduction in the distribution

of green sea turtles is expected from these interactions. Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

We believe the proposed actions are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of the green sea turtle. Although the anticipated mortalities would result in an instantaneous reduction in absolute population numbers, the U.S. populations of green sea turtles would not be appreciably affected. For a population to remain stable, sea turtles must replace themselves through successful reproduction at least once over the course of their reproductive lives, and at least one offspring must survive to reproduce itself. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be exceeded through recruitment of new breeding individuals. Since the abundance trend information for green sea turtles is clearly increasing while takes have been occurring, we believe the lethal interactions attributed to the proposed actions will not have any measurable effect on that trend. In addition, 8 green sea turtle mortalities per year represents a very small fraction, < 0.1 percent $(= (8/8426+30052)*100)$, of the overall population estimated from recent nester data in Florida (8,426) and Costa Rica (30,052). As described in the *Environmental Baseline*, although the Deepwater Horizon oil spill is expected to have resulted in adverse impacts to green sea turtles, there is no information to indicate, or basis to believe, that a significant population-level impact has occurred that would have changed the species' status to an extent that the expected interactions from these fisheries would result in a detectable change in the population status of green sea turtles in the Atlantic. Any impacts are not thought to alter the population status to a degree in which the number of mortalities from the proposed actions could be seen as reducing the likelihood of survival and recovery of the species.

As also described in the *Environmental Baseline*, regulatory actions have been taken to reduce anthropogenic effects to green sea turtles in the Atlantic. These include measures to reduce the number and severity of green sea turtle interactions in the U.S. South Atlantic and Gulf of Mexico shrimp, Mid-Atlantic large mesh gillnet, Mid-Atlantic sea scallop dredge, summer flounder trawl, and the Virginia pound net fisheries—all of which are causes of green sea turtle mortality in the Atlantic. Since most of these regulatory measures have been in place for several years now, it is likely that current nesting trends reflect the benefit of these measures to Atlantic green sea turtles. Therefore, the current nesting trends for green sea turtles in the Atlantic are likely to continue to improve as a result of the regulatory actions taken for these and other fisheries. There are no new known sources of mortality for green sea turtles in the Atlantic other than potential impacts from the Deepwater Horizon oil spill.

The recovery plan for Atlantic green sea turtles (NMFS and USFWS 1991a) lists the following recovery objectives which are relevant to the proposed actions in this Opinion, and must be met over a period of 25 continuous years:

1. The level of nesting in Florida has increased to an average of 5,000 nests per year for at least six years.
2. A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.

Along the Atlantic coast of eastern central Florida, a mean of 5,055 nests were deposited each year from 2001 to 2005 (Meylan et al. 2006) and 10,377 each year from 2008 to 2012 (B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013, as cited in Seminoff et al. 2015). Nesting has increased substantially over the last 20 years and peaked in 2011 with 15,352 nests statewide (Chaloupka et al. 2007; B. Witherington, Florida Fish and Wildlife Conservation Commission, pers. comm., 2013 as cited in Seminoff et al. 2015). The status review estimated total nester abundance for Florida at 8,426 turtles (Seminoff et al. 2015). As described above, sea turtle nesting in Florida is continuing to increase. For the most recent 6-year period of SNBS data, there were 5,895 in 2014, 37,341 nests in 2015, 5,393 in 2016, 53,102 in 2017, 4,545 in 2018, and 53,011 in 2019 (see <https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>). Thus, this recovery criterion continues to be met.

Several actions are being taken to address the second objective; however, there are currently few studies, and no estimates, available that specifically address changes in abundance of individuals on foraging grounds. A study in the central region of the Indian River Lagoon (along the east coast of Florida) found a 661 percent increase in juvenile green sea turtle capture rates over a 24-year study period from 1982-2006 (Ehrhart et al. 2007). Wilcox et al. (1998) found a dramatic increase in the number of green sea turtles captured from the intake canal of the St. Lucie nuclear power plant on Hutchinson Island, Florida beginning in 1993. During a 16-year period from 1976-1993, green sea turtle captures averaged 24 per year. Green sea turtle catch rates for 1993, 1994, and 1995 were 745, 804, and 2,084 percent above the previous 16-year average annual catch rates (Wilcox et al. 1998). In a study of sea turtles incidentally caught in pound net gear fished in inshore waters of Long Island, New York, Morreale and Standora (2005) documented the capture of more than twice as many green sea turtles in 2003 and 2004 with less pound net gear fished, compared to the number of green sea turtles captured in pound net gear in the area during the 1990s. Yet other studies have found no difference in the abundance of green sea turtles on foraging grounds in the Atlantic (Bjorndal et al. 2005, Epperly et al. 2007). Given the clear increases in nesting, however, it is reasonably likely that numbers on foraging grounds have increased.

Based on the information provided above, the loss of 8 green sea turtles annually from the North Atlantic DPS as a result of the operation of the fisheries will not appreciably reduce the likelihood of survival for green sea turtles in the North Atlantic given that is not expected to measurably affect the increasing nesting trend in Florida, that the population size is relatively large, and that measures to reduce the number of North Atlantic DPS of green sea turtles that are injured and die (which should result in increases to the numbers of green sea turtles in the North Atlantic that would otherwise have not occurred in the absence of those regulatory measures) are in place. Given that the action is not expected to measurably affect the nesting trend, the operation of the fisheries will also not appreciably reduce the likelihood of recovery of green sea turtles in the North Atlantic DPS. The fisheries assessed in this Opinion have no adverse effects on green sea turtles that occur outside of the North Atlantic. Therefore, since the operation of the fisheries will not appreciably reduce the likelihood of survival or recovery of green sea turtles in the North Atlantic, the proposed actions will not appreciably reduce the likelihood of survival or recovery for the species.

9.6. Kemp's Ridley Sea Turtle

Kemp's ridley sea turtles are listed as a single species classified as endangered under the ESA. Kemp's ridleys occur in the Atlantic Ocean and Gulf of Mexico. The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963, NMFS and USFWS 2015, USFWS and NMFS 1992).

Nest count data provides the best available information on the number of adult females nesting each year. As is the case with other sea turtles species, nest count data must be interpreted with caution given that these estimates provide a minimum count of the number of nesting Kemp's ridley sea turtles. In addition, the estimates do not account for adult males or juveniles of either sex. Without information on the proportion of adult males to females and the age structure of the population, nest counts cannot be used to estimate the total population size (Meylan 1982, Ross 1996), letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007). Nevertheless, the nesting data does provide valuable information on the extent of Kemp's ridley nesting and the trend in the number of nests laid. It is the best proxy we have for estimating population changes.

Following a significant, unexplained one-year decline in 2010, Kemp's ridley sea turtle nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo nesting database, unpublished data). In 2013 and 2014, there was a second significant decline in Mexico nests, with only 16,385 and 11,279 nests recorded, respectively. In 2015, nesting in Mexico improved to 14,006 nests, and in 2016 overall numbers increased to 18,354 recorded nests. There was a record high nesting season in 2017, with 24,570 nests recorded (J. Pena, pers. comm. to NMFS SERO PRD, August 31, 2017 as cited in NMFS 2020c) and decreases observed in 2018 and again in 2019 (Figure 39). In 2019, there were 11,140 nests in Mexico. It is unknown whether this decline is related to resource fluctuation, natural population variability, effects of catastrophic events like the Deepwater Horizon oil spill affecting the nesting cohort, or some other factor. A small nesting population is also emerging in the United States, primarily in Texas. From 1980-1989, there were an average of 0.2 nests/year at Padre Island National Seashore (PAIS), rising to 3.4 nests/year from 1990-1999, 44 nests/year from 2000-2009, and 110 nests per year from 2010-2019. There was a record high of 353 nests in 2017 (NPS 2020). It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, characterized by a significant decline in 2010, followed by a second decline in 2013-2014, but with a rebound in 2015-2017 (NMFS 2020c) and decreases in nesting in 2018 and 2019 (NPS 2020).

Estimates of the adult female nesting population reached a low of approximately 250-300 in 1985 (NMFS and USFWS 2015, TEWG 2000). Gallaway et al. (2016) developed a stock assessment model for Kemp's ridley to evaluate the relative contributions of conservation efforts and other factors toward this species' recovery. Terminal population estimates for 2012 summed over ages 2 to 4, ages 2+, ages 5+, and ages 9+ suggest that the respective female population sizes were 78,043 (SD = 14,683), 152,357 (SD = 25,015), 74,314 (SD = 10,460), and 28,113 (SD = 2,987) (Gallaway et al. 2016). Using the standard IUCN protocol for sea turtle assessments, the number of mature individuals was recently estimated at 22,341 (Wibbels and Bevan 2019). The calculation took into account the average annual nests from 2016-2018 (21,156), a clutch frequency of 2.5 per year, a remigration interval of 2 years, and a sex ratio of 3.17 females:1 male. Based on the data in their analysis, the assessment concluded the current population trend is unknown (Wibbels and Bevan 2019). However, some positive outlooks for the species include

recent conservation actions, including the expanded TED requirements in the shrimp fishery (84 FR 70048, December 20, 2019) and a decrease in the amount of shrimping off the coast of Tamaulipas and in the Gulf of Mexico (NMFS and USFWS 2015).

Genetic variability in Kemp's ridley turtles is considered to be high, as measured by nuclear DNA analyses (i.e., microsatellites) (NMFS et al. 2011). If this holds true, then rapid increases in population over one or two generations would likely prevent any negative consequences in the genetic variability of the species (NMFS et al. 2011). Additional analysis of the mtDNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton et al. 2006).

Kemp's ridley sea turtles have been documented to interact with both gillnet and bottom trawl gear in the action area. The distribution of Kemp's ridleys overlaps seasonally with the use of these gears, and they are known to be captured in or entangled by gears used in several of the fisheries assessed in this Opinion, albeit at low levels. Based on information from Murray (2018; 2020), Linden (2020) and the GAR STDN, we anticipate 292 Kemp's ridley sea turtles will interact with gear utilized in the ten fisheries assessed in this Opinion every five years. Kemp's ridley sea turtles that interact with gear used in these fisheries (which for the purposes of this Opinion includes gillnet, bottom trawl, hook gear, and trap/pot gear only) are those that are captured or entangled in the gear. An estimated 239 Kemp's ridleys are expected to interact with gillnet gear every five years based on the interactions rates in Murray (2018) and federal waters take apportionment (Linden 2020). In addition, an estimated 53 Kemp's ridleys are expected to interact annually with bottom trawl gear, based on Murray (2020) and the federal waters take apportionment (Linden 2020). No Kemp's ridleys are expected to interact with trap/pot gear in the lobster, red crab, Jonah crab, black sea bass, and scup fisheries. An additional 15 sea turtles may interact with fishing vessels utilized in the ten fisheries every five years. While it is more likely these will be loggerhead or leatherback sea turtles, for assessing impacts on Kemp's ridley sea turtles, we assume that all could be Kemp's ridleys.

Of the anticipated interactions, 78 percent (187) of the anticipated interactions (239) in gillnet gear and 50 percent (27) of the interactions (53) in bottom trawl gear are expected to lead to mortality in a 5-year period. In addition, 15 sea turtles of any species may die from being struck by vessels operating in the fisheries over the 5-year period. Therefore, 229 of the 307 Kemp's ridley sea turtles that interact with gear or vessels in these fisheries every five years are expected to die or sustain serious injuries leading to death or failure to reproduce. This results in the loss of 46 Kemp's ridley sea turtles, on average, each year. Either male or female Kemp's ridleys may be captured/entangled in these fisheries since available information suggests that both sexes occur in the action area. All Kemp's ridleys interacting with these fisheries in the action area are expected to be immatures.

The proposed actions would reduce the species' population compared to the number that would have been present in the absence of the proposed actions, assuming all other variables remained the same. Using the estimate of mature animals (22,341) in Wibbels et al. (2019), the loss of 46 animals per year represents a small fraction, approximately 0.2 percent ($=46/22,341 \times 100$) of the overall population. The proposed actions could also result in a potential reduction in future reproduction, assuming at least some of these individuals would be female and would have survived to reproduce in the future. The annual loss of adult females could preclude the production of thousands of eggs and hatchlings, of which a small percentage is expected to

survive to sexual maturity. Thus, the death of any females that would otherwise have survived to sexual maturity would eliminate their contribution to future generations, and result in a reduction in sea turtle reproduction. The anticipated lethal interactions are expected to occur anywhere in the action area, and sea turtles generally have large ranges in which they disperse. Thus, no reduction in the distribution of Kemp's ridley sea turtles is expected from these fishery interactions. Whether the reductions in numbers and reproduction of Kemp's ridley sea turtles would appreciably reduce their likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. In addition, the species' limited range and low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental stochasticity, which are often difficult to predict with any certainty.

It is likely that the Kemp's ridley was the sea turtle species most affected by the Deepwater Horizon oil spill on a population level. In addition, the sea turtle strandings documented in 2010 and 2011 in Alabama, Louisiana, and Mississippi primarily involved Kemp's ridley sea turtles. Necropsy results indicated that mortality was caused by forced submergence, which is commonly associated with fishery interactions (77 FR 27413, May 10, 2012). As described in the *Environmental Baseline*, regulatory actions have been taken to reduce anthropogenic effects to Kemp's ridley sea turtles. These include measures implemented to reduce the number and severity of Kemp's ridley sea turtle interactions in the U.S. South Atlantic and Gulf of Mexico shrimp, mid-Atlantic large mesh gillnet, Mid-Atlantic summer flounder, Mid-Atlantic scallop dredge, and the Virginia pound net fisheries. In 2021, the expanded TED requirements in the shrimp trawl fishery will become effective, further reducing impacts to sea turtles.

There are no new known sources of mortality for Kemp's ridley sea turtles other than potential impacts from the Deepwater Horizon oil spill. Nevertheless, the effects on Kemp's ridley sea turtles from the proposed actions are not likely to appreciably reduce overall population numbers over time due to current population size, expected recruitment, and the implementation of additional conservation requirements in the shrimp trawl fishery, even in light of the adverse impacts expected to have occurred from the Deepwater Horizon oil spill.

It is important to remember that with significant inter-annual variation in nesting data, sea turtle population trends necessarily are measured over decades and the long-term trend line better reflects the population increase in Kemp's ridleys. With the recent nesting data, the population trend has become less clear. Nonetheless, data from 1990 to present continue to support that Kemp's ridley sea turtles have shown a generally increasing nesting trend. Even with reported biennial fluctuations in nesting numbers from Mexican beaches, all years since 2006 have reported over 10,000 nests per year, indicating an increasing population over the previous decades. We believe this long-term trend in nesting is likely evidence of a generally increasing population, as well as a population that is maintaining (and potentially increasing) its genetic diversity. These nesting data are indicative of a species with a high number of sexually mature individuals. Additionally, new measures have been implemented in the shrimp trawl fishery, which will further reduce impacts to the population. The loss of 46 Kemp's ridleys annually is not expected to change the trend in nesting, the distribution of, or the reproduction of Kemp's ridley sea turtles. Therefore, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival of this species in the wild.

The recovery plan for the Kemp's ridley sea turtle (NMFS et al. 2011) lists the following recovery objectives for downlisting that are relevant to the fisheries assessed in this Opinion:

1. Demographic: A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained. Methodology and capacity to implement and ensure accurate nesting female counts have been developed.
2. Listing factor: TED regulations, or other equally protective measures, are maintained and enforced in U.S. and Mexican trawl fisheries (e.g., shrimp, summer flounder, whelk) that are known to have an adverse impact on Kemp's ridleys in the Gulf of Mexico and Northwest Atlantic Ocean.

With respect to the demographic recovery objective, the nesting numbers in the most recent three years indicate there were 24,570 nests in 2017, 17,945 in 2018, and 11,090 in 2019 on the main nesting beaches in Mexico. Based on 2.5 clutches/female/season, these numbers represent approximately 9,828 (2017), 7,178 (2018), and 4,436 (2019) nesting females in each season. The number of nests reported annually from 2010 to 2014 declined overall; however, they rebounded in 2015 through 2017, and declined again in 2018 and 2019. Although there has been a substantial increase in the Kemp's ridley population within the last few decades, the number of nesting females is still below the number of 10,000 nesting females per season required for downlisting (NMFS and USFWS 2015). Since we concluded that the potential loss of Kemp's ridley sea turtles is not likely to have any detectable effect on nesting trends, we do not believe the proposed action will impede progress toward achieving this recovery objective. Nonlethal captures of these sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, we believe the proposed action will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' recovery in the wild.

In regards to the listing factor recovery criterion, the recovery plan states, "the highest priority needs for Kemp's ridley recovery are to maintain and strengthen the conservation efforts that have proven successful. In the water, successful conservation efforts include maintaining the use of TEDs in fisheries currently required to use them, expanding TED-use to all trawl fisheries of concern, and reducing mortality in gillnet fisheries. Adequate enforcement in both the terrestrial and marine environment also is also noted essential to meeting recovery goals" (NMFS et al. 2011). We are currently undertaking several of these initiatives, which should aid in the recovery of the species. The required use of TEDs in shrimp trawls in the United States under sea turtle conservation regulations and in Mexican waters has had dramatic effects on the recovery of Kemp's ridley sea turtles.

Based on the information provided above, the loss of 46 Kemp's ridley sea turtles annually in the fisheries will not appreciably reduce the likelihood of survival and recovery for Kemp's ridley sea turtles given the long term nesting trend, the population size, and ongoing and future measures (i.e., expanded TED regulations in the shrimp trawl fishery) that reduce the number of Kemp's ridley sea turtles that are injured and die.

9.7. Loggerhead Sea Turtle, NWA DPS

The Northwest Atlantic DPS of loggerhead sea turtles is listed as threatened under the ESA. Based on nesting data and population abundance and trends at the time, NMFS and USFWS determined in 2011 that the Northwest Atlantic DPS should be listed as threatened and not endangered based on (1) the large size of the nesting population, (2) the overall nesting

population remains widespread, (3) the trend for the nesting population appears to be stabilizing, and (4) substantial conservation efforts are underway to address threats (76 FR 58868, September 22, 2011).

It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and USFWS 2008). There are many natural and anthropogenic factors affecting the survival of loggerheads prior to their reaching maturity as well as for those adults who have reached maturity. As described in the *Status of the Species*, *Environmental Baseline*, and *Cumulative Effects* sections above, loggerhead sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration, vessel interactions, hopper dredging, power plant intakes, and other factors that result in mortality of individuals at all life stages. Negative impacts causing death of various age classes occur both on land and in the water. Many actions have been taken to address known negative impacts to loggerhead sea turtles. However, others remain unaddressed, have not been sufficiently addressed, or have been addressed in some manner but whose success cannot be quantified.

As previously stated, there are five subpopulations of loggerhead sea turtles in the western North Atlantic (recognized as recovery units in the 2008 recovery plan for the species). These subpopulations show limited evidence of interbreeding. Recent assessments have evaluated the nesting trends for each recovery unit. It should be noted, and it is explained further below, that nesting trends are based on nest counts or nesting females. They do not include non-nesting adult females, adult males, or juvenile males or females in the population.

Ceriani and Meylan (2017) and Bolten et al. (2019) looked at trends by recovery unit. Information on nest counts is presented in the *Status of the Species*. Trends by recovery unit were variable. For the Northern Recovery Unit, nest counts at loggerhead nesting beaches in North Carolina, South Carolina, and Georgia declined at 1.9 percent annually from 1983 to 2005 (NMFS and USFWS 2008). More recently, the trend has been increasing. Ceriani and Meylan (2017) reported a 35 percent increase for this recovery unit from 2009 through 2013. A longer-term trend analysis based on data from 1983 to 2019 indicates that the annual rate of increase is 1.3 percent (Bolten et al. 2019).

Nest counts at index beaches in Peninsular Florida showed a significant decline in loggerhead nesting from 1989 to 2007, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington et al. 2009). From 2009 through 2013, a 2 percent decrease for the Peninsular Florida Recovery Unit was reported (Ceriani and Meylan 2017). Using a longer time series from 1989-2018, there was no significant change in the number of annual nests (Bolten et al. 2019). It is important to recognize that an increase in the number of nests has been observed from 2007 to 2018 (Bolten et al. 2019). Using short-term trends in nesting abundance can be misleading, and trends should be considered in the context of one generation (50 years for loggerheads) (Bolten et al. 2019).

The Dry Tortugas Recovery Unit includes all islands west of Key West, Florida. A census on Key West from 1995 to 2004 (excluding 2002) estimated a mean of 246 nests per year, or about 60 nesting females (NMFS and USFWS 2008). No trend analysis is available because there was not an adequate time series to evaluate the Dry Tortugas Recovery Unit and there are gaps in the

data prohibiting a robust analysis (Bolten et al. 2019, Ceriani et al. 2019, Ceriani and Meylan 2017).

Evaluation of long-term nesting trends for the Northern Gulf of Mexico Recovery Unit is difficult given changes to survey coverage. From 1995 to 2005, the recovery unit exhibited a significant declining trend (Conant et al. 2009, NMFS and USFWS 2008). In the 2009-2013 trend analysis by Ceriani and Meylan (2017), a 1 percent decrease for this recovery unit was reported, likely due to diminished nesting on beaches in Alabama, Mississippi, Louisiana, and Texas. More recently, nest numbers have increased (Bolten et al. 2019). A longer-term analysis from 1997-2018 found that there has been a non-significant increase of 1.7 percent (Bolten et al. 2019).

The majority of nesting in the Greater Caribbean Recovery Unit occurs on the Yucatán Peninsula, in Quintana Roo, Mexico, with 903 to 2,331 nests annually (Zurita et al. 2003). Other significant nesting sites are found throughout the Caribbean, including Cuba, with approximately 250 to 300 nests annually (Ehrhart et al. 2003), and over 100 nests annually in Cay Sal in the Bahamas (NMFS and USFWS 2008). In the trend analysis by Ceriani and Meylan (2017), a 53 percent increase for this Recovery Unit was reported from 2009 through 2013.

Estimates of the total loggerhead population in the Atlantic are not currently available. However, there is some information available for portions of the population. From 2004-2008, the loggerhead adult female population for the Northwest Atlantic ranged from 20,000 to 40,000 or more individuals (median 30,050), with a large range of uncertainty in total population size (NMFS SEFSC 2009). The estimate of Northwest Atlantic adult loggerhead females was considered conservative for several reasons. The number of nests used for the Northwest Atlantic was based primarily on U.S. nesting beaches. Thus, the results are a slight underestimate of total nests because of the inability to collect complete nest counts for many non-U.S. nesting beaches within the DPS. In estimating the current population size for adult nesting female loggerhead sea turtles, the report simplified the number of assumptions and reduced uncertainty by using the minimum total annual nest count (i.e., 48,252 nests) over the five years. This was a particularly conservative assumption considering how the number of nests and nesting females can vary widely from year to year (e.g., the 2008 nest count was 69,668 nests, which would have increased the adult female estimate proportionately to between 30,000 and 60,000). In addition, minimal assumptions were made about the distribution of remigration intervals and nests per female parameters, which are fairly robust and well known. A loggerhead population estimate using data from 2001-2010 estimated the loggerhead adult female population in the Northwest Atlantic at 38,334 individuals (SD =2,287) (Richards et al. 2011).

The AMAPPS surveys and sea turtle telemetry studies conducted along the U.S. Atlantic coast in the summer of 2010 provided preliminary regional abundance estimate of about 588,000 loggerheads along the U.S. Atlantic coast, with an inter-quartile range of 382,000-817,000 (NMFS 2011c). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified sea turtle sightings (NMFS 2011c). Although there is much uncertainty in these population estimates, they provide some context for evaluating the size of the likely population of loggerheads in the Atlantic.

Although limited information is available on the genetic makeup of loggerheads in an area as extensive as the action area, it is likely that loggerheads interacting with these ten fisheries

originate from several, if not all of the recovery units. Sea turtles from each of the five Northwest Atlantic nesting stocks have been documented in the action area. A genetic study on immature loggerheads captured in the Pamlico-Albemarle Estuarine Complex in North Carolina between 1995-1997 indicated that 80 percent of the juveniles and sub-adults utilizing this foraging habitat originated from the south Florida nesting stock, 12 percent from the northern nesting stock, 6 percent from the Yucatán nesting stock, and 2 percent from other rookeries (including the Florida Panhandle, Dry Tortugas, Brazil, Greece, and Turkey nesting stocks) (Bass et al. 2004). Similarly, genetic analysis of samples collected from loggerheads from Massachusetts to Florida found that all five western Atlantic loggerhead stocks were represented (Bowen et al. 2004). However, earlier studies indicated that only a few nesting stocks were represented along the U.S. Atlantic coast. Mixed stock analysis of a foraging aggregation of immature loggerhead sea turtles captured in coastal waters off Florida, found three stocks: south Florida (69 percent of the loggerheads sampled) respectively), northern (10 percent, respectively), and Mexico (20 percent) (Witzell et al. 2002). Similarly, analysis of stranded turtles from Virginia to Florida indicated that the turtles originated from three nesting areas: south Florida (59 percent), northern (25 percent), and Mexico (20 percent) (Rankin-Baransky et al. 2001).

More recently, Haas et al. (2008) used two approaches in identifying the contribution of each stock in the U.S. Atlantic sea scallop fishery bycatch: an equal contribution from each stock or a weighted contribution by rookery sizes. The sea scallop fishery generally operates in the same areas as the fisheries considered in this Opinion and; therefore, the results are applicable to these fisheries. When weighted by population size, 89 percent of the loggerheads captured in the U.S. Atlantic scallop fishery from 1996-2005 originated from the south Florida nesting stock, 4 percent were from the Mexican stock, 3 percent were from the northern (northeast Florida to North Carolina) stock, 1 percent were from the northwest Florida stock, and 0 percent were from the Dry Tortugas stock. The remaining 3 percent of loggerheads sampled were attributed to nesting stocks in Greece (Haas et al. 2008). Haas et al. (2008) noted that these results should be interpreted with caution given the small sample size and resulting difficulties in precisely assigning rookery contributions to a particular mixed population. A re-analysis of loggerhead genetics data by the Atlantic Loggerhead TEWG has found that it is unlikely that U.S. fishing fleets are interacting with the Mediterranean DPS (LaCasella et al. 2013). Given that updated, more refined analyses are ongoing and the occurrence of Mediterranean DPS juveniles in U.S. Atlantic waters is rare and uncertain, if occurring at all, it is unlikely that individuals from the Mediterranean DPS would be present in the action area (Memorandum from Patricia A. Kurkul, Regional Administrator, to the Record, November 29, 2011). As a result, those records are excluded from our analysis and are reapportioned to the five Northwest Atlantic stocks, which are expected to contribute to individuals in the action area. Note that when equal contributions of each stock were considered, Haas et al. (2008) found that the results varied from the weighted contributions but the south Florida nesting stock still contributed the majority of scallop fishery bycatch (63 percent).

These loggerhead nesting stocks in Haas et al. (2008) do not share the exact delineations of the recovery units identified in the 2008 recovery plan. However, the PFRU encompasses the south Florida stock, the NRU is roughly equivalent to the northern nesting stock, the northwest Florida stock is included in the NGMRU, the Mexico stock is included in the GCRU, and the DTRU encompasses the Dry Tortugas stock. The available genetic analyses indicate the majority of bycatch in Northeast and Mid-Atlantic waters comes from the PFRU with smaller contributions

from the other recovery units in the Northwest Atlantic DPS. However, the exact percentages of fisheries bycatch from specific nesting beaches and recovery units are not available at this time and may be variable from year to year. As a result, we are relying on the genetic analysis weighted by population size presented in Haas et al. (2008), which is the most recent and one of the most comprehensive (in terms of the area from which samples were acquired) of the loggerhead genetics studies. The best available information indicates that the proportion of the interactions from each recovery unit is consistent with the relative sizes of the recovery units.

Based on information from Murray (2018; 2020), (2020), and the GAR STDN, we anticipate 1,995 loggerhead sea turtles from the Northwest Atlantic DPS will interact with gear utilized in the ten fisheries assessed in this Opinion every five years. Loggerhead sea turtles that interact with gear used in these fisheries (which for the purposes of this Opinion includes gillnet, bottom trawl, hook gear, and trap/pot gear only) are those that are captured or entangled in the gear. An estimated 1,036 loggerheads are expected to interact with gillnet gear every five years based on the interaction rates in Murray (2018) and federal waters take apportionment (Linden 2020). In addition, an estimated 954 loggerheads are expected to interact every five years with bottom trawl gear, based on Murray (2020) and the federal waters take apportionment (Linden 2020). Five loggerheads are expected to interact with trap/pot gear in the lobster, red crab, Jonah crab, black sea bass, and scup fisheries every five years. An additional 15 loggerhead sea turtles may interact with fishing vessels utilized in the ten fisheries every five years. For the purposes of evaluating effects to the Northwest Atlantic loggerhead DPS, we are considering that all 15 will be loggerhead sea turtles.

Of these, 78 percent (808) of the interactions (1,036) in gillnet gear, 50 percent (477) of the interactions (954) in bottom trawl gear, and 64 percent (4) of the interactions (5) in trap/pot are expected to lead to mortality every five years. In addition, 15 sea turtles are estimated to be struck by vessels operating in the fisheries in this Opinion every five years. These interactions may be lethal. Therefore, 1,304 of the 2,010 loggerheads that interact with gear or vessels in these fisheries every five years are expected to die or sustain serious injuries leading to death or failure to reproduce. This results in the loss of 261 loggerhead turtles, on average, each year.

The vast majority of the 261 loggerheads mortalities anticipated, on average, annually (i.e., 1,304 mortalities over five years) due to the ten fisheries assessed in this Opinion are likely to originate from the PFRU, with the remainder originating from the NRU, GCRU, NGMRU, and DTRU. Using the mean percent contributions in Haas et al. (2008) and then reapportioning the extra 3 percent of turtles that had been attributed to nesting stocks in Greece, we expect that 237 of the loggerhead mortalities will be from the PFRU, 9 from the NRU, 11 from the GCRU, 3 from the NGMRU, and 1 from the DTRU. Therefore, we conclude that none of the recovery units will be disproportionately impacted by interactions in these fisheries. Thus, genetic heterogeneity should be maintained in the species.

The lethal removal of 1,304 loggerhead sea turtles from the Northwest Atlantic DPS every five years (again, on average 261 per year) will reduce the number of loggerhead sea turtles compared to the number that would have been present in the absence of the proposed actions (assuming all other variables remained the same). These lethal interactions would also result in a future reduction in reproduction due to lost reproductive potential, as some of these individuals would be females who would have reproduced in the future, thus eliminating each female individual's contribution to future generations. For example, an adult female loggerhead sea

turtle in the Northwest Atlantic DPS can lay three or four clutches of eggs every two to four years, with 100 to 126 eggs per clutch (NMFS and USFWS 2008). The annual loss of adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. A reduction in the distribution of loggerhead sea turtles is not expected from lethal interactions attributed to the proposed actions. Because all the potential interactions are expected to occur at random throughout the action area and loggerheads generally have large ranges in which they disperse, the distribution of loggerhead sea turtles in the action area is expected to be unaffected.

Whether the reductions in the Northwest Atlantic DPS of loggerhead numbers and reproduction attributed to the proposed actions would appreciably reduce the likelihood of survival for loggerheads depends on what effect these reductions in numbers and reproduction have on overall population sizes and trends. That is, whether the estimated reductions, when viewed within the context of the *Status of the Species*, *Environmental Baseline*, *Climate Change*, and *Cumulative Effects* are to such an extent that adverse effects on population dynamics are appreciable. Loggerhead sea turtles are a slow growing, late-maturing species. Because of their longevity, loggerheads require high survival rates throughout their life to maintain a population (Conant et al. 2009). In other words, late-maturing species are less tolerant of high rates of anthropogenic mortality. Conant et al. (2009) concluded that loggerhead natural growth rates are low, natural survival needs to be high, and even low (1-10 percent) to moderate (10-20 percent) mortality can drive the population into decline. Because recruitment to the adult population is slow, population modeling studies suggest even small increased mortality rates in adults and sub-adults could substantially impact population numbers and viability (Chaloupka and Musick 1997, Crouse et al. 1987, Crowder et al. 1994, Heppell et al. 2005).

Actions have been taken to reduce anthropogenic impacts to loggerhead sea turtles from various sources, particularly since the early 1990s. These include lighting ordinances, predation control, and nest relocations to help increase hatchling survival, as well as measures to reduce the mortality of juveniles and adults in various fisheries and other marine activities. Conant et al. (2009) concluded that the results of their models (i.e., predicted continued declines) are largely driven by mortality of juvenile and adult loggerheads from fishery bycatch that occurs throughout the Northwest Atlantic. While significant progress has been made to reduce bycatch in some fisheries in certain parts of the loggerhead's range, and the results of new nesting trend analyses may indicate the positive effects of those efforts, notable fisheries bycatch persists. The question we are left with for this analysis is whether the effects of the proposed actions appreciably reduce survival and recovery, given the current status of the species and predicted population trajectories, as well as the many natural and human-caused impacts on sea turtles. We may not see the long-term effects of the Deepwater Horizon oil release event and climate change on the population status and trends of loggerheads for several years to come.

As described in the *Status of the Species*, we consider that the Deepwater Horizon oil release had an adverse impact on loggerhead sea turtles, and resulted in mortalities, along with unknown lingering impacts outside the action area resulting from nest relocations, non-lethal exposure, and foraging resource impacts. However, there is no information to indicate that a significant population-level impact has occurred that would have changed the species' status to an extent that the expected interactions from the fisheries assessed in this Opinion would result in a detectable change in the population status of the Northwest Atlantic DPS of loggerhead turtles. This is especially true given the size of the population and that, unlike Kemp's ridleys, the

Northwest Atlantic DPS of loggerheads is proportionally much less dependent on Gulf of Mexico.

It is possible that the Deepwater Horizon oil release reduced the survival rate of all age classes to varying degrees and may continue to do so for some undetermined time. However, there is no information at this time that it has, or should be expected to have, substantially altered the long-term survival rates in a manner that would significantly change the population dynamics compared to the conservative estimates used in this Opinion. Any impacts are not thought to alter the population status to a degree in which the number of mortalities from the proposed actions would reduce the likelihood of survival of the species.

We have determined that the effects on loggerhead sea turtles associated with the proposed actions are not reasonably expected to cause an appreciable reduction in the likelihood of survival of the Northwest Atlantic loggerhead DPS, even in light of the impacts of the Deepwater Horizon oil release and climate change. Over the proposed action, we expect the Northwest Atlantic DPS of adult females to remain large (tens or hundreds of thousands of individuals) and to retain the potential for recovery, as explained below. While the effects of the proposed actions will most directly affect the overall size of the population, the annual take represents a very small fraction, approximately 0.7 percent ($=261/38,334 \times 100$) of the overall female population estimated by Richards et al. (2011). The mortality estimate includes both juveniles and adults while the population estimate is only female adults so this is a conservative estimate. We expect that the population will remain large for several decades to come. The action is not expected to reduce the genetic heterogeneity, broad demographic representation, or successful reproduction of the population, nor affect loggerheads' ability to meet their life cycle requirements, including reproduction, sustenance, and shelter.

In the recovery plan for loggerheads, the nesting beach Demographic Recovery Criteria are specific to recovery units. This criteria for nests and nesting females were based on a time frame of one generation for U.S. loggerheads, defined in the recovery plan as 50 years. To be considered for delisting, each recovery unit will have recovered to a viable level and will have increased for at least one generation. The rate of increase used for each recovery unit was dependent upon the level of vulnerability of the recovery unit. The minimum statistical level of detection (based on annual variability in nest counts over a generation time of 50 years) of 1 percent per year was used for the PFRU, the least vulnerable recovery unit. A higher rate of increase of 3 percent per year was used for the NGMRU and DTRU, the most vulnerable recovery units. A rate of increase of 2 percent per year was used for the NRU, a moderately vulnerable recovery unit (NMFS and USFWS 2008).

A fundamental problem with restricting population analyses to nesting beach surveys is that they may not reflect changes in the non-nesting population. This is because of the long time to maturity and the relatively small proportion of females that are reproducing on a nesting beach. A decrease in oceanic juvenile or neritic juvenile survival rates may be masked by the natural variability in nesting female numbers and the slow response of adult abundance to changes in recruitment to the adult population (Chaloupka and Limpus 2001). In light of this, two additional Demographic Criteria were developed to ensure a more representative measure of population status was achieved. These criteria are not delineated by recovery unit because individuals from the recovery units mix in the marine environment; therefore, they are applicable to all recovery units. The first of these additional Demographic Criteria assesses trends in abundance on

foraging grounds, and the other assesses age-specific trends in strandings relative to age-specific trends in abundance on foraging grounds. For the foraging grounds, a network of index in-water sites, both oceanic and neritic, distributed across the foraging range must be established and monitored to measure abundance. Recovery can be achieved if there is statistical confidence (95 percent) that a composite estimate of relative abundance from these sites is increasing for at least one generation. For trends in strandings relative to in-water abundance, recovery can be achieved if stranding trends are not increasing at a rate greater than the trends in in-water relative abundance for similar age classes for at least one generation. Recovery criteria must be met for all recovery units in order for the species to be de-listed (NMFS and USFWS 2008).

Assuming some or all loggerhead mortalities through interactions with these fisheries are females, the loss of female loggerhead sea turtles as a result of the proposed actions is expected to reduce the reproduction of loggerheads in the Northwest Atlantic DPS compared to the reproductive output of Northwest Atlantic DPS of loggerheads in the absence of the proposed actions. In addition to being linked to survival, these losses are relevant to the Demographic Recovery Criteria for nests and nesting females. As described in the *Status of the Species*, nesting trends for each of the loggerhead sea turtle recovery units in the Northwest Atlantic Ocean DPS are variable. Overall, short-term trends have shown increases, however, over the long-term the DPS is considered stable.

Assuming half the loggerheads interacting with the fisheries in this Opinion are females and interactions are with adults (a worst case scenario with respect to the reproductive value to the population), the loggerhead mortalities from the fisheries would remove 0.34 percent of the DPS (131 out of the estimated 38,334 adult female loggerheads in the Northwest Atlantic from Richards et al. (2011)). In general, while the loss of a certain number of individuals from a species may have an appreciable reduction on the numbers, reproduction, and distribution of the species, this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range, or the species has extremely low levels of genetic diversity. This situation is not likely in the case of the Northwest Atlantic DPS of loggerheads because the species is widely geographically distributed, it is not known to have low levels of genetic diversity, and there are tens to hundreds of thousands of individuals (and possibly more) in the DPS.

In determining whether the operation of the ten fisheries would reduce appreciably the likelihood of survival and recovery of loggerhead sea turtles, NMFS also considered the PVA for loggerhead sea turtles based on the impacts of the Atlantic sea scallop fishery (Merrick and Haas 2008). We recognize that this PVA was published in 2008 and new information has become available since its publication. However, this is the most recently available PVA and does provide information to consider in our analysis. This information is considered with the information above to assess the impacts of the fisheries on the Northwest Atlantic DPS of loggerhead sea turtles.

The Atlantic sea scallop PVA estimated quasi-extinction (the point at which so few animals remain that the species/population will inevitably become extinct) likelihoods under conditions with and without fishery effects (Merrick and Haas 2008). Since the PVA was count-based, the only relatively complete and available population time series at the time (nesting beach counts for 1998-2005) was used for the analysis. As such, the analysis focused on the viability of the

adult females and did not model the viability of the entire loggerhead population (Merrick and Haas 2008). The PVA is described in detail in Merrick and Haas (2008) (Appendix 4).

The PVA established a baseline using the rate of change of the adult female population (which implicitly included the mortalities from these ten fisheries up to that time), and the 2005 count of adult females estimated from all beaches in the Southeast United States based on an extrapolation from nest counts (Merrick and Haas 2008). The rate of change was then adjusted by adding back the scallop fishery interactions (converted to adult female equivalents) and re-running the PVA. The results of these two analyses were then compared. The authors concluded that both the baseline and adjusted baseline (adding back the scallop fishery interactions) had quasi-extinction probabilities of zero (0) at 25, 50, and 75 years, and a probability of 1 percent at 100 years.

Although the PVA uses data from 1989-2005, and models different effects of the scallop and other Atlantic fisheries on loggerheads than what may occur presently, it is still informative for consideration in this Opinion. The PVA analysis done for the 2008 Atlantic sea scallop biological opinion (NMFS 2008a), and our comparison of its results to the current status and trends of the Northwest Atlantic loggerhead DPS (in light of effects from these fisheries, other baseline activities, and climate change) supports the conclusion that operation of the ten fisheries will neither affect the number of nests and nesting females (Demographic Criteria #1) nor the trends in abundance on foraging grounds (Demographic Criteria #2) to the point where there is an appreciable reduction in the species' likelihood of recovery. Based on the rate of change of the adult female population, the PVA determined that there was only a 1 percent chance that loggerheads in the Atlantic could become quasi-extinct within 100 years either with or without scallop fishery interactions. Again, it should be reiterated that the effects of baseline takes in other fisheries, including those assessed in this Opinion, were built into the assumptions underlying the 2008 PVA model. In addition, the Murray (2018) and Murray (2020) reports as well as data from the Sea Turtle Injury Working Group evidence that the current level of bycatch and mortality in the ten fisheries addressed in this Opinion are less than they were in 2008 when the original PVA was run.

Even amidst ongoing threats to the species such as fishery mortality and climate change, the potential average loss of 1,304 loggerheads from the Atlantic over the next five years (and in future 5-year periods) is not likely to result in any appreciable decline to the Northwest Atlantic DPS. This is due to: (1) the large size of the current nesting population, (2) the fact that the overall nesting population remains widespread, (3) the trend for the nesting population appears to be stabilizing, and short-term trends in some recovery units are increasing, since the time period considered during the PVA, and (4) substantial conservation efforts have been implemented and are underway to address threats.

9.8. Leatherback Sea Turtle

Leatherback sea turtles are listed as endangered under the ESA. Leatherbacks are widely distributed throughout the oceans of the world and are found in waters of the Atlantic, Pacific, and Indian Oceans, the Caribbean Sea, Mediterranean Sea, and the Gulf of Mexico (Ernst and Barbour 1972). Leatherback nesting occurs on beaches of the Atlantic, Pacific, and Indian Oceans as well as in the Caribbean (NMFS and USFWS 2013). Leatherbacks face a multitude of threats that can cause death prior to and after reaching maturity. Some activities resulting in leatherback mortality have been addressed.

Dutton et al. (2013) evaluated the stock structure of leatherbacks in the Atlantic. Samples from eight nesting sites in the Atlantic and one in the southwest Indian Ocean identified seven management units in the Atlantic and revealed fine scale genetic differentiation among neighboring populations. The mtDNA analysis failed to find significant differentiation between Florida and Costa Rica or between Trinidad and French Guiana/Suriname (Dutton et al. 2013). In 2020, seven leatherback populations that met the discreteness and significance criteria of DPSs were identified (NMFS and USFWS 2020). These include the Northwest Atlantic, Southwest Atlantic, Southeast Atlantic, Southwest Indian, Northeast Indian, West Pacific, and East Pacific. The population found within the action is area is the Northwest Atlantic Atlantic DPS (Figure 44). While NMFS and USFWS concluded that seven populations met the criteria for DPSs, the species continues to be listed at the global level (85 FR 48332, August 10, 2020). Therefore, this analysis considers the range-wide status.

The most recent published assessment, the leatherback status review, estimated that the total index of nesting female abundance for the Northwest Atlantic DPS is 20,659 females (NMFS and USFWS 2020). This abundance estimate is similar to other estimates. The TEWG estimate approximately 18,700 (range 10,000 to 31,000) adult females using nesting data from 2004 and 2005 (TEWG 2007). The IUCN Red List assessment for the NW Atlantic Ocean subpopulation estimated 20,000 mature individuals (male and female) and approximately 23,000 nests per year (data through 2017) with high inter-annual variability in annual nest counts within and across nesting sites (Northwest Atlantic Leatherback Working Group 2019). The estimate in the status review is higher than the estimate for the IUCN Red List assessment, likely due to a different remigration interval, which has been increasing in recent years (NMFS and USFWS 2020). For this analysis, we found that the status review estimate of 20,659 nesting females represents the best available scientific information given that it uses the most comprehensive and recent demographic trends and nesting data.

Previous assessments of leatherbacks concluded that the Northwest Atlantic population was stable or increasing (TEWG 2007, Tiwari et al. 2013b). However, as described in the *Status of the Species*, more recent analyses indicate that the overall trends are negative (NMFS and USFWS 2020, Northwest Atlantic Leatherback Working Group 2018, 2019). At the stock level, the Working Group evaluated the NW Atlantic – Guianas-Trinidad, Florida, Northern Caribbean, and the Western Caribbean stocks. The NW Atlantic – Guianas-Trinidad stock is the largest stock and declined significantly across all periods evaluated, which was attributed to an exponential decline in abundance at Awala-Yalimapo, French Guiana as well as declines in Guyana; Suriname; Cayenne, French Guiana; and Matura, Trinidad. Declines in Awala-Yalimapo were attributed, in part, due to beach erosion and a loss of nesting habitat (Northwest Atlantic Leatherback Working Group 2018). The Florida stock increased significantly over the long-term, but declined from 2008-2017 (Northwest Atlantic Leatherback Working Group 2018). Slight increases in nesting were seen in 2018 and 2019, however, nest counts remain low compared to 2008-2015 (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>). The Northern Caribbean and Western Caribbean stocks have also declined. The Working Group report also includes trends at the site-level, which varied depending on the site and time period, but were generally negative especially in the recent period.

Similarly, the leatherback status review concluded that the Northwest Atlantic DPS exhibits decreasing nest trends at nesting aggregations with the greatest indices of nesting female abundance. Though some nesting aggregations indicated increasing trends, most of the largest

ones are declining. This trend is considered to be representative of the DPS (NMFS and USFWS 2020). Data also indicated that the Southwest Atlantic DPS is declining (NMFS and USFWS 2020).

Populations in the Pacific have shown dramatic declines at many nesting sites (Mazaris et al. 2017, Santidrián Tomillo et al. 2017, Santidrián Tomillo et al. 2007, Sarti Martínez et al. 2007, Tapilatu et al. 2013). The IUCN Red List assessment estimated the number of total mature individuals (males and females) at Jamursba-Medi and Wermon beaches to be 1,438 turtles (Tiwari et al. 2013a). More recently, the leatherback status review estimated the total index of nesting female abundance of the West Pacific DPS at 1,277 females for the West Pacific DPS and 755 females for the East Pacific DPS (NMFS and USFWS 2020). The East Pacific DPS has exhibited a decreasing trend since monitoring began with a 97.4 percent decline since the 1980s or 1990s, depending on nesting beach (Wallace et al. 2013). Population abundance in the Indian Ocean is difficult to assess due to lack of data and inconsistent reporting. Most recently, the 2020 status review estimated that the total index of nesting female abundance for the SW Indian DPS is 149 females and that the DPS is exhibiting a slight decreasing nest trend (NMFS and USFWS 2020). While data on nesting in the Northeast Indian Ocean DPS is limited, the DPS is estimated at 109 females. This DPS has exhibited a drastic population decline with extirpation of the largest nesting aggregation in Malaysia (NMFS and USFWS 2020).

There have been several documented captures of leatherback sea turtles in gillnet, bottom trawl, and trap/pot gear utilized by the fisheries in the action area. Leatherback interactions with the fisheries are likely to continue given that the distribution of leatherbacks overlaps with areas where the gears are fished. Based on information from Murray (2018), Murray (2020), Linden (2020), and the GAR STDN, we anticipate 142 leatherback sea turtles will interact with gear utilized in the ten fisheries assessed in this Opinion every five years. Leatherback sea turtles that interact with gear used in these fisheries (which for the purposes of this Opinion includes gillnet, bottom trawl, hook gear, and trap/pot gear only) are those that are captured or entangled in the gear. An estimated 52 leatherbacks are expected to interact with gillnet gear every five years based on the interaction rates in Murray (2018) and federal waters take apportionment (Linden 2020). In addition, an estimated 40 leatherbacks are expected to interact annually with bottom trawl gear, based on Murray (2020) and the federal waters take apportionment (Linden 2020). Also, 50 leatherbacks are expected to interact with trap/pot gear in the federal lobster, red crab, Jonah crab, black sea bass, and scup fisheries every five years. An additional 15 sea turtles may interact with fishing vessels utilized in the ten fisheries every five years from any sea turtle species. For assessing impacts on leatherback sea turtles, we assume that all of these animals could be leatherbacks.

Of these, 78 percent (41) of the interactions (52) in gillnet gear, 50 percent (20) of the interactions (40) in bottom trawl gear, and 64 percent (32) of interactions (50) in trap/pot gear are expected to lead to mortality every five years. As described above, we anticipate that 15 sea turtles of any species may be struck by vessels operating in the fisheries over the 5-year period and that these interactions could be lethal. Therefore, 108 of the 157 leatherback sea turtles that interact with gear or vessels in these fisheries every five years are expected to die or sustain serious injuries leading to death or failure to reproduce. This results in the loss of approximately 22 leatherback sea turtles, on average, each year.

Captures and/or entanglements of leatherback sea turtles in gillnet, bottom trawl, and trap/pot gear could result in death due to forced submergence, given that there are no regulatory controls on tow/soak times in these fisheries other than the 30-day maximum soak period for fixed gear under the ALWTRP. Given that leatherbacks forage within the water column rather than on the bottom, interactions with bottom trawl gear are expected to occur when the gear is traveling through the water column versus on the bottom. Interactions between leatherbacks and gillnet and trap/pot gear are expected to occur in the net panels of gillnet gear and in the vertical lines.

The lethal removal of 108 leatherback sea turtles every five years (on average, approximately 22 per year) will reduce the number of leatherback sea turtles as compared to the number that would have been present in the absence of the proposed actions (assuming all other variables remained the same). The lethal interactions could also result in a potential reduction in future reproduction, assuming one or more of these individuals would be female and otherwise survived to reproduce in the future. A leatherback sea turtle will lay multiple nests (clutches) each year. In the Northwest Atlantic DPS, eggs per clutch is 82 for the western Atlantic, and clutch frequency averages 5.5 nests per year (NMFS and USFWS 2020). Therefore, an adult female leatherback sea turtle can produce hundreds of eggs per nesting season. Although a significant portion of the eggs can be infertile (NMFS and USFWS 2020), the annual loss of adult female sea turtles, on average, could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. Thus, the death of any female leatherbacks that would have otherwise survived to reproduce would eliminate the individual's and its future offspring's contribution to future generations. The anticipated lethal interactions are expected to occur anywhere in the action area. Given that these sea turtles generally have large ranges in which they disperse, no reduction in the distribution of leatherback sea turtles is expected from the proposed actions. Whether the estimated reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction have relative to current population sizes and trends.

We believe the proposed actions are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of leatherback sea turtles in the wild. Approximately 0.1 percent ($=22/20,659 \times 100$) of the population is anticipated to die annually through the proposed action. Both juvenile and adult leatherbacks interact with gears used in these fisheries. It should be noted that the abundance estimate is for nesting females only (i.e., does not include adult males or earlier life stages such as juveniles); therefore, the percent of the population that dies due to the proposed action is expected to be less than the percentage estimated here. Although the anticipated mortalities would result in a reduction in absolute population numbers, it is not likely this reduction would appreciably reduce the likelihood of survival of this species. If the hatchling survival rate to maturity is greater than the mortality in the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of sea turtles unaffected by the proposed actions. Considering the number of lethal interactions relative to the population size, we believe the proposed actions are not likely to have an appreciable effect on overall population trends. In addition, the proposed actions are expected to control those impacts by maintaining effort levels consistent with or lower than those that have occurred in previous years.

Fisheries bycatch has been identified as a threat to the Northwest Atlantic DPS of leatherback sea turtles. The Leatherback Working Group noted that leatherback entanglements in vertical

line fisheries (e.g., pot gear targeting crab, lobster, conch, fish) in continental shelf waters off New England, USA, and Nova Scotia, Canada, were a potential mortality sink that require continued monitoring and bycatch reduction efforts. However, the majority of the documented fisheries bycatch and mortality has occurred in fisheries outside of the fisheries considered in this Opinion. Across the range of the DPS, thousands of mature individuals are lost annually due to gillnet bycatch (especially off nesting beaches). In particular, studies estimate that well over 1,000 leatherback turtles die annually due to drift and bottom-set gillnets off Trinidad (Lum 2006, NMFS and USFWS 2020). Longline bycatch is also considered to be a widespread threat to the DPS, likely resulting in the loss of thousands of individuals annually.

As explained in the *Environmental Baseline*, although no direct leatherback impacts (i.e., oiled sea turtles or nests) from the Deepwater Horizon oil spill in the northern Gulf of Mexico were observed, some impacts from that event may be expected. However, there is no information to indicate, or basis to believe, that a significant population-level impact has occurred that would change the species' status to an extent that the expected interactions from these fisheries would result in a detectable change in the population status of leatherback sea turtles. Any impacts are not thought to alter the population status to a degree in which the number of mortalities from the proposed actions could be seen as reducing the likelihood of survival and recovery of the species.

As described in the *Environmental Baseline*, regulatory actions have been taken to reduce anthropogenic effects to Atlantic leatherbacks. These include measures to reduce the number and severity of leatherback interactions in the U.S. Atlantic longline fisheries and the U.S. South Atlantic and Gulf of Mexico shrimp fisheries. Reducing the number of leatherback sea turtles injuries and mortalities from these activities is expected to increase the number of Atlantic leatherbacks and increase leatherback reproduction in the Atlantic. Since most of these regulatory measures have been in place for several years now, it is likely that current nesting trends reflect the benefit of these measures to Atlantic leatherback sea turtles. There are no new known sources of mortality for leatherback sea turtles in the Atlantic other than potential impacts from the Deepwater Horizon oil spill.

Based on the information provided above, the loss of 22 leatherback sea turtles annually in the Atlantic due to the fisheries will not appreciably reduce the likelihood of survival for leatherbacks in the Atlantic given the relatively large population size and measures taken to reduce the number of Atlantic leatherback sea turtles that are injured or die in the Atlantic Ocean. The fisheries have no effects on leatherback sea turtles that occur outside of the Atlantic Ocean. Given that the operation of the fisheries will not appreciably reduce the likelihood of survival for leatherbacks in the Atlantic Ocean, it will not appreciably reduce the likelihood of survival of the species.

The recovery plan for Atlantic leatherback sea turtles (NMFS and USFWS 1992) lists the following recovery objective, which is relevant to the proposed actions in this Opinion:

- The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico; St. Croix, U.S. Virgin Islands; and along the east coast of Florida.

We believe the proposed action is not likely to impede the recovery objective above and will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild. Since we concluded that the potential loss of leatherback sea turtles is not likely to have any detectable effect on nesting trends, we do not believe the proposed action will impede

progress toward achieving this recovery objective. Nonlethal captures of these sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, we believe the proposed action will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild. Since the fisheries have no effects on leatherback sea turtles that occur outside of the Atlantic, their operation will not appreciably reduce the likelihood of recovery for the species.

9.9. Atlantic Sturgeon

Whether the reduction in numbers and reproduction from the loss of Atlantic sturgeon resulting from the proposed actions would appreciably reduce the species likelihood of survival and recovery depends on how the changes in numbers and reproduction would affect the population's growth rate, and whether the growth rate would allow the species to recover. For the population of each DPS to remain stable, a certain amount of spawning must occur within each DPS to offset deaths within each population. Two ways to measure spawning production are spawning stock biomass per recruit (SSB/R) and eggs per recruit (EPR). The EPR_{max} refers to the maximum number of eggs produced by a female Atlantic sturgeon over the course of its lifetime assuming no fishing mortality (or other sources of anthropogenic mortality, as well). Similarly, SSB/R_{max} is the expected contribution a female Atlantic sturgeon would make to the total weight of the fish in a stock that are old enough to spawn during its lifetime over the course of its lifetime, assuming no fishing mortality. In both cases, as fishing mortality increases, the expected lifetime production of a female decreases from the theoretical maximum (i.e., SSB/R_{max} or EPR_{max}) due to an increased probability the animal will be caught and, therefore, unable to achieve its maximum potential (Boreman 1997). Since the EPR_{max} or SSB/R_{max} for each individual within a population is the same, it is appropriate to talk about these parameters not only for individuals but for populations as well.

Maintaining a SSB/R of at least 20 percent of SSB/R_{max} has been suggested as a level that allows a population to remain stable (i.e., retain the capacity for survival) (Goodyear 1993). Maintaining a SSB/R of at least 50 percent of SSB/R_{max} has been suggested an appropriate target for rebuilding (i.e., recovery) (Boreman et al. 1984). Boreman (1997) indicates that since stock biomass and egg production are typically linearly correlated it is appropriate to apply the 20 percent (Goodyear 1993) and 50 percent (Boreman 1997) thresholds directly to EPR estimates.

Boreman (1997) reported adult female Atlantic sturgeon in the Hudson River could have likely sustained a fishing mortality rate of 14 percent and still retained enough spawners for the population to remain stable (i.e., maintain an EPR of at least 20 percent of EPR_{max}). Additionally, Boreman (1997) suggested a fishing mortality rate of 5 percent corresponds to maintaining an EPR of at least 50 percent of EPR_{max} (Boreman 1997). Boreman (1997) estimates were calculated using preliminary data provided by Kahnle who subsequently worked on analyses (ASMFC 1998b, Kahnle et al. 2007) which calculated $EPR_{50\%} = 0.03$ using updated and more complete information. ASMFC (2007), ASSRT (2007), and Kahnle et al. (2007) all used $F=0.03 = EPR_{50\%}$ as the maximum fishing mortality rate for maintaining and recovering populations of Atlantic sturgeon. We will also use this as a metric for analyzing impacts to Atlantic sturgeon.

These fishing mortality rates are specific to adult female spawners. Since estimates of fishing mortality rates that would equal 50 percent of EPR_{max} are not available for any of the five Atlantic sturgeon DPS, the information on the Hudson River is the best available. While we have

some limited information on male to female ratios for the Hudson River (Erickson et al. 2011, Kahnle et al. 2007, Pekovitch 1979), we do not know the current sex ratio for adult or sub-adult sturgeon for any of the five Atlantic sturgeon DPSs. In the absence of this information, we chose to evaluate our anticipated takes of all adults against these female-specific fishing mortality rates because we believe doing so is conservative toward the species.

We have considered the best available information to determine the DPSs of origin for lethal interactions. Using the genetic mixed stock analysis from Kazyak et al. (2020), we have determined that Atlantic sturgeon in the action area likely originate from the five DPSs at the following frequencies: Gulf of Maine 8.7 percent; NYB 71.4 percent; Chesapeake Bay 10.7 percent; Carolina 2.6 percent; South Atlantic 5.6 percent; and Canada 1.0 percent. Given these percentages, we expect 15 of the annual Atlantic sturgeon mortalities from the ten federal fisheries in this Opinion will originate from Gulf of Maine DPS; 118 from the New York Bight DPS, 17 from the Chesapeake Bay DPS, 4 from the Carolina DPS; and 9 from the South Atlantic DPS. That equates to 75 Gulf of Maine, 590 New York Bight, 85 Chesapeake Bay, 20 Carolina, and 45 South Atlantic DPS fish will die as a result of the fisheries every five years.

9.9.1. *Gulf of Maine DPS*

The Gulf of Maine DPS is listed as threatened, and while Atlantic sturgeon occur in several rivers of the Gulf of Maine region, recent spawning has only been physically documented in the Kennebec River. However, spawning is suspected to occur in the Androscoggin, Piscataqua, and Merrimack Rivers. There is currently no census of the number of Atlantic sturgeon in any river nor is any currently available for the entire DPS. NMFS use of the NEAMAP data indicates that the estimated ocean population of Gulf of Maine DPS Atlantic sturgeon sub-adults and adults is 7,455 individuals. Gulf of Maine origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. While there are some indications that the status of the Gulf of Maine DPS may be improving, there is currently not enough information to establish a trend for any life stage or for the DPS as a whole. The ASMFC stock assessment concluded that the abundance of the Gulf of Maine DPS is "depleted" relative to historical levels. The assessment also concluded that there was a 51 percent probability that the abundance of the Gulf of Maine DPS has increased since implementation of the 1998 fishing moratorium, but there was a 74 percent probability that mortality for the Gulf of Maine DPS exceeds the mortality threshold used for the assessment (ASMFC 2017).

The proposed action may result in an average of 123 Atlantic sturgeon takes from the Gulf of Maine DPS annually. We estimated those takes will likely result in the mortality of 15 Atlantic annually (or 75 every five years). The ASMFC stock assessment concluded that the abundance of the Gulf of Maine DPS is "depleted" relative to historical levels. The assessment also concluded that there was a 51 percent probability that the abundance of the Gulf of Maine DPS has increased since implementation of the 1998 fishing moratorium, but there was a 74 percent probability that mortality for the Gulf of Maine DPS exceeds the mortality threshold used for the assessment (ASMFC 2017).

Annually, we anticipate that an average of 15 individuals (i.e., adults and/or sub-adults) from the Gulf of Maine DPS may be lethally taken by the proposed action. The opinion for the Atlantic sea scallop trawl fishery provides for an average lethal take of one individual from the Gulf of Maine DPS annually (NMFS 2012b). The opinion for the Southeastern U.S. shrimp trawl fishery

provides for an average of one lethal take from the Gulf of Maine DPS annually (NMFS 2014d). The opinion for the Atlantic shark fisheries managed under the Consolidated HMS FMP provides incidental take coverage for an average lethal take of 3 (rounded up from 2.7) individuals from the Gulf of Maine DPS annually (NMFS 2020c). Collectively, we anticipate that 20 individual Atlantic sturgeon, or 0.27 percent ($=20/7455*100$) of the adult/sub-adult population from the Gulf of Maine DPS may be removed annually because of federal fisheries. This 0.27 percent is below the estimated 3 percent federal fishing mortality rate we believe the population could likely withstand and still maintain 50 percent of EPR_{max} . In other words, the fishing mortality from these fisheries alone would likely not result in less than 50 percent of EPR_{max} for the Gulf of Maine DPS.

The proposed action may result in the annual average removal of 15 Atlantic sturgeon that would have been reproductive adults from the Gulf of Maine DPS, which would reduce the reproductive potential of the DPS. The reproductive potential of the Gulf of Maine DPS will not be affected in any way other than through a reduction in numbers of individuals. Reproductive potential of other captured and released individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed action will also not affect the spawning grounds within the rivers where Gulf of Maine DPS fish spawn. The action will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by Gulf of Maine DPS fish. The proposed action is not likely to reduce distribution because the action will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas that may be used by Gulf of Maine DPS sub-adults or adults. Further, the action is not expected to reduce the river-by-river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary.

Based on the information provided above, the annual average death of 15 Gulf of Maine DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment) and recovery of the Gulf of Maine DPS. The action will not affect Gulf of Maine DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population to persist, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring.

As a recovery plan has not yet been drafted for Atlantic sturgeon, we evaluated the five listing factors. Recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., “endangered”), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., “threatened”) because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of Gulf of Maine DPS Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of Gulf of Maine DPS Atlantic sturgeon. The proposed action will not utilize Gulf of Maine DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the capture and injury of Atlantic sturgeon and the average annual mortality of 15 Gulf of Maine DPS Atlantic sturgeon; as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the Gulf of Maine DPS. As the reduction in numbers and future reproduction is not significant, the loss of these individuals is not likely to change the status of Gulf of Maine DPS Atlantic sturgeon. The effects of the proposed action will not likely delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will not cause the mortality of a significant percentage of the species as a whole and this mortality is not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that the Gulf of Maine DPS can be brought to the point at which they are no longer listed as threatened.

Based on the analysis presented herein, the proposed action, resulting in the average annual mortality of 15 Gulf of Maine DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

9.9.2. *New York Bight DPS*

The New York Bight DPS is listed as endangered, and while Atlantic sturgeon occur in several rivers in the New York Bight, recent spawning has only been physically documented in the Hudson and Delaware Rivers. The essential physical features necessary to support spawning and recruitment are also present in the Connecticut and Housatonic Rivers (82 FR 39160; August 17, 2017). However, there is no current evidence that spawning is occurring nor studies underway to investigate whether spawning is occurring in those rivers, aside from one recent study which found young South Atlantic DPS fish in the Connecticut River, which was unexpected to the researchers (Savoy et al. 2017). Based on existing data, we expect any New York Bight DPS Atlantic sturgeon in the action area to originate from the Hudson or Delaware River.

There are no abundance estimates for the entire New York Bight DPS or for the entirety of either the Hudson River or Delaware River spawning populations. There are, however, some estimates for specific life stages (e.g., natal juvenile abundance, spawning run abundance, and effective population size). Using side scan sonar technology in conjunction with detections of previously tagged Atlantic sturgeon, Kazyak et al. (2020) estimated the 2014 Hudson River spawning run size to be 466 sturgeon (95% CI = 310-745). Based on genetic analyses of two different life stages, subadults and natal juveniles, effective population size for the Hudson River spawning population has been estimated to be 198 (95% CI=171.7-230.7; O'Leary et al. 2014) and 156 (95% CI=138.3-176.1) (Waldman et al. 2019) while estimates for the Delaware River spawning population from the same studies were 108.7 (95% CI=74.7-186.1) (O'Leary et al. 2014) and 40 (95% CI=34.7-46.2) (Waldman et al. 2019). The difference in effective population size for the Hudson and Delaware River spawning populations across both studies support that the Hudson

River spawning population is the more robust of the two spawning groups. This conclusion is further supported by genetic analyses that demonstrated Atlantic sturgeon originating from the Hudson River spawning population were more prevalent in mixed aggregations than sturgeon originating from the Delaware River spawning population, even when sampling occurred in areas and at times that targeted for adults belonging to the Delaware River spawning population (Wirgin et al. 2015a, Wirgin et al. 2015b). Waldman et al.'s calculations of maximum effective population size, and comparison of these to four other spawning populations outside of the New York Bight DPS further supports our previous conclusion that the Hudson River spawning population is more robust than the Delaware River spawning population and is likely the most robust of all of the U.S. Atlantic sturgeon spawning populations.

For this Opinion, we have estimated adult and sub-adult abundance of the New York Bight DPS based on available information for the genetic composition and the estimated abundance of Atlantic sturgeon in marine waters (Damon-Randall et al. 2013, Kocik et al. 2013). We concluded that sub-adult and adult abundance of the New York Bight DPS was 34,566 sturgeon based upon the NEAMAP data. This number encompasses many age classes since sub-adults can be as young as two years old when they first enter the marine environment, and adults can live to approximately 60 years old (Hilton et al. 2016). For example, a study of Atlantic sturgeon captured in the geographic New York Bight determined that 742 of the Atlantic sturgeon captured represented 21 estimated age classes and that, individually, the sturgeon ranged in age from 2 to 35 years old (Dunton et al. 2016).

The 2017 ASMFC stock assessment determined that abundance of the New York Bight DPS is "depleted" relative to historical levels (ASMFC 2017). However, the assessment also determined there is a relatively high probability (75 percent) that the New York Bight DPS abundance has increased since the implementation of the 1998 fishing moratorium, and a 31 percent probability that mortality for the New York Bight DPS exceeds the mortality threshold used for the assessment (ASMFC 2017).

The proposed action may result in an average of 1,004 Atlantic sturgeon takes from the New York Bight DPS annually. Annually, we anticipate that 118 individuals from the New York Bight DPS may be lethally taken by the proposed action. The opinion for the Atlantic sea scallop trawl fishery provides for an average lethal take of one individual from the New York Bight DPS annually (NMFS 2012b). The opinion for the Southeastern U.S. shrimp trawl fishery provides for an average lethal takes of three individuals from the New York Bight DPS annually (NMFS 2014d). The opinion for the fisheries managed under the Consolidated HMS FMP (excluding pelagic longline) provides incidental take coverage for an average lethal take of 12 individuals from the New York Bight DPS annually (NMFS 2020c). Together, we anticipate a total of 134 Atlantic sturgeon from the New York Bight DPS may be removed annually because of federal fisheries, or 0.39 percent ($=134/34,566 \times 100$) of the sub-adult/adult population in the New York Bight DPS (i.e., 34,566, based on NMFS use of the NEMAP data). This 0.39 percent is below the estimated 3 percent federal fishing mortality rate we believe the population could likely withstand and still maintain 50 percent of EPR_{max} . In other words, the fishing mortality from these fisheries alone would likely not result in less than 50 percent of EPR_{max} for the New York Bight DPS.

The proposed action may result in the anticipated annual average removal of 118 Atlantic sturgeon that would have been reproductive adults from the New York Bight DPS, which would

reduce the reproductive potential of the DPS. The reproductive potential of the New York Bight DPS will not be affected in any way other than through a reduction in numbers of individuals. Reproductive potential of other captured and released individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed action will also not affect the spawning grounds within the rivers where New York Bight DPS fish spawn. The action will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by New York Bight DPS fish. The proposed action is not likely to reduce distribution because the action will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas that may be used by New York Bight DPS sub-adults or adults. Further, the action is not expected to reduce the river-by-river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary.

Based on the information provided above, the annual average death of 118 New York Bight DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment) and recovery of the New York Bight DPS. The action will not affect New York Bight DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population to persist, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring.

As described for the Gulf of Maine DPS, we evaluated the five listing factors as a recovery plan has not been drafted. The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in a small reduction in the number of New York Bight DPS Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of New York Bight DPS Atlantic sturgeon. The proposed action will not utilize New York Bight DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the capture and injury of Atlantic sturgeon and the mortality of 118, on average annually, New York Bight DPS Atlantic sturgeon; as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the New York Bight DPS. As the reduction in numbers and future reproduction is not significant, the loss of these individuals is not likely to change the status of New York Bight DPS Atlantic sturgeon. The effects of the proposed action will not likely delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will not cause the mortality of a significant percentage of the species as a whole and this mortality is not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that the New York Bight DPS can be brought to the point at which they are no longer listed as threatened.

Based on the analysis presented herein, the proposed action, resulting in the mortality of an annual average of 118 New York Bight DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

9.9.3. *Chesapeake Bay DPS*

The Chesapeake Bay DPS is listed as endangered, and while Atlantic sturgeon occur and may potentially spawn in several rivers of the Chesapeake Bay. There is evidence of spawning in the James River; Pamunkey River, a tributary of the York River; and Marshyhope Creek, a tributary of the Nanticoke River (Balazik and Musick 2015, Hager et al. 2014, Kahn et al. 2014, NMFS 2017b). In addition, detections of acoustically-tagged adult Atlantic sturgeon in the Mattaponi and Rappahannock Rivers at the time when spawning occurs in others rivers, and historical evidence for these as well as the Potomac River supports the likelihood of Atlantic sturgeon spawning populations in the Mattaponi, Rappahannock, and Potomac rivers (NMFS 2017b).

Chesapeake Bay origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently no census nor enough information to establish a trend for any life stage, for the James River spawning population, or for the DPS as a whole, although the NEAMAP data indicates that the estimated ocean population of Chesapeake Bay DPS Atlantic sturgeon is 8,811 sub-adult and adult individuals. The 2017 ASMFC stock assessment determined that abundance of the Chesapeake Bay DPS is "depleted" relative to historical levels (ASMFC 2017). The assessment also determined there is a relatively low probability (36 percent) that abundance of the Chesapeake Bay DPS has increased since the implementation of the 1998 fishing moratorium, and a 30 percent probability that mortality for the Chesapeake Bay DPS exceeds the mortality threshold used for the assessment (ASMFC 2017).

The proposed action may result in an annual average of 151 Atlantic sturgeon takes from the Chesapeake Bay DPS. Annually, we anticipate that an average of 17 individuals from the Chesapeake Bay DPS may be lethally taken by the proposed action. The opinion for the Atlantic sea scallop trawl fishery provides for an average lethal take of one individual from the Chesapeake Bay DPS annually (NMFS 2012b). The opinion for the Southeastern U.S. shrimp trawl fishery provides for an average of one lethal take of an individual from the Chesapeake Bay DPS annually (NMFS 2014d). The opinion for fisheries (excluding pelagic longline) managed under the Consolidated HMS FMP provides incidental take coverage for an average lethal take of three individuals from the Chesapeake Bay DPS annually (NMFS 2020c). Together, we anticipate that a total of 22 Atlantic sturgeon from the Chesapeake Bay DPS may be removed annually because of federal fisheries, or 0.25 percent ($=22/8,811 \times 100$) of the adult/sub-adult population in the Chesapeake Bay DPS. This 0.25 percent is below the estimated 3 percent federal fishing mortality rate we believe the population could likely withstand and still maintain 50 percent of EPR_{max} . In other words, the fishing mortality from these fisheries alone would likely not result in less than 50 percent of EPR_{max} for the Chesapeake Bay DPS.

The proposed action may result in the anticipated annual average removal of 17 Atlantic sturgeon that would have been reproductive adults from the Chesapeake Bay DPS, which would reduce the reproductive potential of the DPS. The reproductive potential of the Chesapeake Bay DPS will not be affected in any way other than through a reduction in numbers of individuals. Reproductive potential of other captured and released individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed action will also not affect the spawning grounds within the rivers where Chesapeake Bay DPS fish spawn. The action will also not create any barrier to pre-

spawning sturgeon accessing the overwintering sites or the spawning grounds used by Chesapeake Bay DPS fish. The proposed action is not likely to reduce distribution because the action will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas that may be used by Chesapeake Bay DPS sub-adults or adults. Further, the action is not expected to reduce the river-by-river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary.

Based on the information provided above, the annual average death of 17 Chesapeake Bay DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment) and recovery of the of the Chesapeake Bay DPS. The action will not affect Chesapeake Bay DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population to persist, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring.

As described for the Gulf of Maine DPS, we evaluated the five listing factors as a recovery plan has not been drafted. The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of Chesapeake Bay DPS Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of Chesapeake Bay DPS Atlantic sturgeon. The proposed action will not utilize Chesapeake Bay DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the capture and injury of Atlantic sturgeon and the mortality of an annual average 17 Chesapeake Bay DPS Atlantic sturgeon; as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the Chesapeake Bay DPS. As the reduction in numbers and future reproduction is not significant, the loss of these individuals is not likely to change the status of Chesapeake Bay DPS Atlantic sturgeon. The effects of the proposed action will not likely delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will not cause the mortality of a significant percentage of the species as a whole and this mortality is not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that the Chesapeake Bay DPS can be brought to the point at which they are no longer listed as threatened.

Based on the analysis presented herein, the proposed action, resulting in the average annual mortality of 17 Chesapeake Bay DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

9.9.4. ***Carolina DPS***

The Carolina DPS is listed as endangered and consists of Atlantic sturgeon originating from at least five rivers where spawning is still thought to occur. Carolina DPS origin Atlantic sturgeon are affected by numerous sources of human induced mortality and habitat disturbance throughout the riverine and marine portions of their range. There is currently no census of the number of Atlantic sturgeon in any river nor is any currently available for the entire DPS, although the NEAMAP data indicates that the estimated ocean population of Carolina DPS Atlantic sturgeon,

sub-adults and adults, is 1,356 individuals. The 2017 ASMFC stock assessment determined that abundance of the Carolina DPS is "depleted" relative to historical levels (ASMFC 2017). The assessment also determined there is a relatively high probability (67 percent) that abundance of the Carolina DPS has increased since the implementation of the 1998 fishing moratorium, and a 75 percent probability that mortality for the Carolina DPS exceeds the mortality threshold used for the assessment (ASMFC 2017).

The proposed action may result in 36 Atlantic sturgeon takes from the Carolina DPS annually. Annually, we anticipate that four individuals from the Carolina DPS may be lethally taken by the proposed action. The opinion for the Atlantic sea scallop trawl fishery provides for an average lethal take of one individual from the Carolina DPS annually (NMFS 2012b). The opinion for the Southeastern U.S. shrimp trawl fishery provides for an average of one lethal take of an individual from the Carolina DPS annually (NMFS 2014d). The opinion for HMS fisheries (excluding pelagic longline) managed under the Consolidated HMS FMP provides incidental take coverage for an average lethal take of two (rounded up from 1.7) individuals from the Carolina DPS annually (NMFS 2020c). Together, we anticipate that a total of 8 Atlantic sturgeon from the Carolina DPS may be removed annually because of federal fisheries, or 0.59 percent ($=8/1,356 \times 100$) of the subadult and adult population in the Carolina DPS. This 0.59 percent is below the estimated 3 percent federal fishing mortality rate we believe the population could likely withstand and still maintain 50 percent of EPR_{max} .

The proposed action may result in the anticipated annual average removal of four Atlantic sturgeon that would have been reproductive adults from the Carolina DPS, which would reduce the reproductive potential of the DPS. The reproductive potential of the Carolina DPS will not be affected in any way other than through a reduction in numbers of individuals. Reproductive potential of other captured and released individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed action will also not affect the spawning grounds within the rivers where Carolina DPS fish spawn. The action will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by Carolina DPS fish. The proposed action is not likely to reduce distribution because the action will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas that may be used by Carolina DPS sub-adults or adults. Further, the action is not expected to reduce the river-by-river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary.

Based on the information provided above, the annual average death of four Carolina DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment) and recovery of the of the Carolina DPS. The action will not affect Carolina DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population to persist, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring.

As described for the Gulf of Maine DPS, we evaluated the five listing factors as a recovery plan has not been drafted. The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of Carolina DPS

Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of Carolina DPS Atlantic sturgeon. The proposed action will not utilize Carolina DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the capture and injury of Atlantic sturgeon and the mortality of no more than 4 Carolina DPS Atlantic sturgeon, on average annually; as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the Carolina DPS. As the reduction in numbers and future reproduction is not significant, the loss of these individuals is not likely to change the status of Carolina DPS Atlantic sturgeon. The effects of the proposed action will not likely delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will not cause the mortality of a significant percentage of the species as a whole and this mortality is not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that the Carolina DPS can be brought to the point at which they are no longer listed as threatened.

Based on the analysis presented herein, the proposed action, resulting in the average annual mortality of four Carolina DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

9.9.5. *South Atlantic DPS*

The South Atlantic DPS is listed as endangered and consists of Atlantic sturgeon originating from at least six rivers where spawning is still thought to occur. In 2004 and 2005, there were an estimated 343 adults spawning in the Altamaha River, Georgia (Schueller and Peterson 2006). This represents a percentage of the total adult population for the Altamaha River. Males spawn every 1-5 years and females spawn every 2-5 years; thus, the total Altamaha River adult population, assuming a 2:1 ratio of males to females as seen in the Hudson River, could range from 457- 1,715. Spawning occurs in at least five other rivers in this DPS. Therefore, the number of Atlantic sturgeon in the Altamaha River population is only a portion of the total DPS. No census of the number of Atlantic sturgeon in any of the other spawning rivers or for the DPS as a whole is available. However, the NEAMAP data indicates that the estimated ocean population of South Atlantic DPS Atlantic sturgeon sub-adults and adults is 14,911 individuals.

The 2017 ASMFC stock assessment determined that abundance of the South Atlantic DPS is "depleted" relative to historical levels (ASMFC 2017). Due to a lack of suitable indices, the assessment was unable to determine the probability that the abundance of the South Atlantic DPS has increased since the implementation of the 1998 fishing moratorium. However, it was determined that there is a 40 percent probability that mortality for the South Atlantic DPS exceeds the mortality threshold used for the assessment (ASMFC 2017).

The proposed action may result in 79 Atlantic sturgeon takes from the South Atlantic DPS annually. Annually, we anticipate that an average of nine individuals from the South Atlantic DPS may be lethally taken by the proposed action. The opinion for the Atlantic sea scallop trawl fishery provides for an average lethal take of one adult or sub-adult sturgeon from the South Atlantic DPS annually (NMFS 2012b). The opinion for the Southeastern U.S. shrimp trawl fishery provides for an average of two lethal takes adult or sub-adult sturgeon from the South

Atlantic DPS annually (NMFS 2014d). The opinion on fisheries (excluding pelagic longline) managed under the Consolidated HMS FMP provides incidental take coverage for an average lethal take of 7 (rounded up from 6.3 individuals) from the South Atlantic DPS annually (NMFS 2020c). Together, we anticipate that 19 Atlantic sturgeon from the South Atlantic DPS may be removed annually because of federal fisheries, or 0.13 percent ($=19/14,911 \times 100$) of the adult and sub-adult population in the South Atlantic DPS. This 0.13 percent is below the estimated 3 percent federal fishing mortality rate we believe the population could likely withstand and still maintain 50 percent of EPR_{max} . In other words, the fishing mortality from these fisheries alone would likely not result in less than 50 percent of EPR_{max} for the South Atlantic DPS.

The proposed action may result in the anticipated annual average removal of nine Atlantic sturgeon that would have been reproductive adults from the South Atlantic DPS, which would reduce the reproductive potential of the DPS. The reproductive potential of the South Atlantic DPS will not be affected in any way other than through a reduction in numbers of individuals. Reproductive potential of other captured and released individuals is not expected to be affected in any way. Additionally, we have determined that any impacts to behavior will be minor and temporary and that there will not be any delay or disruption of any normal behavior including spawning; there will also be no reduction in individual fitness or any future reduction in numbers of individuals. The proposed action will also not affect the spawning grounds within the rivers where South Atlantic DPS fish spawn. The action will also not create any barrier to pre-spawning sturgeon accessing the overwintering sites or the spawning grounds used by South Atlantic DPS fish. The proposed action is not likely to reduce distribution because the action will not impede Atlantic sturgeon from accessing any seasonal concentration areas, including foraging areas that may be used by South Atlantic DPS sub-adults or adults. Further, the action is not expected to reduce the river-by-river distribution of Atlantic sturgeon. Any effects to distribution will be minor and temporary.

Based on the information provided above, the annual average death of nine South Atlantic DPS Atlantic sturgeon will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment) and recovery of the of the South Atlantic DPS . The action will not affect South Atlantic DPS Atlantic sturgeon in a way that prevents the species from having a sufficient population to persist, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring.

Recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., “endangered”), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., “threatened”) because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of South Atlantic DPS Atlantic sturgeon in any geographic area and thus, it will not affect the overall distribution of South

Atlantic DPS Atlantic sturgeon. The proposed action will not utilize South Atlantic DPS Atlantic sturgeon for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect its continued existence. The proposed action is likely to result in the capture and injury of Atlantic sturgeon and the mortality of no more than nine South Atlantic DPS Atlantic sturgeon, on average annually; as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of the South Atlantic DPS. As the reduction in numbers and future reproduction is not significant, the loss of these individuals is not likely to change the status of South Atlantic DPS Atlantic sturgeon. The effects of the proposed action will not likely delay the recovery timeline or otherwise decrease the likelihood of recovery since the action will not cause the mortality of a significant percentage of the species as a whole and this mortality is not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that the South Atlantic DPS can be brought to the point at which they are no longer listed as threatened.

Based on the analysis presented herein, the proposed action, resulting in the average annual mortality of nine South Atlantic DPS Atlantic sturgeon, is not likely to appreciably reduce the survival and recovery of this species.

9.10. GOM DPS Atlantic Salmon

Atlantic salmon have been observed to interact with both gillnet and bottom trawl gear used in the ten fisheries that are the focus of this Opinion. Based on recent NEFOP and ASM data from 2010-2019, as well as historic observer program data dating back to 1989, we anticipate two interactions with either bottom trawl or gillnet gear every five years as a result of the operation of these fisheries, both of which may be lethal. Due to the sizes of the fish involved and the locations of these past captures, future interactions may be with either post-smolt or adult Atlantic salmon and all are anticipated to be with ESA-listed GOM DPS fish.

The marine life history of Atlantic salmon of U.S. origin is not as well understood as the freshwater phase. Atlantic salmon of U.S. origin are highly migratory, undertaking long marine migrations from their natal rivers to the Northwest Atlantic Ocean, where they are distributed seasonally over much of the region. The marine phase starts with the completion of smoltification and migration through the estuary of the natal river. Part of the migratory pattern of post-smolts and adults overlaps with the action area at times when the ten fisheries are active.

To determine if the proposed actions will jeopardize the GOM DPS of Atlantic salmon, we must conduct an analysis of the effects of the proposed actions on the likelihood of the species' survival and recovery. The 2019 recovery plan for Atlantic salmon (USFWS and NMFS 2019) incorporates an approach termed Recovery Planning and Implementation, which focuses on the three statutory requirements in the ESA, including site-specific recovery actions; objective, measurable criteria for delisting; and time and cost estimates to achieve recovery and intermediate steps. The 2019 recovery plan projects four phases of recovery over a 75-year timeframe to achieve delisting of the GOM DPS of Atlantic salmon. The four phases are:

- Phase 1: The first recovery phase focuses on identifying the threats to the species and characterizing the habitat needs of the species necessary for their recovery.

- Phase 2: The second recovery phase focuses on ensuring the persistence (survival) of the GOM DPS through the use of the conservation hatcheries while abating imminent threats to the continued existence of the DPS. Phase 2 focuses on freshwater habitat used by Atlantic salmon for spawning, rearing, and upstream and downstream migration; it also emphasizes research on threats within the marine environment.
- Phase 3: The third phase of recovery will focus on increasing the abundance, distribution, and productivity of naturally reared Atlantic salmon. It will involve transitioning from dependence on the conservation hatcheries to wild smolt production.
- Phase 4: In Phase 4, the GOM DPS of Atlantic salmon is recovered and delisting occurs. The GOM DPS will be considered recovered once: a) 2,000 wild adults return to each Salmon Habitat Recovery Unit (SHRU), for a DPS-wide total of at least 6,000 wild adults; b) each SHRU has a population growth rate of greater than 1.0 in the 10-year period preceding delisting, and, at the time of delisting, the DPS demonstrates self-sustaining persistence; and c) sufficient suitable spawning and rearing habitat for the offspring of the 6,000 wild adults is accessible and distributed throughout the designated Atlantic salmon critical habitat, with at least 30,000 accessible and suitable HUs in each SHRU, located according to the known migratory patterns of returning wild adult salmon.

We are presently in Phase 2 of the recovery program (ensuring the survival of the GOM DPS through the use of the conservation hatcheries while abating imminent threats to the continued existence of the DPS). As indicated in the 2019 recovery plan for Atlantic salmon, the U.S. FWS and NMFS do not have plans to transition from dependence on conservation hatcheries to wild fish production in the foreseeable future. Therefore, for purposes of our survival analysis, we assume hatchery supplementation will continue in all three SHRUs over the course of the proposed actions. We also expect that as passage improves in certain Gulf of Maine rivers, it may become a higher priority for stocking. The hatchery program, sponsored by the U.S. FWS, has been in place for over 100 years and because we do not have any information to the contrary, we expect it will continue over the duration of the proposed actions. The importance of continuation of the hatchery program is recognized in the 2019 recovery plan and continuation of the hatchery and stocking efforts are an integral part of the recovery strategy.

As detailed in the 2019 recovery plan, in order for the listing status of Atlantic salmon to change, each of the three relevant biological criteria (abundance, productivity, and habitat) must be met in two (downlisting) or three (delisting) of the recovery units. The biological criteria for reclassifying (downlisting) the GOM DPS of Atlantic salmon from endangered status to threatened status are:

- **Abundance:** The DPS has total annual returns of at least 1,500 adults originating from wild origin, or hatchery stocked eggs, fry or parr spawning in the wild, with at least 2 of the 3 SHRUs having a minimum annual escapement of 500 naturally reared adults.
- **Productivity:** Among the SHRUs that have met or exceeded the abundance criterion, the population has a positive mean growth rate greater than 1.0 in the 10-year (two-generation) period preceding reclassification.
- **Habitat:** In each of the SHRUs where the abundance and productivity criterion have been met, there is a minimum of 7,500 units of accessible and suitable spawning and rearing habitats capable of supporting the offspring of 1,500 naturally reared adults.

The biological criteria for removing Atlantic salmon from the endangered species list are:

- **Abundance:** The DPS has a self-sustaining annual escapement of at least 2,000 wild origin adults in each SHRU, for a DPS-wide total of at least 6,000 wild adults.
- **Productivity:** Each SHRU has a positive mean population growth rate of greater than 1.0 in the 10-year (two-generation) period preceding delisting. In addition, at the time of delisting, the DPS demonstrates self-sustaining persistence, whereby the total wild population in each SHRU has less than a 50-percent probability of falling below 500 adult wild spawners in the next 15 years based on PVA projections.
- **Habitat:** Sufficient suitable spawning and rearing habitat for the offspring of the 6,000 wild adults is accessible and distributed throughout the designated Atlantic salmon critical habitat, with at least 30,000 accessible and suitable Habitat Units in each SHRU, located according to the known migratory patterns of returning wild.

In 2019, 1,528 pre-spawn salmon returned to the GOM DPS (includes wild, naturally-reared, and hatchery raised salmon). Of those, 15 percent returned to the Downeast Coastal SHRU, 79 percent returned to the Penobscot Bay SHRU, and 6 percent returned to the Merrymeeting Bay SHRU. The abundance of returning salmon was more than 20 percent higher than the 10-year average, and the proportion of the run that was naturally reared (24 percent) was higher than what has been seen on average over the last decade (16 percent) (Kircheis et al. 2020). Regardless, the abundance of wild and naturally reared returns remain well below what is needed for either reclassification or delisting (USFWS and NMFS 2019). Based upon the 2019 return percentages summarized above, we expect that 79 percent of future mortalities from the ten fisheries will be salmon from the Penobscot Bay SHRU while the other 21 percent of mortalities will be from the other two SHRUs. Over a 10-year period, that would roughly equate to three mortalities of GOM DPS salmon from the larger Penobscot Bay SHRU and one mortality from the smaller Downeast Coastal or Merrymeeting Bay SHRUs.

The mean 10-year population growth rate for the GOM DPS as a whole in 2019 was 1.12, making it the eighth consecutive year where that threshold rate has exceeded 1.0. However, the reclassification and delisting productivity criteria require that each SHRU sustain a population growth rate of more than 1.0, in addition to meeting the relevant abundance criteria. In 2019, the 1.0 threshold was exceeded at both the Merrymeeting Bay (1.84) and Penobscot Bay (1.08) SHRUs, but was not met at the Downeast Coastal SHRU (0.99) (USFWS and NMFS 2019).

In 2019, a minimum of 31 connectivity projects were conducted that improved access to 108 stream miles of rivers in the GOM DPS. These projects do not necessarily lead to gains that can be counted towards the habitat recovery criteria, as many of them are upstream of barriers that have not yet been deemed accessible themselves. However, the most notable project in 2019, the breaching of the Head Tide Dam on the Sheepscot River, restored access to 2,363 habitat units in the Merrymeeting Bay SHRU, which have been added to the total accessible habitat units under the recovery criteria. It should be noted that the number of projects reported in the 2019 SHRU reports are likely an underestimate of the number of projects actually conducted. As of 2019, all three SHRUs have achieved the reclassification (downlisting) goal of at least 7,500 accessible habitat units. However, none of the SHRUs have yet to achieve the delisting goal of 30,000 accessible habitat units (USFWS and NMFS 2019).

The jeopardy analysis below makes a conclusion regarding the survival and recovery of the GOM DPS of Atlantic salmon as a whole, and not just survival and recovery of the species in the action area. Therefore, in the survival and recovery portions of this analysis, we consider how the

consequences to individual salmon that were identified in the *Effects of the Proposed Actions* section of this Opinion will affect the marine population of Atlantic salmon, how the consequences to the marine population will affect the Downeast Coastal, Penobscot Bay, and Merrymeeting Bay SHRUs, and then finally, how the consequences to the three SHRUs are likely to affect the survival and recovery of the GOM DPS as a whole. As highlighted in the 2019 recovery plan, the survival and recovery of all three SHRUs is necessary for attainment of the delisting criteria and recovery of the GOM DPS.

Survival Analysis

When considering how a proposed action is likely to affect the survival of a species, we consider effects to reproduction, numbers, and distribution. The number of returning adult Atlantic salmon to the Downeast Coastal, Penobscot Bay, and Merrymeeting Bay SHRUs is a measure of both the reproduction and numbers of the species. We consider the ability of pre-spawn Atlantic salmon to access high quality spawning and rearing habitat in the six major Downeast Rivers (i.e., Dennys, East Machias, Machias, Pleasant, Narraguagus, and Union), the Penobscot River, and the Kennebec and Androscoggin Rivers as a measure of distribution. Below, we analyze whether the proposed actions will reduce the numbers, reproduction, or distribution of the GOM DPS of Atlantic salmon in the action area and the three SHRUs to a point that appreciably reduces the species' likelihood of survival in the wild.

Two lethal interactions in the ten fisheries every five years would reduce the number of GOM DPS Atlantic salmon compared to their numbers in the absence of the proposed actions, assuming all other variables remained the same. Lethal interactions would also result in a potential reduction in future reproduction, assuming some individuals would be females and would have otherwise survived to reproduce. For example, an adult 2SW female Atlantic salmon can produce a total of 1,500 to 1,800 eggs per kilogram of body weight, yielding an average of 7,500 eggs (Baum and Meister 1971), of which a small percentage are expected to survive to sexual maturity. A lethal capture of an adult female GOM DPS Atlantic salmon in gillnet or bottom trawl gear would likely remove this level of reproductive output from the species. Over a 10-year period, three adult females could be removed from the Penobscot Bay ShRU and one adult female from either the Downeast Coastal or Merrymeeting Bay ShRU. The anticipated lethal interactions could occur anywhere in the action area, but are most likely to occur in the Gulf of Maine or on Georges Bank. Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

The most recent data available on the population trend of Atlantic salmon indicate that their abundance within the range of the GOM DPS has been generally declining since the 1800s (Fay et al. 2006). Contemporary estimates of abundance for the entire GOM DPS have rarely exceeded 5,000 individuals in any given year since 1967 (Fay et al. 2006), and appear to have stabilized at very low levels since 2000. After a period of slow population growth between the 1970s and the early 1980s, adult returns of salmon in the GOM DPS peaked around 1985 and declined through the 1990s and early 2000s. The population growth observed in the 1970s is likely attributable to favorable marine survival and increases in hatchery capacity, particularly from the Green Lake National Fish Hatchery that was constructed in 1974. Marine survival remained relatively high throughout the 1980s, and salmon populations in the GOM DPS remained relatively stable until the early 1990s. In the early 1990s, marine survival rates decreased, leading to the declining trend in adult abundance observed throughout 1990s and

early 2000s. An increase in the abundance of returning adult salmon was observed between 2008 and 2011, but returns then dropped significantly after 2011. The last couple of years have been relatively good years for returns (higher than the 10-year average), but have not been close to what was observed in 2011.

Adult returns for the GOM DPS remain well below conservation spawning escapement (CSE) goals that are widely used (ICES 2005) to describe the status of individual Atlantic salmon populations. When CSE goals are met, Atlantic salmon populations are generally self-sustaining. When CSE goals are not met (i.e., less than 100 percent), populations are not reaching full potential; and this can be indicative of a population decline. For all GOM DPS rivers in Maine, current Atlantic salmon populations (including hatchery contributions) are well below CSE levels required to sustain themselves (Fay et al. 2006), which is further indication of their poor population status.

The observed declines in Atlantic salmon suggests that the combined impacts from ongoing activities described in the *Environmental Baseline, Cumulative Effects*, and the *Status of Listed Species* (including those activities that occur outside of the action area of this Opinion) are continuing to cause the population to deteriorate. However, we believe the proposed actions are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of the GOM DPS Atlantic salmon. For the population to remain stable, Atlantic salmon must replace themselves through successful reproduction at least once over the course of their reproductive lives, and at least one offspring must survive to reproduce itself. If the survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be exceeded through recruitment of new breeding individuals from successful reproduction of Atlantic salmon that were not seriously injured or did not die in the fisheries. While the abundance trend information for Atlantic salmon is either stable or declining, we believe the very small numbers of lethal interactions attributed to the proposed actions will not have any measurable effect on that trend for three reasons. First, the loss of individual Atlantic salmon due to the proposed actions is not expected to impact the genetic heterogeneity of the three SHRUs or the species as a whole because the fisheries are widespread throughout the Gulf of Maine and Georges Bank and not likely to disproportionately capture individuals from the smaller, more vulnerable Merrymeeting Bay and Downeast Coastal SHRUs compared to the larger Penobscot Bay SHRU. Second, although we assume that the Atlantic salmon captures could be of high reproductive value adult females from the GOM DPS, it is possible that they could also be from non-listed Canadian, Saco, Merrimack, or Connecticut River stocks or involve adult male or post-smolt life stages with less reproductive value. Finally, the already existing salmon hatchery programs throughout the range of the GOM DPS should be able to replace the small amount of individuals lost from the DPS due to the ten fisheries over time (as long as they continue to operate, biological recovery criteria continue to be met, and freshwater and marine survival do not get significantly worse).

In summary, the proposed actions are anticipated to result in a small decrease in the numbers and reproduction of Atlantic salmon in the action area and the DPS as a whole, compared to current conditions. When compared to a future scenario without the proposed actions (i.e., no fishing activities under the ten fisheries), the proposed action would reduce the potential numbers and reproductive potential (through a reduction in numbers) of Atlantic salmon in the North Atlantic Ocean, but would have a negligible impact on the species' distribution. Based on the analysis

provided above, the potential loss of two Atlantic salmon post-smolts or adults every five years will not reduce the likelihood of survival of the GOM DPS of Atlantic salmon.

The *Status of the Species* section and four-phased approach summarized above generally describe the actions needed for recovery of the GOM DPS. Although commercial and recreational fisheries are identified in the recovery plan as threats to the GOM DPS, the fisheries included in this Opinion are not identified among those threats, which include the directed West Greenland fishery as well as directed and subsistence fisheries in Newfoundland and Labrador, Canada. Improving the survival of Atlantic salmon in the marine environment is also an important part of meeting the objective of GOM DPS Atlantic salmon recovery (USFWS and NMFS 2019). The average return estimate for all GOM DPS Atlantic salmon from 2010-2019 is 1,247 fish (Kircheis et al. 2020). The number of interactions (0.4) annually is less than 0.04 percent ($=0.4/1,247*100$) of the returning population. Given that we determined above that this small number of lethal interactions will not affect the population trends, there is no indication that bycatch in the ten fisheries assessed here are considered a threat to Atlantic salmon recovery.

As mentioned in the survival analysis above, the proposed actions will not affect Atlantic salmon in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment that would prevent Atlantic salmon from completing their entire life cycle, including reproduction, sustenance, and shelter.

Despite the threats faced by individual Atlantic salmon inside and outside of the action area, the proposed action will not increase the vulnerability of individual Atlantic salmon to these threats, and exposure to ongoing threats will not increase susceptibility to effects related to the proposed actions. While we are not able to predict with precision how climate change will impact GOM DPS Atlantic salmon in the action area or how the species will adapt to climate change-related environmental impacts, we do not expect the proposed actions to contribute to climate related effects in the action area. We have considered the effects of the proposed actions in light of cumulative effects explained above, including climate change, and have concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change. Therefore, we believe that the capture and subsequent loss of two GOM DPS Atlantic salmon every five years as a result of the operation of the fisheries will not reduce the likelihood of recovery the GOM DPS of Atlantic salmon. Based on the analysis presented herein, the proposed actions are not likely to appreciably reduce the survival and recovery of the species.

9.11. Giant Manta Ray

As described in the *Status of the Species*, giant manta rays can be found worldwide and are listed as threatened throughout its range. There are no current and accurate abundance estimates available, as the species tends to be only sporadically observed. There is no population growth rate available for the giant manta ray, however, the best available data indicate that the species has suffered population declines of significant magnitude (up to 95 percent in some places) in the Indo-Pacific and Eastern Pacific portion of its range. These declines are largely based on trends in landings and market data, diver sightings, and anecdotal observations. The observed declines in giant manta rays suggest that the combined impacts from ongoing activities described in the *Environmental Baseline*, *Cumulative Effects*, and the *Status of the Species* (including those activities that occur outside of the action area of this Opinion) are continuing to cause the

population to deteriorate. Giant manta rays are at risk throughout a significant portion of their range, due in large part to the observed declines in the Indo-Pacific. However, larger subpopulations of the species still exist, including off Mozambique, Ecuador, and potentially Thailand. In areas where the species is not subject to fishing, populations may be stable. However, given the migratory nature of this species, population declines in waters where the manta rays are protected have also been observed but are attributed to overfishing of the species in adjacent areas within its large home range.

As described above, it is unlikely that overutilization as a result of bycatch mortality is a significant threat to giant manta rays in the Atlantic Ocean (83 FR 2916; January 22, 2018). However, information is severely lacking on both population sizes and distribution of the giant manta ray as well as current catch and fishing effort on the species throughout this portion of its range. The species is not considered to be at high risk in the Atlantic; however, if the species was hypothetically extirpated within the Indo-Pacific and eastern Pacific portion of the range, only the potentially small and fragmented Atlantic populations would remain. The demographic risks associated with small and fragmented populations, and discussed in the proposed rule 82 FR 3694, January 12, 2017), such as demographic stochasticity, dispensation, and inability to adapt to environmental changes, would become significantly greater threats to the species as a whole, and coupled with the species' inherent vulnerability to depletion, indicate that even low levels of mortality could cause drastic declines in the population.

As described in the *Environmental Baseline* and *Climate Change* sections, effects from U.S. fishing have resulted in interactions with giant manta rays and large-scale impacts that affect ocean temperatures, currents, and potentially food chain dynamics, may pose a threat to this species. However, given the migratory behavior of the giant manta ray and tolerance to both tropical and temperate waters, these animals likely have the ability to shift their range or distribution to remain in an environment conducive to their physiological and ecological needs, providing the species with resilience to these effects.

As described in the *Effect of the Action* section, based on NEFOP data, we anticipate that 4 interactions will occur every five years. One lethal take is expected to occur in either gillnet or trawl gear over the 10-year period of this Opinion.

The non-lethal interactions are not expected to have any measurable impact on the reproduction, numbers, or distribution of this species. Manta rays appear to be able to heal from wounds very quickly (McGregor et al. 2019). A study of *Manta alfredi* in Indonesia found that while the long-term impacts of sublethal effects from fishing interactions is unknown, there are some observations to suggest that reproductively is not significantly impaired. Observations of pregnant individuals with single cephalic fin amputations suggest that manta rays retain their reproductive fitness even with these sub-lethal injuries. Further, the proportion of pregnant manta rays with injuries was not significantly lower than the overall proportion of females with injuries, suggesting that injured manta rays are not substantially impaired reproductively (Germanov et al. 2019). Given this information, we anticipate no reductions in reproduction or numbers of this species. Since these captures may occur throughout the action area and would be released within the general area where caught, no change in the distribution of this species is anticipated. Therefore, we believe the non-lethal take of an average of 0.8 giant manta rays per year will not result in population level impacts nor will it change their distribution.

Lethal interactions would reduce the number of giant manta rays, compared to their numbers in the absence of the proposed actions, assuming all other variables remained the same. Lethal interactions would also result in a potential reduction in future reproduction, assuming the individual is female and would have otherwise survived to reproduce. A lethal capture of an adult female giant manta ray in gillnet or trawl gear would remove this level of reproductive output from the species. The anticipated lethal interaction is expected to occur anywhere in the action area south of Long Island, New York. Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends.

Available abundance data is represented by records of more than 90 individuals (Kendall 2010 as cited in Miller and Klimovich 2017) and over 500 individuals (F. Young, pers. comm. 2017 as cited in Miller and Klimovich 2017) observed off the east coast of Florida. If we assume the population present in the action area includes at least 500 individuals, one lethal take would represent 0.2 percent ($=1/500 \times 100$) of this subpopulation. This one interaction, however, would be expected over the 10-years period.

For the population to remain stable, giant manta rays must replace themselves through successful reproduction at least once over the course of their reproductive lives, and at least one offspring must survive to reproduce itself. If the survival rate to maturity is greater than the mortality rate of the population, the loss of a breeding individual would be exceeded through recruitment of new breeding individuals from successful reproduction of giant manta rays that did not die as a result of the fisheries. While the abundance trend information for giant manta ray is declining, and possibly stable in areas where it is not subject to fishing, we believe that one lethal interaction attributed to the proposed actions over a 10-year period will not have any measurable effect on that trend. Thus, we believe the impact of the fisheries on giant manta rays is sufficiently small.

Since giant manta rays were recently listed, a recovery plan for them is not yet available. However, the first step in recovering a species is to reduce identified threats; only by alleviating threats can lasting recovery be achieved. The Final Listing Rule (83 FR 2916, January 22, 2018) noted that overall, current management measures that are in place for fishermen under U.S. jurisdiction appear to directly and indirectly contribute to the infrequency of interactions between U.S. fishing activities and the threatened giant manta ray. As such, NMFS does not believe these activities are contributing significantly to the identified threats of overutilization and inadequate regulatory measures and did not find that developing regulations under section 4(d) to prohibit some or all of these activities is necessary and advisable for the conservation of the species (considering the U.S. interaction with the species is negligible and its moderate risk of extinction is primarily a result of threats from foreign fishing activities). Any conservation actions for the giant manta ray that would bring it to the point that the measures of the ESA are no longer necessary will ultimately need to be implemented by foreign nations.

The proposed action is not likely to impede giant manta rays from continuing to survive and will not impede the process of restoring the ecosystems that affect giant manta rays. The proposed action will have a small effect on the overall size of the population, and we do not expect it to affect the giant manta ray's ability to meet its lifecycle requirements and to retain the potential for recovery. While a preliminary study suggests that the species may exist as isolated

subpopulations (Stewart et al. 2016a) available tracking information indicates that manta rays are pelagic and migratory and can likely travel large distances to reproduce (Clark 2010, Miller and Klimovich 2017). A study off the Yucatan Peninsula found shared haplotypes across Atlantic, Pacific, and Indian Ocean basins, indicative a highly migratory species, with little impedance to dispersal and therefore, gene flow (Hacohen-Domené et al. 2017). The conservation biology “50/500” rule-of-thumb suggests that the effective population size (N_e ; the number of reproducing individuals in a population) in the short term should not be <50 individuals in order to avoid inbreeding depression and demographic stochasticity (Franklin 1980, Harmon and Braude 2010). In the long-term, N_e should not be < 500 in order to decrease the impact of genetic drift and potential loss of genetic variation that will prevent the population from adapting to environmental changes (Franklin 1980, Harmon and Braude 2010). Taking into consideration this information and given the size of the population (at least 500 individuals) and the low number of takes estimated in the fisheries (<1 on average annually), we conclude the authorization of the fisheries will not result in the appreciably reduction of the giant manta population such that the rates of dispersal and in turn, gene flow, are altered in manner that reduces the populations ability to respond to stochastic environmental and demographic events. Given this, we expect the overall population to remain large enough to maintain genetic heterogeneity, broad demographic representation, and successful reproduction. Based on the evidence available, we conclude that the incidental take of four giant manta rays every five years and the mortality of one giant manta ray over a 10-year period would not be expected to appreciably reduce the threatened giant manta ray’s likelihood of survival and recovery in the wild.

10. INCIDENTAL TAKE STATEMENT (INCLUDING RPMS, T&CS, AND TAKE MONITORING PROTOCOL)

10.1. Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, unless a special exemption has been granted. Take is defined as “to harass, harm, pursue, hunt, shoot, capture, or collect, or to attempt to engage in any such conduct.” Harm is further defined by NMFS to include any act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. “Otherwise lawful activities” are those actions that meet all state and federal legal requirements except for the prohibition against taking in ESA section 9 (51 FR 19936, June 3, 1986), which would include any state endangered species laws or regulations. Section 9(g) makes it unlawful for any person “to attempt to commit, solicit another to commit, or cause to be committed, any offense defined [in the ESA]” (16 U.S.C. 1538(g)). A “person” is defined in part as any entity subject to the jurisdiction of the United States, including an individual, corporation, officer, employee, department or instrument of the Federal government (see 16 U.S.C. 1532(13)). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of carrying out an otherwise lawful activity is not considered to be prohibited under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS). In issuing ITSs, NMFS takes no position on whether an action is an “otherwise lawful activity.”

The prohibitions against incidental take are currently in effect for endangered large whales, sea turtles, all five listed DPSs of Atlantic sturgeon, and the GOM DPS of Atlantic salmon. When a proposed federal action is found to be consistent with section 7(a)(2) of the ESA, section 7(b)(4) of the ESA requires NMFS or the USFWS to issue a statement specifying the impact of incidental taking, if any. It also states that reasonable and prudent measures (RPMs) necessary to minimize impacts of any incidental take be provided along with implementing terms and conditions. The measures described below are non-discretionary and must, therefore, be undertaken in order for the exemption in section 7(o)(2) to apply. Failure to implement the terms and conditions through enforceable measures may result in a lapse of the protective coverage section of 7(o)(2).

An ITS is not required to provide protective coverage for the giant manta ray because there are no take prohibitions under ESA section 4(d) for these species. Consistent with the decision in *Center for Biological Diversity v. Salazar*, 695 F.3d 893 (9th Cir. 2012), however, this ITS is included to serve as a check on the no-jeopardy conclusion by providing a reinitiation trigger if the level of take analyzed in the Opinion is exceeded.

NMFS is including an incidental take exemption for non-lethal take of North Atlantic right, fin, sei, and sperm whales. At this time, we are authorizing zero lethal take of these whales because the lethal incidental take of ESA-listed whales has not been authorized under section 101(a)(5) of the MMPA. Following the issuance of such authorizations, NMFS may amend this Opinion to adjust lethal incidental take allowance for these species, as appropriate. NMFS recognizes that further efforts are necessary to reduce interactions between authorized federal fisheries and large whales in order to achieve the MMPA's goal of insignificant levels of incidental mortality and serious injury of marine mammals approaching a zero mortality and serious injury rate, taking into consideration the economics of the fishing industry, the availability of existing technology, and existing state or regional fishery management plans. NMFS continues to work toward this zero mortality goal of the MMPA through the means identified in the pertinent subsections of section 5.4 including continued development and implementation of the ALWTRP with the collaboration of the ALWTRT. Although NMFS has concluded that with implementation of the Framework, the ten fisheries are not likely to jeopardize the continued existence of the species in the wild by appreciably reducing the likelihood of survival and recovery of right, fin, sei, and sperm whales, the need for further efforts among stakeholders to reduce large whale/fishery interactions and achieve the zero mortality goal of the MMPA is not diminished by these no-jeopardy conclusions.

NMFS anticipates the following incidental takes of large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays may occur in the future because of the proposed action. The level of takes occurring annually is variable and influenced by sea temperatures, species abundances, fishing effort, and other factors that are difficult to predict. Because of this variability, it is unlikely that all species evaluated in this Opinion will be consistently impacted year after year. For example, some years may have no observed or otherwise documented interactions and, thus, no estimated take will occur. As a result, monitoring fisheries using 1-year estimated take levels is largely impractical. For these reasons, and based on our experience monitoring fisheries, we believe a 5-year time period is appropriate for meaningful monitoring of take with respect to the ITS. Table 83 displays the annual average take of these species over five years. In the case of North Atlantic right whales, take is specified as an annual percentage of the total population, as noted in the table.

Table 83: Average annual take over a 5-year period

	Total Take	Lethal Take⁷¹
<i>Large Whales</i>		
North Atlantic right whale	9.14% of population	0
Fin whale	1.89	0
Sei whale	1	0
Sperm whale	1	0
<i>Sea Turtles</i>		
Green, North Atlantic DPS	Gillnet: 2 Trawl: 6.4	Gillnet: 1.6 Trawl: 3.2
Kemp's ridley	Gillnet: 47.8 Trawl: 10.6	Gillnet: 37.4 Trawl: 5.4
Loggerhead, NWA DPS	Gillnet: 207.2 Trawl: 190.8 Pot/trap: 1	Gillnet: 161.6 Trawl: 95.4 Pot/trap: 0.8
Leatherback	Gillnet: 10.4 Trawl: 8 Pot/trap: 10	Gillnet: 8.2 Trawl: 4 Pot/trap: 6.4
Any combination of turtle species	Vessel strike: 3	Vessel strike: 3
<i>ESA-listed Fish</i>		
Atlantic sturgeon, Gulf of Maine DPS	Gillnet: 55 Trawl: 68	Gillnet: 11 Trawl: 4
Atlantic sturgeon, New York Bight DPS	Gillnet: 448 Trawl: 556	Gillnet: 90 Trawl: 28
Atlantic sturgeon, Chesapeake Bay DPS	Gillnet: 68 Trawl: 83	Gillnet: 13 Trawl: 4
Atlantic sturgeon, Carolina DPS	Gillnet: 16 Trawl: 20	Gillnet: 3 Trawl: 1
Atlantic sturgeon, South Atlantic DPS	Gillnet: 35 Trawl: 44	Gillnet: 7 Trawl: 2
Atlantic salmon	Gillnet and trawl combined: 0.4	Gillnet and trawl combined: 0.4
Giant manta ray	Gillnet and trawl combined: 0.8	Gillnet and trawl combined: 0.1 (1 every 10 years)

⁷¹ For species with zero authorized lethal take, that take is exceeded and reinitiation is required if the proposed action results in a single lethal take or a prorated M/SI is assigned to the federal fishery.

10.2. Reasonable and Prudent Measures

NMFS has determined that the following Reasonable and Prudent Measures (RPMs) and Terms and Conditions (T&Cs) are necessary or appropriate to minimize impacts of the incidental take on large whales, sea turtles, the five DPSs of Atlantic sturgeon, the GOM DPS of Atlantic salmon, and giant manta rays in the ten fisheries assessed in this Opinion (Table 84). In order to be exempt from the prohibitions of section 9 of the ESA and regulations issued pursuant to section 4(d), NMFS must comply with the following T&Cs, which implement the RPMs. These T&Cs are non-discretionary.

Table 84: RPMs, Terms and Conditions, and justifications

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
RPM 1: GEAR RESEARCH: - NMFS must continue to work with the fishing industry and partners to promote, fund, conduct, and/or review research on gear modifications to reduce incidental takes, and the severity of interactions that do occur, of ESA-listed species. - Since fishing characteristics and behavior vary between fisheries, NMFS must annually assess research to better characterize the fisheries covered in this Opinion and the nature of their interactions. - NMFS must continue to share gear research results and tools with Canadian partners to assist them in lowering the number and severity of large whale entanglements in their waters.	- NMFS must develop and evaluate gear research priorities and information needs for ESA-listed species included in the ITS annually. - NMFS must develop a “Roadmap to Ropeless Fishing” within one year of the publication of the Opinion. The Roadmap will identify the research and technology needs related to ropeless fishing, including how these needs will be met. The Roadmap will include consideration of economic, safety, operational, and enforcement aspects of ropeless technology. - NMFS must continue to investigate both new and existing modifications to gillnet, bottom trawl, and trap/pot gear and their effects on large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays. - NMFS must continue to support whale scarring research to estimate the number and severity of entanglements. - NMFS will convene a working group to review all the available information on Atlantic sturgeon bycatch in the federal large gillnet (≥ 7 inches stretched) mesh fisheries. Within one year of publication of this Opinion, the working group will develop an action plan to reduce Atlantic sturgeon bycatch in these fisheries by 2024.	RPM 1 and the accompanying Term and Condition specifies the need for continued gear research and evaluation, as well as further investigation and implementation of results to aid in bycatch reduction of large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays observed captured or entangled in gillnet, bottom trawl, and trap/pot fishing gear. This is essential for reducing the level and severity of incidental take associated with the fishing industry while maintaining sustainable fishing practices. Improving knowledge on dynamic fisheries and updating protocols and modifying current practices, when paired with updated information on where interactions are most likely to occur, are essential for the long-term reduction of impacts on large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays.

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
<u>RPM 2: ECOLOGICAL STUDIES:</u> NMFS must continue to review available data to determine whether there are areas or conditions within the action area where large whale, sea turtle, Atlantic sturgeon, Atlantic salmon, and giant manta ray interactions with fishing gears used in the ten fisheries are more likely to occur.	- NMFS must continue to review all data available on the observed/documented take of large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays in these fisheries and other suitable information (e.g., data on observed interactions with other fisheries, species distribution information, or fishery surveys in the area where the fisheries operate) to assess whether there is sufficient information to undertake any additional analysis to attempt to identify correlations with environmental conditions or other drivers of incidental take within some or all of the action area. - If such analysis is deemed appropriate, within a reasonable amount of time after completing the review, NMFS must take appropriate action to reduce large whale, sea turtle, Atlantic sturgeon, Atlantic salmon, and giant manta ray interactions and/or their impacts.	RPM 2 and the accompanying Terms and Condition specify the importance of using current data already available to reduce the incidental bycatch and increase survivability of large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays. Temporal and spatial data can provide insight on where these interactions are most likely to occur, and can be paired with modifications to fishing practices to minimize the respective incidental capture and mortality of large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays.

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
<u>RPM 3: HANDLING</u> • NMFS must ensure that any bycaught or entangled large whale, sea turtle, Atlantic sturgeon, Atlantic salmon, and giant manta ray is handled in such a way as to minimize stress to the animal and increase its survival rate. • For sea turtles in a comatose or lethargic state, NMFS requires that they must be retained on board, handled, resuscitated, and released according to the established procedures, as practicable and in consideration of best practices for safe vessel and fishing operations.	• NMFS requires that vessel operators follow the sea turtle handling and resuscitation requirements at 50 CFR 223.206. Operators must bring comatose sea turtles aboard and perform resuscitation according to the regulations. If an observer is present, observer protocols will be followed, including bringing fresh dead animals to shore when feasible. • NMFS must distribute information to permit holders in the ten fisheries specifying handling and/or resuscitation requirements they must undertake for any caught or entangled sea turtles, Atlantic sturgeon, Atlantic salmon, or giant manta rays. For large whales, NMFS must provide permit holders with the contact information for the appropriate disentanglement response networks. • As new information becomes available, NMFS must update its protected species handling and release protocols. • Fishermen within these ten fisheries are authorized through this Opinion to disentangle sea turtles according to the STDN Disentanglement Guidelines. This authorization extends to sea turtles captured in the individual fishermen's gear as well as gear used in the federal fishery for which the vessel holds a permit as long as that fishery is covered in this Opinion. GARFO PRD will provide disentanglement guidelines to vessels. • NMFS must continue to require that disentanglement responders collect detailed, consistent information on the gear involved in entanglements and submit all information on the gear to NMFS.	RPM #3 and the accompanying Terms and Condition describe the importance of specific handling and resuscitation requirements in order to increase survivorship of large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays. Minimizing the stress of an animal that was involved in an incidental take increases its chances of survival post-release. By creating protocols that can be easily accessed by fishermen who may encounter these species in their respective fishery, NMFS and the industry can reduce the severity of the interaction and minimize potential long-term impacts on the animal, such as stress-related complications, and mortality.

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
<u>RPM 4: MONITORING 1:</u> NMFS must ensure that monitoring and reporting of any large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays struck by vessels or encountered in gear used in the ten fisheries: (1) detects any adverse effects such as serious injury or mortality; (2) detects whether the anticipated level of take has occurred or been exceeded; and (3) includes the collection of necessary biological and life history data from individual encounters (e.g., species ID, date, location, size measurements, genetic information, photos/video).	- NMFS must continue to monitor the ten fisheries in order to document and report incidental bycatch and entanglement of large whales, sea turtles, Atlantic sturgeon, Atlantic salmon, and giant manta rays. - NMFS must continue to compile an annual omnibus report of observed large whale, sea turtle, Atlantic sturgeon, Atlantic salmon, and giant manta ray takes in New England and Mid-Atlantic fisheries, including trips where species from these ten FMPs are landed by May 1st each year. - NMFS must continue to produce updated bycatch estimates for sea turtles and Atlantic sturgeon in gillnet and trawl gear within the action area when sufficient information and an adequate sample size of data is available (this has typically been done on a five-year cycle). - Observers must continue to tag and take tissue samples (under their ESA section 10 permit) from incidentally captured sea turtles. The NEFSC will be the clearinghouse for any genetic samples of sea turtles taken by observers. - Observers must also take genetic samples (i.e., fin clips or scales) of all incidentally captured Atlantic sturgeon and Atlantic salmon according to the current observer protocols. Samples will be sent to the appropriate NMFS line office or research partner for analysis. - NMFS must conduct outreach to fishermen on reducing vessel strikes of sea turtles. Fishermen must immediately report any vessel strike to GARFO's Marine Animal Hotline directly or through the USCG. - Within one year, NMFS must specify mandatory harvester reporting requirements (e.g., vessel trip reports) for the American lobster and Jonah crab fisheries in federal waters.	RPM 4 and the accompanying Terms and Condition highlight the importance of monitoring effort in fisheries to predict what impacts these changes could have. With many different factors impacting a fishery, effort can fluctuate annually. NMFS must track vessel strikes and bycatch of protected species in these fisheries in order to identify potential impacts to protected species and make adjustments to management, as necessary.

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
<u>RPM 5: MONITORING 2:</u> • NMFS must continue efforts to better investigate and understand cryptic mortality of large whales and post-release mortality of sea turtles in gillnet, bottom trawl, and trap/pot gear used in the ten fisheries and the factors affecting these rates over time. • NMFS must continue efforts to understand the degree to which North Atlantic right whale cryptic mortality and mortality not attributed to source (i.e. vessel strike or entanglement) or country (i.e., United States or Canada) is a result of the operation of interactions in the federal fisheries.	• NMFS must continue to annually evaluate observed takes of large whales and sea turtles using the post-interaction mortality criteria for these species. NMFS has defined criteria for estimating post-interaction mortality in various fisheries using available scientific studies in conjunction with veterinary and other expert opinion, primarily based on animal behavior and the presence and severity of injuries. NMFS will continue apply this criteria to data collected by observers onboard commercial fishing vessels or by personnel specifically trained and permitted to disentangle and release large whales and sea turtles. • The action plan for sturgeon developed under RPM 1 must include an evaluation of information available on post-release mortality, identification of data needed to better assess impacts, and a plan, including timeframes, for obtaining and using this information to evaluate impacts. • NMFS must continue to evaluate all interactions with large whales to determine if gear marking or other gear characteristics can be used to identify the source of the interaction and to determine whether there is new information not considered in this Opinion on apportioning interactions to source. • The Final EIS for the amendments to the ALWTRP will describe, and NMFS will annually report on, monitoring and enforcement of the ALWTRP.	RPM 5 and the accompanying Terms and Condition specify the need for close monitoring of cryptic and post-interaction mortality rates for large whales and sea turtles and what factors affect these rates. Using the post-interaction mortality criteria created by experts in the field, NMFS can use the best available data annually to detect trends in these interactions, survival rates, and if there are modifications that can be made to the fishery, the handling and release of large whales and sea turtles, and disentanglement training to increase chances of survival post-interaction.

Reasonable and Prudent Measures (RPMs)	Terms and Conditions (T&Cs)	Justifications for RPMs and T&Cs
<u>RPM 6: POPULATION ASSESSMENTS</u> NMFS must continue efforts to develop population evaluation assessment tools.	- NMFS must continue to support the development of the NEIT Population Evaluation Tool and NEFSC loggerhead PVA and other population assessment tools. - NMFS must use the best available tools, as appropriate, to assess the North Atlantic right whale extinction risk, current threats, and progress towards achieving the goals of the Conservation Framework, during the evaluation periods.	RPM 6 and the accompanying Term and Condition specify the need for supporting the development of tools needed to assess and monitor the fisheries impacts on ESA-listed species' populations. Population assessment tools will also improve NMFS' ability to monitor the implementation of the Conservation Framework.

10.3. Monitoring Protocols

10.3.1. Large Whale Monitoring

NMFS will continue to monitor levels of large whale entanglement in the ten fisheries. Each year, NMFS will evaluate the most recent annual scarring report published in the New England Aquarium's catalog report for right whales, as well as any other available information for all species, to determine the number of total entanglements that occurred each year following the publication of this Opinion. For right whales, the annual entanglement rate will be specified as the annual percentage of the total population determined to have been entangled each year. We will use a 5-year annual running average to determine if the ITS has been exceeded.

Serious injury determinations and stock assessment reports have been used as the principal means to estimate the large whale entanglements resulting in M/SI in the ten fisheries and to monitor M/SI levels. NMFS has developed a monitoring strategy for the ALWTRP and will produce an annual report stating the most up-to-date M/SI five year rolling average. To provide the most up-to-date rolling average possible, the five-year average will consist of the most recently available year's data from the Marine Animal Incident Database averaged with the previous four years of data obtained from the U.S. Atlantic and Gulf of Mexico Marine Mammal SARs. Analyzing the data in this way will reduce the two-year lag associated with using SAR estimates alone by one year. For the purposes of monitoring large whale takes, NMFS will use the same methodology used in the *Effects of the Proposed Action* to apportion entanglements that are not confirmed to fishery.

For the purposes of monitoring large whale entanglements and M/SI, NMFS will use the scarring reports, serious injury determination reports, SARs, and the ALWTRP monitoring reports to collect entanglement information. NMFS will re-examine interactions and M/SI annually in the ten fisheries. Using these data, NMFS will determine whether incidental take has been exceeded. In addition, as described in the Framework, we will evaluate the requirements of the Framework and information on the population status and environmental baseline. (i.e., changes to calving rates, risk reductions in Canada, risk reductions in U.S. state fisheries, or vessel-strike reductions in U.S. waters) in 2025-2026.

10.3.2. Sea Turtle Monitoring

NMFS must continue to monitor levels of sea turtle bycatch in the ten fisheries. Fisheries observer data, and their incorporation into statistical models (specifically, ratio estimator models as described in Murray (2018, 2020)) are being used as the principal means to estimate sea turtle bycatch rates in the ten fisheries and to monitor incidental take levels. At present, and due to reasons explained below, the NEFSC produces statistically robust sea turtle bycatch estimates for gillnet and bottom trawl gear on five-year rotational cycles. During those individual cycles, observer data by gear type is analyzed over 1-2 years and monitored over the following 3-4 years. NMFS must continue to use fisheries observer data and the NEFSC-produced bycatch estimates to monitor sea turtle bycatch in gillnet and bottom trawl gear that is authorized by the ten FMPs, though the role of observers and use of fishery dependent data will differ for each gear type. Entanglement reports have been used as the principal means to estimate sea turtle bycatch in the trap/pot fisheries and to monitor incidental take levels. NMFS must continue to use entanglement reports as well as available observer data to monitor sea turtle bycatch in trap/pot gear authorized by the FMPs.

Gillnet and bottom trawl gear

For the purposes of monitoring this ITS for the gillnet and bottom trawl components of the ten fisheries, we will continue to use records from the fisheries observer program as the primary means of collecting incidental take information. For sea turtles, the take estimates described in this Opinion were generated using a statistical model that is not feasible to conduct on an annual basis due to the data needs; length of time to develop, review, and finalize the estimates; and methodology, as explained below. In monitoring take, NMFS will evaluate the observer data and bycatch estimates.

In its discussion of sea turtle bycatch estimation, Murray (2009b) explains that “to directly compare future levels of loggerhead bycatch to the average annual estimates and [95 percent] confidence intervals [CIs] reported in this paper, these future estimates would also need to be 5-year averages.” This necessity is reiterated in the Warden (2011b) trawl bycatch analysis for loggerhead sea turtles, which states that “if these interaction estimates are updated approximately every five years, then future levels of loggerhead interactions can be evaluated by comparing the average annual estimates and CIs reported in this paper to the future average annual estimates and CIs.” Therefore, for the following reasons, we will continue to implement a five-year monitoring framework for sea turtles rather than an annual one:

- As mentioned throughout the Opinion, observed sea turtle interactions are rare, and we often need to pool data across years to have enough data to produce a robust, model-based estimate of total interactions. We need at least ten observations per parameter in the model. Thus, even with a very simple model, we usually require 20-30 observed bycatch events. It is uncommon to have this many observed sea turtle interactions in a single year, as documented in previous bycatch estimates. Subsequently, when we pool data over five years to report an annual average, we need another five years to compare averages, as explained above.
- It normally takes a year to process, clean, and analyze data for a valid bycatch estimate, for one gear type. With current resources, it is neither reasonable nor possible to estimate bycatch annually across multiple gear types.
- Annual estimates are unlikely to change considerably such that they affect the population assessments. On page 35 of Warden et al. (2015), the authors state that “when the population is large compared to the incidental mortality, frequent (e.g., annual) monitoring is not likely to produce results that are substantially different from the previous assessment. Less frequent but more comprehensive assessments, which explicitly address uncertainty, may provide more reliable information.”

Although we collect raw data on the number of observed sea turtle takes in gillnet and bottom trawl fisheries as they are documented and verified (usually on a time lag of at least three months per the NEFOP’s data quality control and assurance procedures), we cannot produce reliable short-term take estimates using them because observed sea turtle takes are rare events, dependent on a wide range of both human and natural factors that vary greatly over short time periods (i.e., less than a year). Examples of human factors include variation in the number of vessels fishing, time spent fishing, percent observer coverage, regulatory regimes, market forces, etc. Natural factors include changes in oceanographic conditions such as water temperature, distribution of prey, weather conditions, shifting distributions and abundance of sea turtles, etc. Typically, the number of takes observed in a short time period (i.e., one year), when considered with the factors identified above, means that the observed takes cannot be extrapolated to estimate the total

number of takes with good precision. Nor do the raw data provide a large enough sample size to identify any exceedances of the incidental take level. For all of the foregoing reasons, we will rely on the statistical methods used in Murray (2018) and Murray (2020), which we have determined represent the best available scientific and commercial data for sea turtle bycatch estimation, to re-estimate takes in the gillnet and bottom trawl fisheries assessed in this Opinion approximately every five years.

With respect to green sea turtles in gillnet gear, we do not have a recent five-year bycatch estimate due to so few recorded interactions. Thus, the raw annual numbers of observed takes are the best available scientific and commercial data, and reviewing those numbers is the only available method for monitoring the incidental take levels in gillnet gear. Thus, we will continue to rely on such data for monitoring incidental takes of that species until a five-year estimate is available. Given the annual variability in take, the take levels are set as 5-year running averages (total for any 5-year period) and not for static 5-year periods (i.e., 2021-2025, 2022-2026, 2023-2027 and so on, as opposed to 2021-2025, 2026-2030, 2031-2035, etc.). This approach will allow us to reduce the likelihood of requiring reinitiation unnecessarily because of inherent variability in incidental take levels, but still allow for an accurate assessment of how the proposed action is performing versus our expectations. The 5-year running average will be calculated annually.

This two-pronged methodology for monitoring sea turtle incidental takes in gillnet and bottom trawl gear is consistent with the conceptual framework described in Haas (2010), in which a low level metric such as raw counts (simple to estimate, but less informative) could be used for monitoring incidental take on the short term (i.e., annually) and a higher level metric such as a bycatch estimate (difficult to estimate, more informative) could be used for monitoring incidental take over a longer (i.e., five year) time frame. For all four species of sea turtles, no other monitoring alternatives exist for gillnet and bottom trawl fisheries that are feasible on a shorter term than the 5-year period required to produce an updated bycatch estimate.

Pot/trap gear

For the purposes of monitoring the ITS in regards to sea turtles that are known to be entangled in trap/pot gear, NMFS will continue to use STDN data as the primary means of collecting incidental take information. NMFS will assess takes annually in the lobster, Jonah crab, red crab, scup, and black sea bass fisheries using all available and up-to-date STDN entanglement data. NMFS will use the same methodology used in the *Effects of the Proposed Action* to apportion entanglements that are not confirmed to fishery. Using these data, NMFS will determine if the five-year rolling average incidental take level in this Opinion has been met or exceeded.

10.3.3. Atlantic Sturgeon Monitoring

NMFS must monitor levels of Atlantic sturgeon bycatch in the ten fisheries. Fisheries observer data, and their incorporation into statistical models (specifically, generalized linear models (ASMFC 2017, Miller and Shepard 2011)), has been used as the principal means to estimate Atlantic sturgeon bycatch in gillnet and bottom trawl fisheries and will be used to monitor incidental take levels in gear authorized by the FMPs for the ten fisheries.

For the purposes of monitoring this ITS for the gillnet and bottom trawl components of the ten fisheries, we will continue to use fisheries observer data as the primary means of collecting incidental take information. As the estimates depend on incidental take rate information over a several year period, re-examination after one year is not likely to produce any noticeable change

in the take rate. For these reasons, we will re-estimate incidental takes in the ten fisheries every five years using appropriate statistical methods. For the five Atlantic sturgeon DPSs, we will use all available information (e.g., observed incidental takes, changes in fishing effort, etc.) to monitor the fishery.

10.3.4. *Atlantic Salmon and Giant Manta Ray Monitoring*

NMFS must monitor levels of Atlantic salmon and giant manta ray bycatch in the ten fisheries. Observer coverage has been used as the principal means to estimate Atlantic salmon and giant manta ray bycatch in U.S. Northeast and Mid-Atlantic gillnet and bottom trawl fisheries and will be used to monitor incidental take levels in gear that is authorized by the FMPs for the ten fisheries. Given the annual variability in take, the take levels are set as 5-year running average (total for any 5-year period) and not for static 5-year periods (i.e., 2021-2025, 2022-2026, 2023-2027 and so on, as opposed to 2021-2025, 2026-2030, 2031-2035, etc.). This approach will allow us to reduce the likelihood of requiring reinitiation unnecessarily because of inherent variability in incidental take levels, but still allow for an accurate assessment of how the proposed action is performing versus our expectations. The 5-year running average will be calculated annually.

For the purposes of monitoring this ITS for the gillnet and bottom trawl components of the ten fisheries, we will continue to use observer coverage as the primary means of collecting incidental take information. For the Atlantic salmon and giant manta rays, we will use all available information (e.g., observed takes, changes in fishing effort, etc.) to assess if the annual incidental take level in this Opinion has been exceeded.

10.4. Conservation Recommendations

In addition to section 7(a)(2), which requires agencies to ensure that proposed actions are not likely jeopardize the continued existence of listed species, section 7(a)(1) of the ESA places a responsibility on all federal agencies to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Conservation Recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The following additional measures are recommended regarding incidental take and ESA-listed species conservation:

1. NMFS should continue to follow its established protocols for bringing to shore any sea turtle incidentally taken in fishing gears used in the ten fisheries that is freshly dead, that dies on the vessel shortly after the gear is retrieved, or dies following attempts at resuscitation in accordance with the regulations. The protocols include steps to be taken to ensure that the carcass can be safely and properly stored on the vessel and properly transferred to appropriate personnel for examination. The protocols also identify the purpose for examining the carcass and the samples to be collected. Port samplers and observers should also be trained in the protocols for notification of the appropriate personnel in the event that a vessel comes into port with a sea turtle carcass.
2. NMFS should develop guidance for fishing practices that minimize bycatch of giant manta rays, including handling and release procedures using different gears, and produce education and outreach materials about safe handling and release.

3. NMFS should develop standardized guidelines for fisheries data collection (e.g., species identification, sizing, tissue samples, and reproductive status) and monitoring (e.g., landings, discards, fishing effort, and gear types) for giant manta rays. NMFS should collect data or fund research to estimate post-release mortality across various sizes and gear types.
4. NMFS should also review its policies/protocols for the processing of genetic samples to determine what can be done to improve the efficiency and speed for obtaining results of genetic samples taken from all incidentally taken Atlantic sturgeon and Atlantic salmon.
5. NMFS should work with states to minimize take and its impacts in state permitted activities and encourage the states to seek authorization for incidental take that is otherwise unavoidable.
6. NMFS should support studies and stock assessments on seasonal ESA-listed species distribution and abundance in the action area, behavioral studies to improve our understanding of ESA-listed species interactions with fishing gear, and foraging studies including prey abundance/distribution studies (which may influence distribution), as well as studies and analysis necessary to develop population estimates for ESA-listed species.
7. NMFS should continue to undertake and support vessel and aerial surveys, passive acoustic monitoring, and the Sightings Advisory System to better understand the distribution and habitat use of ESA-listed species to inform assessments of co-occurrence.
8. NMFS will continue to conduct outreach to fishermen on reducing risks to protected species due to incidental bycatch and vessel strikes. NMFS should continue to develop and implement measures to reduce the risk of vessel strikes of large whales. NMFS has conducted a review of the vessel strike reduction measures, including an assessment of the effectiveness of mandatory vessel speed restrictions, as it pertains to right whale management. NMFS is currently evaluating the need for future action or potential modifications to the vessel strike reduction efforts to enhance protection of right whales.
9. NMFS should encourage all commercial and recreational fishermen to report sightings of large whales, especially right whales, to the following hotline numbers: **866-755-6622** (from Maine to Virginia) and **877-WHALE-HELP** (from North Carolina to Florida).
10. NMFS should increase its monitoring and surveillance of North Atlantic right whales to identify areas of predicted co-occurrence between whales and fishing gear and develop methods to validate the forecasts of co-occurrence.
11. NMFS should continue to undertake and support disentanglement activities, in coordination with the states, other members of the disentanglement and stranding network, and with Canada.
12. NMFS should continue to create education and outreach material to communicate conservation messages for ESA-listed species, including new materials for giant manta rays, through social media, websites, magazines, and print to federal agencies, local communities, and non-governmental organizations (NGOs).

13. NMFS should explore the methods and feasibility for authorizing fishermen to tag incidentally-captured Atlantic sturgeon with a Passive Integrated Transponder (PIT) tag.
14. NMFS should explore how to provide PIT tag readers to fishermen when and where their fishing efforts overlap with expected sturgeon aggregations areas.

11. REINITIATING CONSULTATION

This concludes formal consultation on the a of the fisheries operating under the eight federal (Atlantic Bluefish, Atlantic Deep-Sea Red Crab, Mackerel/Squid/Butterfish, Monkfish, Northeast Multispecies, Northeast Skate Complex, Spiny Dogfish, and Summer Flounder/Scup/Black Sea Bass) and two interstate fishery management plans (American Lobster and Jonah Crab) and on the Implementation of the New England Fisheries Management Council's Omnibus Essential Fish Habitat Amendment 2. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In the event that the amount or extent of take is exceeded, NMFS, GARFO must immediately request reinitiation of formal consultation.

This Biological Opinion considers Phase 1 of the Conservation Framework to be the measures that were proposed in the Proposed Rule of December 31, 2020 to amend the Atlantic Large Whale Take Reduction Plan. Because this Biological Opinion is being issued prior to the publication of the final rule, it is possible that the measures we implement in that final rule may differ somewhat from those specified in the proposed rule based on our consideration of comments received on the proposed rule and additional analyses conducted during development of the rule. Any substantive deviations from the proposed rule not previously considered in the Biological Opinion may trigger re-initiation of this consultation, but any measures that differ from the proposed rule that are determined to provide equal or greater conservation-value as compared to the measures in the proposed rule, would not trigger reinitiation.

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**13. APPENDIX A: NORTH ATLANTIC RIGHT WHALE CONSERVATION
FRAMEWORK FOR FEDERAL FISHERIES IN THE GREATER ATLANTIC
REGION**

May 2021

North Atlantic Right Whale Conservation Framework for Federal Fisheries in the Greater Atlantic Region

Purpose

During the development of an Endangered Species Act (ESA) section 7 consultation on the authorization of federal fisheries in the Greater Atlantic Region, we identified the need to implement measures to further reduce entanglement of North Atlantic right whales (hereafter “right whales”) to meet the mandates of the ESA. As described below, the Conservation Framework includes the measures proposed in a December 2020 rulemaking to modify the Atlantic Large Whale Take Reduction Plan (ALWTRP) and three additional phases. This Conservation Framework outlines NMFS’ commitment to implement measures that are necessary for the recovery of right whales, while providing a phased approach and some flexibility to the fishing industry. NMFS is currently conducting an ESA section 7 consultation on the authorization of eight federal fisheries managed under the Magnuson-Stevens Act and two interstate fishery management plans under the Atlantic Coastal Act and the implementation of the New England Fisheries Management Council’s Omnibus Essential Fish Habitat Amendment 2 (Batched Fisheries Opinion). The Batched Fisheries Opinion includes fisheries managed under the American lobster, Atlantic bluefish, Atlantic deep-sea red crab, Jonah crab, monkfish, Northeast multispecies, Northeast skate complex, spiny dogfish, Atlantic squid/mackerel/butterfish, and summer flounder/scup/black sea bass fishery management plans. It is our intent that these measures be considered as part of the proposed action in the consultation on the Batched Fisheries. The Conservation Framework includes fixed gear fisheries authorized under the respective fishery management plans included in the Batched Fisheries Opinion. The Conservation Framework does not specify particular measures but identifies the level of reductions in mortalities and serious injuries (M/SI) that NMFS is committed to achieve in order to meet its ESA mandates. Although we believe the Conservation Framework targets can be met through gear and operational measures, NMFS has the authority⁷² to implement other measures (e.g., partial/complete closures) to reduce risk and will exercise that authority if needed.

Background

North Atlantic right whales, one of the world’s most endangered large whale species, are protected under the Marine Mammal Protection Act (MMPA) and the ESA. While these two laws have different objectives, they work together to protect and recover North Atlantic right whales, restoring stocks to sustainable levels. NMFS has developed this North Atlantic Right Whale Conservation Framework to further reduce M/SI due to entanglements in federal fisheries to meet the mandates of the ESA, while recognizing the important role that the MMPA take reduction program goals and ongoing actions have in reducing mortalities and serious injuries in U.S. commercial fisheries and recovering the North Atlantic right whale species.

⁷² Marine Mammal Protection Act (16 U.S.C. 1361 et seq.), the Endangered Species Act (16 U.S.C. 1531 et seq.), the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.) and other statutes, as appropriate.

Primary threats to the species include climate change, entanglement in fishing gear, and vessel strikes. The fisheries included in this Conservation Framework are fixed gear fisheries in federal waters managed by NMFS' Greater Atlantic Regional Fisheries Office (GARFO) under the Magnuson-Stevens Fishery Conservation and Management Act and the Atlantic Coastal Fisheries Cooperative Management Act. Some of these fisheries are also regulated under the ALWTRP regulations issued pursuant to section 118 of the MMPA. Under the ESA, the impacts of federally-authorized activities are considered under the consultation requirements of section 7 of the ESA. In developing the ESA section 7 Biological Opinion on these fisheries, entanglements in the federal fisheries listed above were estimated to seriously injure or result in the death of an average of approximately five right whales each year⁷³. This Conservation Framework outlines ongoing and planned actions to reduce M/SI of right whales incidental to these fisheries under the MMPA and the further reductions needed to meet the mandates of the ESA.

MMPA: Atlantic Large Whale Take Reduction Program Ongoing and Planned Activities

When incidental mortality or serious injury of marine mammals from commercial fishing exceeds a stock's "potential biological removal" (PBR) level, the MMPA directs NMFS to convene a take reduction team made up of stakeholders from the fishing industry, fishery management councils and commissions, state and federal resource management agencies, the scientific community, and conservation organizations to consider the best available information and develop recommended modifications to commercial fishery operations to reduce M/SI to below a stock's PBR. NMFS considers these recommendations in implementing regulatory and non-regulatory measures under a take reduction plan. The MMPA specifies that the goal of a take reduction plan shall be to reduce M/SI incidental to commercial fishing to below a stock's PBR. First implemented in 1997, the ALWTRP has been modified several times to reduce the risk of mortality and serious injury of large whales incidentally taken in commercial gillnet and trap/pot fisheries. The most recent final rule was published in May 2015 (80 FR 30367, May 28, 2015).

Because of the declining population and the persistent incidental entanglements resulting in M/SI above the stock's PBR, ALWTRP modifications have, and continue to be, directed primarily at reducing the risk of commercial fisheries on right whales. In late 2017, the evidence of a declining population exacerbated by high right whale mortalities caused NMFS to refocus the Atlantic Large Whale Take Reduction Team (ALWTRT) on new modifications to the ALWTRP. NMFS has proposed measures to reduce M/SI (85 FR 86878, December 31, 2020) and is planning to reconvene the ALWTRT to consider additional measures.

In the [current proposed rule](#), NMFS has proposed modifications to the ALWTRP that focus on the Northeast Region lobster and Jonah crab trap/pot fisheries. In developing this action, NMFS estimated that to reduce M/SI to below PBR for right whales, entanglement risk across U.S.

⁷³ For information on how these estimates, which include an estimate of observed/unknown cause and unobserved (i.e., cryptic) mortality resulting from entanglement in the fisheries, were calculated, see section 7.2 of the Biological Opinion on the Continued Implementation of Management Measures for the American Lobster, Atlantic Bluefish, Atlantic Deep-Sea Red Crab, Mackerel/Squid/Butterfish, Monkfish, Northeast Multispecies, Northeast Skate Complex, Spiny Dogfish, Summer Flounder/Scup/Black Sea Bass, and Jonah Crab Fisheries.

fisheries (state and federal) needs to be reduced by 60 to 80 percent. However, given additional sources of uncertainty in the 80-percent target, as well as the challenges achieving such a target without substantial economic impacts to the fishery, the ALWTRT focused on recommendations to achieve the lower 60-percent target. Therefore, under the ALWTRP, NMFS has proposed measures to reduce M/SI in the American lobster and Jonah crab pot/trap fisheries in both state and federal waters⁷⁴ by an estimated 60 percent. For a full description of how these targets were determined, the ALWTRT discussions, and the proposed measures, see the [Draft Environmental Impact Statement for Amending the Atlantic Large Whale Take Reduction Plan: Risk Reduction Rule](#). The measures proposed under the ALWTRT are included as the first phase in this Conservation Framework.

In 2021, the ALWTRT will be asked to recommend modifications to the ALWTRP to address risk in the remaining fixed gear fisheries that use buoy lines, including other trap/pot fisheries and gillnet fisheries coastwide. The ALWTRT has begun discussing risk reduction considerations for late summer scoping. NMFS will consider how any changes to the ALWTRP under this future action contribute to meeting the goals of the Conservation Framework.

As described above, the MMPA and ESA work together to protect and recover right whales. While recommendations from the ALWTRT inform the development of measures integrated into the ALWTRP and associated regulations to meet the mandates of the MMPA, they also contribute to progress towards the ESA goals described below.

ESA: Section 7 Consultation of Federal Fisheries Management

Under the ESA, the consultation considers the impacts of the federal fisheries (i.e., federally-permitted vessels operating in federal waters) on ESA-listed species. The implementation of the proposed modifications to the ALWTRP related to the Northeast Region lobster and Jonah crab trap/pot fisheries in federal waters is expected to reduce M/SI in the American lobster and Jonah crab pot/trap fisheries by approximately 60 percent⁷⁵. Once the ALWTRP measures are implemented, NMFS estimates that, without further action, the federal fisheries are anticipated to result in the death of approximately an annual average of 2.69 right whales (27 right whales over a 10-year period).

We recognize that the fishing industry has implemented all the required mitigation measures since 1997. However, data suggest that mortalities and serious injuries of right whales continued at higher rates than are sustainable even with the measures implemented under the Take Reduction Plan. As a result of climate change and exposure to mortality in unregulated areas, the persistent deaths and injuries in U.S. fisheries cannot be sustained by the reduced North Atlantic right whale population. As the population of right whales continues to decline, we must

⁷⁴ The area include in the ALWTRP proposed rule is north of 40°00' N latitude and east of 71° 51.5' W longitude.

⁷⁵ It should be noted that the ALWTRP rulemaking includes both state and federal waters. The proposed measures across the state and federal waters are designed to achieve at least a 60 percent reduction in M/SI. For the purposes of this analysis, we do not apply a "credit" for measures that were previously implemented in the Massachusetts Restricted Area. Without this, the proposed rule achieves 58.1% reduction; 26.6% of that reduction is expected to occur in federal waters. Reduced impacts in state waters would contribute to an improved baseline. The impacts to the baseline from these measures are considered in the Biological Opinion.

acknowledge that previous efforts have not reduced entanglements to the degree needed to satisfy ESA and MMPA requirements, and additional efforts are necessary to recover this critically endangered species.

Our analyses indicate that further reductions in entanglements and M/SI in the federal fisheries under this Conservation Framework are needed to ensure the fisheries will not appreciably reduce the likelihood of the survival and recovery of the species as required by the ESA. To determine the extent to which additional measures are needed, we used qualitative and quantitative analyses. We developed a population projection model to predict the population trajectory over 50 years (Linden, 2021)⁷⁶. We recognize that the fisheries are likely to be modified in the next 10 years; however, there is no information available at this time to predict how any future modifications will change the operation of the fisheries. While these changes cannot be considered in the projections now, we have developed and are committing to the comprehensive adaptive management approach and schedule described below so that as new information becomes available, the changes can be considered in the future. The adaptive management approach will also consider changes to calving rates and reductions of M/SI from other non-fishery sources (e.g., vessel strikes).

Using the population projections, we compared the trajectory of the female population after implementing the proposed ALWTRP measures to the trajectory projected if the remaining M/SI in the federal fisheries was further reduced by 25, 50, 75, or 95 percent. With no further reduction in M/SI, our analyses indicate the federal fisheries are impacting the survival and recovery of right whales. We also concluded that reductions below 95 percent were insufficient to meet the ESA mandates as survival and recovery would still be appreciably reduced due to the federal fisheries that would continue to occur, albeit at a lower level. We further refined our analysis and determined that M/SI in the federal fisheries needs to be reduced to 0.136 on average annually⁷⁷, within 10 years under a phased implementation (see below), to ensure that the fisheries will not appreciably reduce the likelihood of survival and recovery of the species. Unless M/SI from other sources (i.e., U.S. vessel strikes, non-federal U.S. fisheries, Canadian fisheries and vessel strikes (see below)) are reduced and/or calving rates increase, this level of reduction in M/SI in the federal fisheries is necessary to ensure the goals of the ESA, namely survival and recovery of the species, are met.

Therefore, through this Conservation Framework, we are committing to use our authorities to implement measures to further reduce entanglements and M/SI in federal fisheries, reducing M/SI from an annual average of 2.69 after the implementation of the proposed rule to no more than 0.136. The reduction in entanglements is also expected to reduce sublethal effects that may affect the health and reproductive output of right whales. These reductions will be phased in over the 10-year period (2021-2030). The Conservation Framework describes the targets to be achieved and the dates by which they must be implemented to ensure the Framework's goals are

⁷⁶ Linden, D. 2021. Population projections of North Atlantic right whales under varying human-caused mortality risk and future uncertainty National Marine Fisheries Service, Greater Atlantic Region, Gloucester, MA.

⁷⁷ Note that the numbers included here differ slightly from the numbers included in the draft Conservation Framework. This is a result of updates to the data considered and new runs of the population projections using the updated information.

achieved. At this time, the Conservation Framework does not specify the measures that will be implemented. When developing measures at each phase, we will be able to consider gear innovations, ALWTRT recommendations, fishing and shipping changes, and evidence of impacts of U.S. and Canadian right whale conservation.

M/SI in Canadian waters

In the Biological Opinion, we estimate the total M/SI of right whales across their full range. The estimated mortality was then partitioned between the United States and Canada following the methods used for M/SI in fisheries to develop the ALWTRT target. These methods were peer reviewed, and while the reviewers did not come to consensus on accuracy, they considered the approach reasonable. We estimate that, on average, approximately 21 right whales die or are seriously injured annually under current conditions. Of these, 11.10 are estimated to occur in Canadian waters and 10.02 in U.S. waters. In Canada, right whales are protected under the Species at Risk Act and the Fisheries Act. As described in the Opinion, the population projections demonstrate that action is needed in both countries to turn the population trajectory positive. Since 2017, the Government of Canada has implemented measures to protect North Atlantic right whales from impacts from both the fishing and shipping industries. Canada has modified their measures annually to reduce M/SI. Given the limited time these measures have been in effect as well as annual changes to and the dynamic nature of the measures, at this time, we have no way to accurately assess the benefit to right whales from Canada's recent measures. As such, in our current analysis, we are not able to quantify the level of risk reduction in Canada and include it in the analysis. However, we assert that the measures taken by Canada are and will continue to benefit right whales, and as part of our evaluation of new data and measures (see table below), we will periodically consider whether it is possible to attribute a benefit from Canadian measures in our analysis. Until this benefit can be assessed, this Conservation Framework takes a conservative approach that considers the retrospective recent serious injury and mortality rates and plans as if the Canadian measures are not benefitting the right whale population. As more information becomes available on risk reduction in Canadian waters and from other U.S. sources (e.g., vessel strikes), the Conservation Framework may be modified to reduce the degree to which additional measures are needed while ensuring that the fisheries in the Framework are not appreciably reducing survival and recovery of the species.

Adaptive Management within the Conservation Framework

This Conservation Framework is designed to increase the likelihood of not only survival but also successful recovery of right whales, as required by the ESA. To accomplish this, the Conservation Framework recognizes and addresses many sources of uncertainty. Conservative assumptions are made about future conditions, including environmental conditions, threats, and the species' response to management actions in the United States and Canada. We recognize that there are efforts to reduce M/SI from other sources, uncertainty associated with available data, and changing environmental conditions. To maintain the maximum likelihood of recovery success over time, this Conservation Framework is adaptive and allows for revisions as additional information becomes available or should any of the assumptions require revisions. Adaptive management, that is, adjusting management as management results, needs, and other events become better understood, provides a systematic means of addressing uncertainties and is an important component of this Conservation Framework. A primary tenet of adaptive management is to evaluate the efficacy of management actions. Therefore, the Conservation

Framework includes a comprehensive evaluation mid-way through implementation to determine whether the target reductions in M/SI currently specified for the final five years of the Framework need to be fully implemented. During the evaluation period, we will assess the U.S. and Canadian risk reduction measures, the population status, and calving and survival rates to determine the extent to which additional measures are needed. The Conservation Framework currently assumes no changes to the species' status or reductions in M/SI from other sources, with the exception of actions in state waters from the proposed ALWTRP rule or related state measures. If reductions in M/SI from sources other than the federal fisheries or improvements to the species status are identified during the evaluation, we will revisit this assumption to determine whether it is necessary for all elements of the Conservation Framework to be fully implemented to achieve its conservation goals.

Conservation Framework Actions

The Conservation Framework actions include the current ALWTRP rulemaking and anticipates three additional rulemakings over the next ten years. We will conduct evaluations at defined periods and adapt the Conservation Framework as appropriate. At year five, we will comprehensively evaluate whether and to what extent the fourth and final rulemaking needs to be implemented.

Phase	Year	Conservation Framework Action Description
	Annually	Provide updates, as appropriate, on the implementation of the Framework to the New England and Mid-Atlantic Fishery Management Councils, Atlantic States Marine Fisheries Commission, and ALWTRT.
1	2021	NMFS implements the MMPA ALWTRP rulemaking focused on 60% reduction in right whale M/SI incidental to the American lobster and Jonah crab trap/pot fisheries. In federal waters, this action reduces M/SI from entanglement, on average annually, to 2.69. Implementation for certain measures will begin in 2021; others will be phased over time.
2	2023	NMFS implements rulemaking to reduce M/SI in federal gillnet and other pot/trap (i.e., other than lobster and Jonah crab fisheries included in Phase 1) fisheries by 60%, reducing M/SI from entanglement, on average annually, to 2.61. As described above, the ALWTRT will convene in 2021 to recommend modifications to the ALWTRP to address risk in the remaining fixed gear fisheries. This phase will consider how any changes to the ALWTRP contribute to achieving the target reduction under this Framework.
Evaluation	2023-2024	NMFS evaluates any updated or new data on right whale population and threats to assess progress towards achieving the conservation goals of this Framework. At this time, we will also assess measures taken by Canada to address serious injury and mortality in Canadian waters.

Phase	Year	Conservation Framework Action Description
3	2025	NMFS implements rulemaking to further reduce M/SI by 60% in all federal fixed gear fisheries, reducing M/SI from entanglement, on average annually, to 1.04.
Evaluation	2025-2026	NMFS evaluates measures implemented in the 2025 action as well as new data on the right whale population and threats to assess progress towards achieving the conservation goals of this Framework. Based on the results of this evaluation, NMFS will determine the degree to which additional measures are needed to ensure the fisheries are not appreciably reducing the likelihood of survival and recovery. As described above, if actions outside the federal fisheries reduce risk to right whales by 0.5 M/SI on average annually (1 whale every two years), the M/SI reduction requirement in Phase 4 will be reduced from 87 to 39 percent. If M/SI from other sources is reduced by greater than one M/SI on average annually, we will evaluate whether further action in the federal fisheries is needed.
4	2030	In accordance with the goals identified in the 2025-2026 evaluation, NMFS implements regulations to further reduce M/SI (up to 87%) in fixed gear fisheries. With an 87% reduction, M/SI will be reduced to 0.136.

Evaluation of Reductions by 2030 Needed to Achieve Conservation Framework Goals

NMFS will evaluate population metrics and threats including, but not limited to:

1. Population status.
2. Population distribution and habitat use.
3. Calving and survival rates.
4. Entanglements in U.S. state, U.S. federal, and Canadian commercial fisheries.
5. Changes to the federal fisheries (e.g., changes in co-occurrence due to shifts in areas the fishery operates or changes in effort).
6. Vessel strikes in U.S. and Canadian waters.
7. Apportionment of M/SI (including cryptic mortality) to federal fisheries and other sources, including M/SI in Canada, and between vessel strikes and entanglement.

In 2025-2026, we will re-run the population projections to assess the female population trajectory given any new information. These population projections will help inform the level of further reductions in M/SI that will be needed to achieve the conservation goals of the Conservation Framework and to ensure the federal fisheries are not appreciably reducing the likelihood of survival and recovery. According to the current analysis, a reduction in M/SI in U.S. commercial fisheries of up to 87 percent would be required. That M/SI reduction may be reduced from the 87 percent target to a target of 39 percent if an action outside the federal fisheries reduces risk to right whales by 0.5 M/SI on average annually (1 whale every two years).

It is possible that population-wide risk reduction measures or population growth will reach a level at which further action in the federal fisheries is not needed. If M/SI from other sources is reduced by greater than one M/SI on average annually, we will evaluate whether further action in the federal fisheries is needed and, if so, at what level.⁷⁸

Development of Measures - Engaging and Coordinating With Partners

As described above, this Conservation Framework specifies targets rather than particular measures to be implemented. We are committed to working with our partners on the implementation of measures to meet the goals of the Conservation Framework. Examples of potential conservation measures may include, but are not limited to, measures such as further buoy line reduction by increasing traps per trawl, further weakening of vertical buoy lines, converting to bottom-stowed vertical lines with remote retrieval devices (referred to as ‘ropeless’ fishing), targeted seasonal restricted areas closed to buoy lines, broad buoy line restrictions, and managing the number of vertical lines through a buoy line allocation program.

NMFS will consider input from the New England and Mid-Atlantic Fishery Management Councils and the Atlantic States Marine Fisheries Commission in developing and implementing mitigation measures under this Conservation Framework. We anticipate that the ALWTRT will be convened at least annually to evaluate incidental entanglement mortality and serious injury, right whale population status, gear monitoring, gear research, and compliance, as required by the MMPA. Any ALWTRT recommendations and associated MMPA rulemaking will be considered. Additionally, at the ALWTRT meetings, as appropriate, we will provide updates on the implementation of the Conservation Framework. Team members’ individual input received during these updates, along with other new information, will be considered when developing mitigation measures to meet the objectives of the Conservation Framework. We are committed to implementing this Conservation Framework to further reduce M/SI in the federal fisheries to meet the mandates of the ESA and plan to work closely with our partners throughout the process. We will consider all input received by stakeholders in developing and implementing measures to reach the conservation targets by the dates specified in this Conservation Framework.

Other Sources of Mortality

While this Conservation Framework is specific to the federal fisheries in the Greater Atlantic Region, NMFS and our partners are also working to address other sources of M/SI in the United States and in Canada, as described below.

U.S. Commercial Fisheries in State Waters

We continue to work with states and the ALWTRT to reduce M/SI of large whales, not just right whales, incidentally captured in both state and federal fisheries. The current ALWTRP rulemaking includes measures that apply in state (as well as federal) lobster and crab trap/pot fisheries. Additionally, to obtain authorization for incidentally taking ESA-listed marine mammals, such as right whales, states must apply for an ESA section 10(a)(1)(B) incidental take

⁷⁸We understand that any changes to the Framework may require reinitiation of the Batched Fisheries Opinion under section 7 of the ESA.

permit for state fisheries. Those applications must include conservation plans that specify the anticipated impact of the state fisheries on the species and its habitat, measures to monitor, minimize, and mitigate such impacts, as well as other information. The Commonwealth of Massachusetts has indicated they are preparing an application, and other New England states have expressed interest or reached out for information on this process. Regardless of whether states apply for ESA section 10 incidental take permits, as noted previously, the ALWTRT will continue its work to identify take reduction measures for state fisheries as part of the MMPA take reduction process. In addition to the efforts of NMFS and the ALWTRT, states such as the Commonwealth of Massachusetts have enacted their own measures (e.g., time/area closures) that expand upon the ALWTRP measures.

U.S. Vessel Strikes

NMFS has implemented a number of measures to reduce the risk of vessel strikes to right whales in U.S. Atlantic waters. These include mandatory speed restrictions for most vessels greater than 65 feet in length transiting through designated Seasonal Management Areas, vessel routing measures to reduce the co-occurrence of vessels and whales, and the establishment of Dynamic Management Areas and Right Whale Slow Zones where vessels are requested to either slow down or avoid areas where aggregations of right whales have recently been detected. Additionally, NMFS maintains a longstanding 500-yard minimum approach distance for right whales to prevent accidental strikes and regularly reaches out to mariners through the USCG Mandatory Ship Reporting system, port meetings, and other avenues to educate vessel operators about speed restrictions and alert them to the presence of right whale aggregations.

However, vessel strike remains a threat to right whales in U.S. (and Canadian, see below) waters. In early 2021, NMFS released an assessment of the vessel strike reduction measures, including an assessment of the effectiveness of mandatory vessel speed restrictions, as it pertains to right whale management. NMFS collected comments on that assessment and, considering these public comments, is currently evaluating the need for future action or potential modifications to the vessel strike reduction efforts to enhance protection of right whales.

In addition to NMFS' efforts, the Commonwealth of Massachusetts has enacted its own measures in the Cape Cod Bay area, mandating a 10-knot speed limit for most vessels less than 65 feet in length during March and April when right whales commonly aggregate in the Bay.

Entanglements and Vessel Strikes in Canadian Waters

NMFS remains committed to working with Canada through various bilateral fora including the U.S.-Canada bilateral working group to focus on the cross-boundary conservation and protection of right whales. Specifically, NMFS continues to regularly engage with Fisheries and Oceans Canada and Transport Canada at both the senior leadership and staff levels to share information and explore opportunities for collaboration on transboundary resource management issues. This includes the efforts of the bilateral right whale working group to identify jointly data and management gaps that are impeding recovery of right whales in both Canada and the United States. NMFS is committed to working with Canada through the [MMPA Import Provisions process](#) to evaluate whether applicable Canadian fisheries have regulatory programs that are comparable in effectiveness to the regulatory program governing U.S. fisheries for protecting

marine mammals, including right whales.⁷⁹ These bilateral efforts are important to achieving the United States and Canada's shared goals of conserving and restoring this species.

Each year, the Government of Canada implements a number of measures to address entanglements and vessel strikes involving right whales in Canadian waters. The measures that Fisheries and Oceans Canada has implemented currently include, but are not limited to, a new season-long closure area protocol in the Gulf of St. Lawrence, expansion of the dynamic fishery closure areas into the Bay of Fundy, and mandatory gear markings for all fixed gear fisheries in eastern Canada. Transport Canada's measures currently include, but are not limited to, a variety of mandatory (static and dynamic) and voluntary vessel speed restriction zones in the Gulf of St. Lawrence between April and November for most vessels greater than 13 meters (43 feet) in length. Canada has continued to modify their mitigation measures annually in response to interactions and information on right whale distribution and movements. However, entanglement and vessel strikes continue to be a threat to right whales in Canadian waters within and possibly beyond the areas under management. It is also not possible currently to quantify the level of reduction in M/SI that is achieved through existing Canadian management measures. It is important that evaluation of the effectiveness of Canadian's measures must be accomplished in the near future in order to fully assess the impacts of the measures on the overall survival and recovery of right whales.

Conclusion

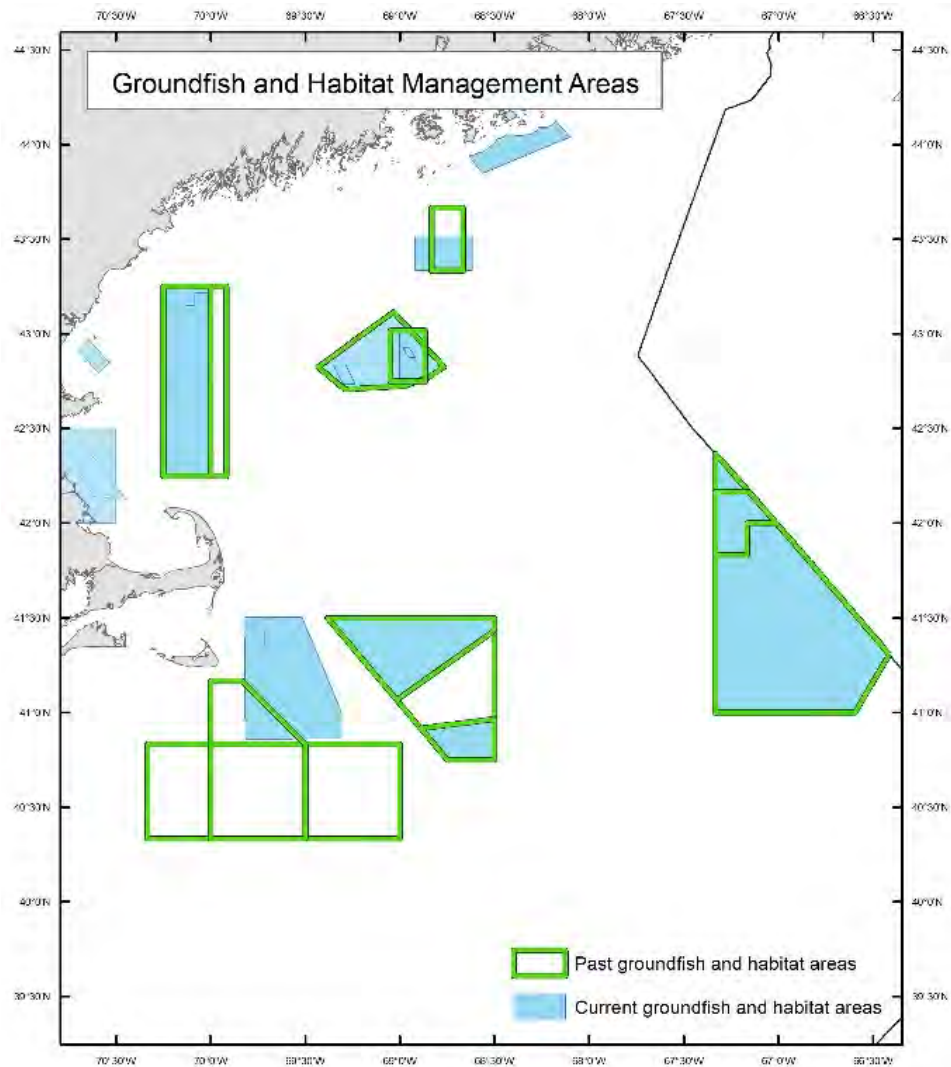
Significant efforts to recover North Atlantic right whales are currently underway and planned throughout the species' range. This Conservation Framework provides an additional commitment by NMFS GARFO to further efforts in federal waters to reduce mortalities and serious injuries due to entanglement in the fisheries managed by GARFO. Protecting and conserving this critically endangered species is especially important given the reduced rate of calving, the rapid decline in the population, and the evidence of a continued high rate of mortality. To ensure the species' recovery, the United States and Canada must introduce additional efforts to reduce right whale mortalities and serious injuries. NMFS remains committed to recovering right whales and is continuing to work to reduce mortalities and serious injuries.

⁷⁹ It is likely that the MMPA Import Provisions will be increasingly important, as environmental changes are likely to continue to shift lobster and right whale distribution into Canadian waters.

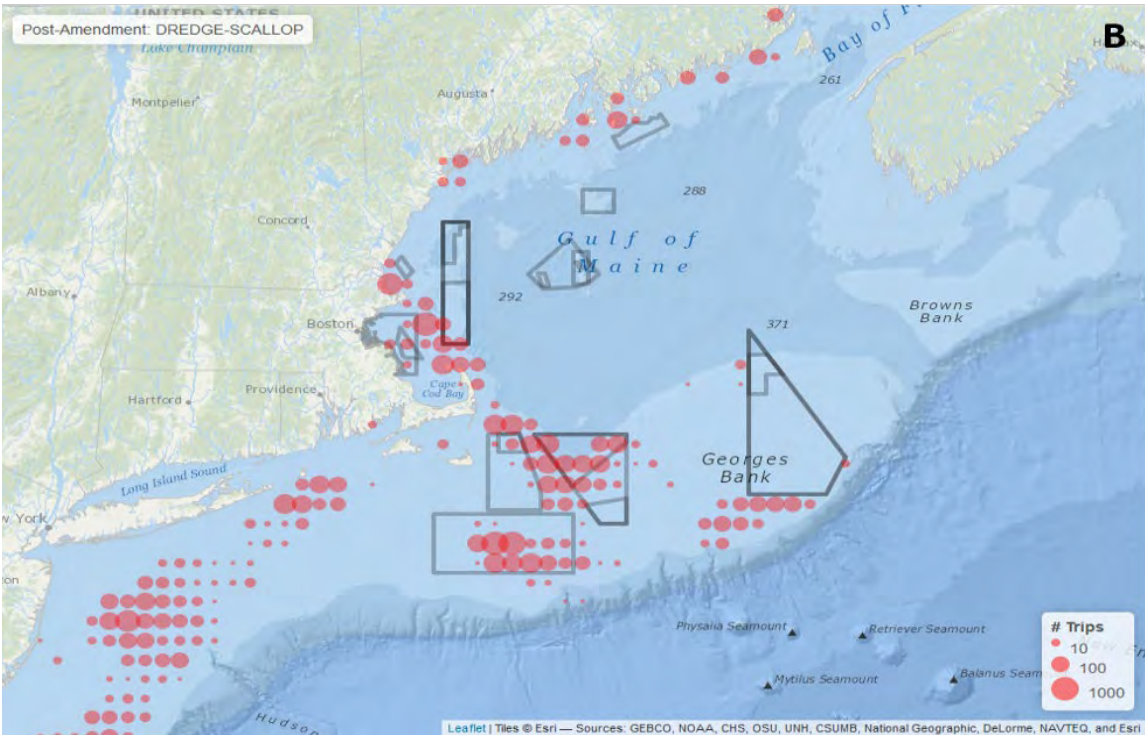
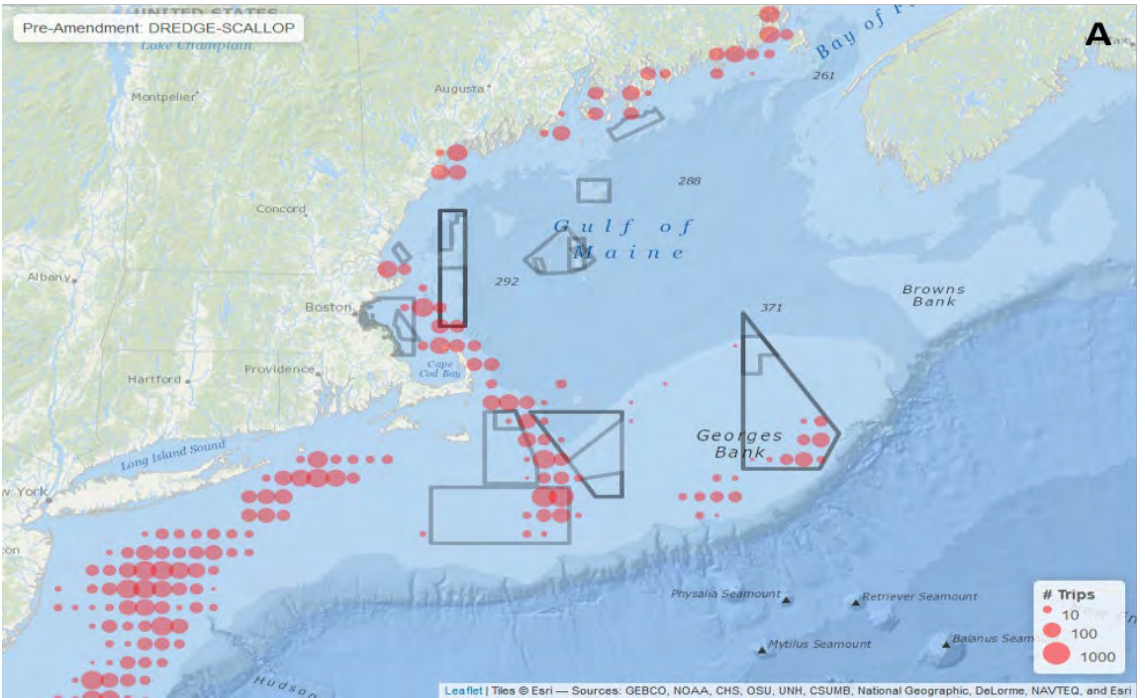
14. APPENDIX B: SCALLOP DREDGE, HYDRAULIC CLAM DREDGE, BOTTOM TRAWL, SINK GILLNET, BOTTOM LONGLINE, MID-WATER TRAWL, AND PURSE SEINE VTR DATA PRE-AND POST- HABITAT OMNIBUS AMENDMENT.

Maps of scallop dredge, hydraulic clam dredge, bottom trawl, sink gillnet, bottom longline, mid-water trawl, and purse seine VTR data Pre-and Post- Habitat Omnibus Amendment. Figure A=Pre-Amendment (September 1, 2016-March 31, 2018) and Figure B=Post Amendment (April 1, 2018-October 31, 2019). VTR data and maps were provided by GARFOs APSD. Refer to the *Reference Map* to identify areas delineated as groundfish and Habitat closures pre-and post-Amendment. Each map by gear type includes all pre- and post-Amendment areas.

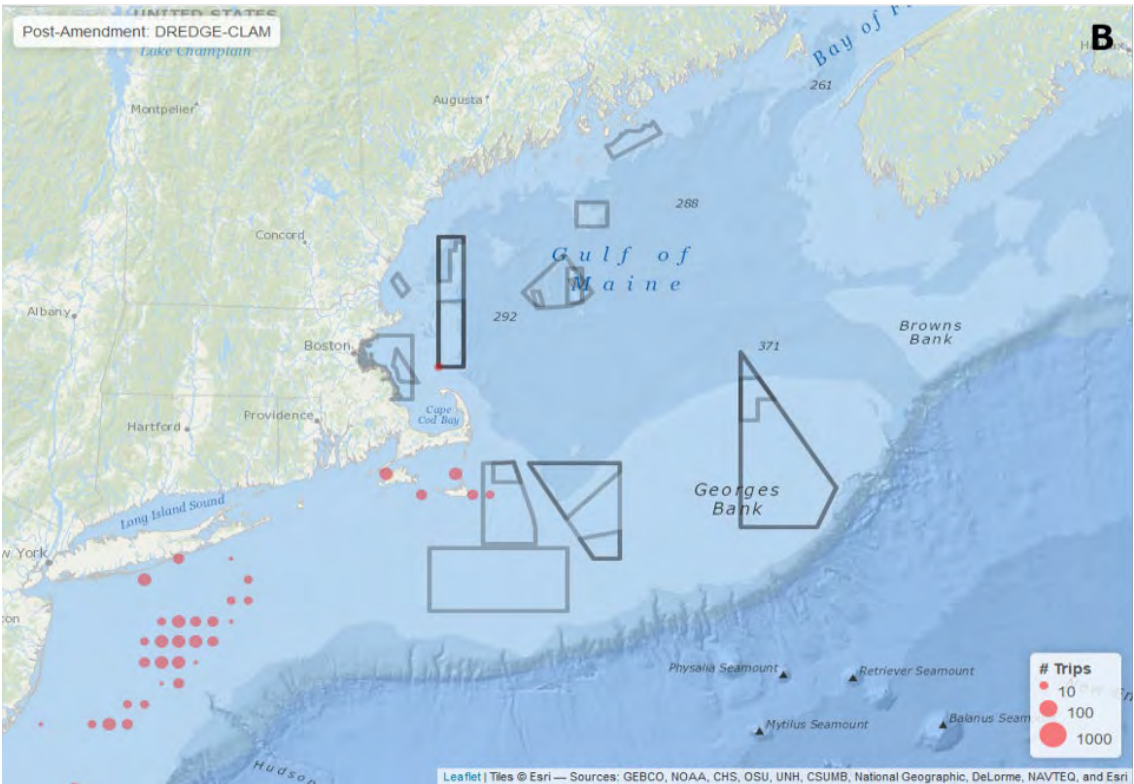
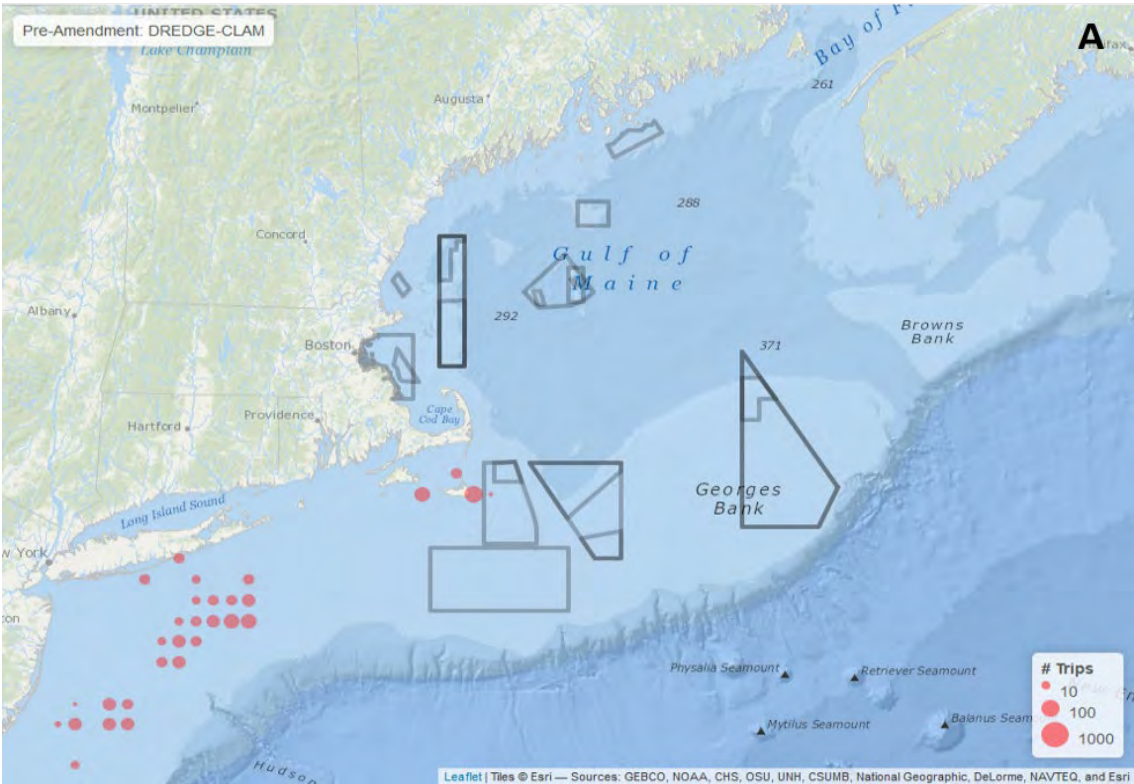
Reference Map: Habitat and Groundfish Closure Areas Pre- and Post- Habitat Amendment



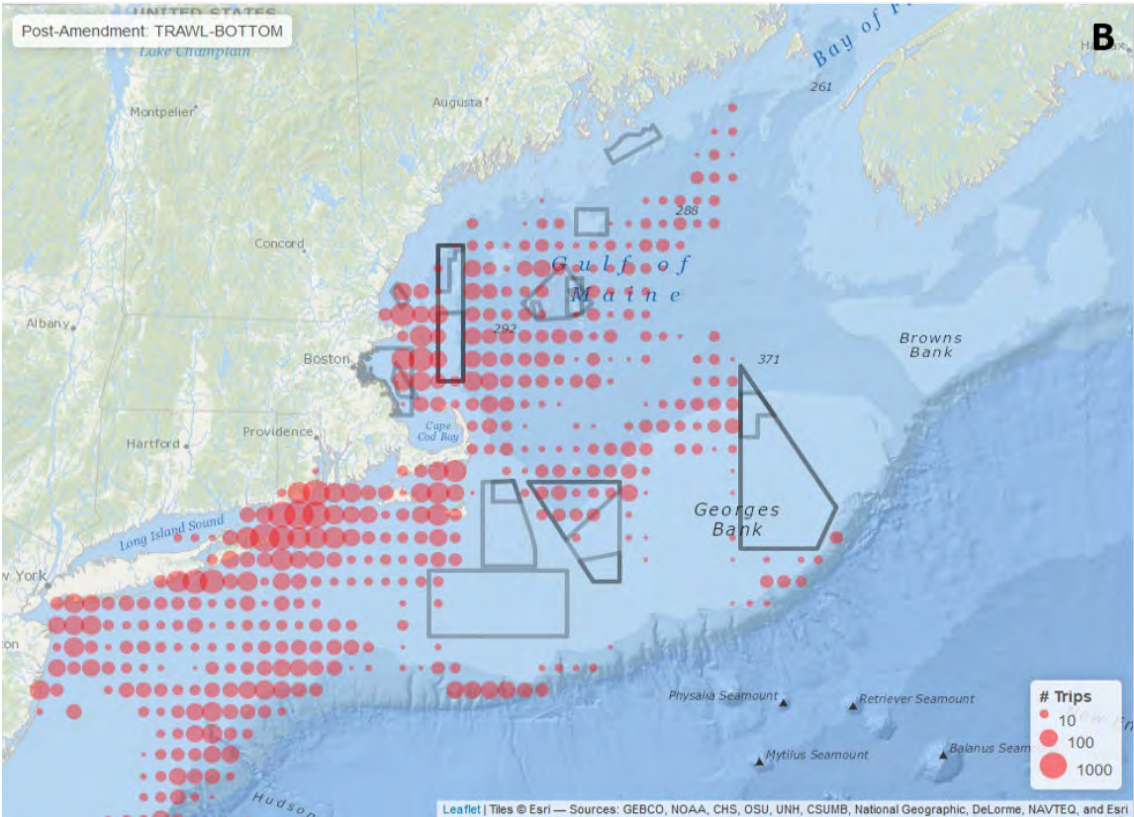
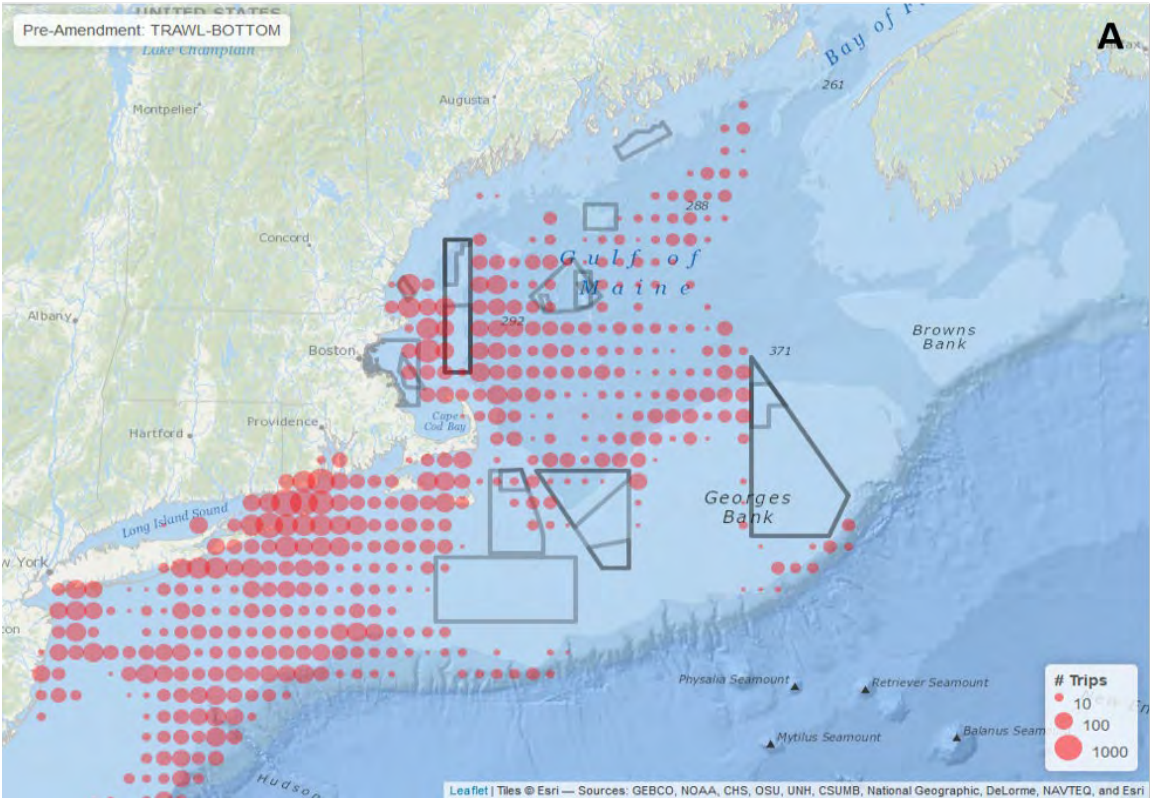
Scallop Dredge



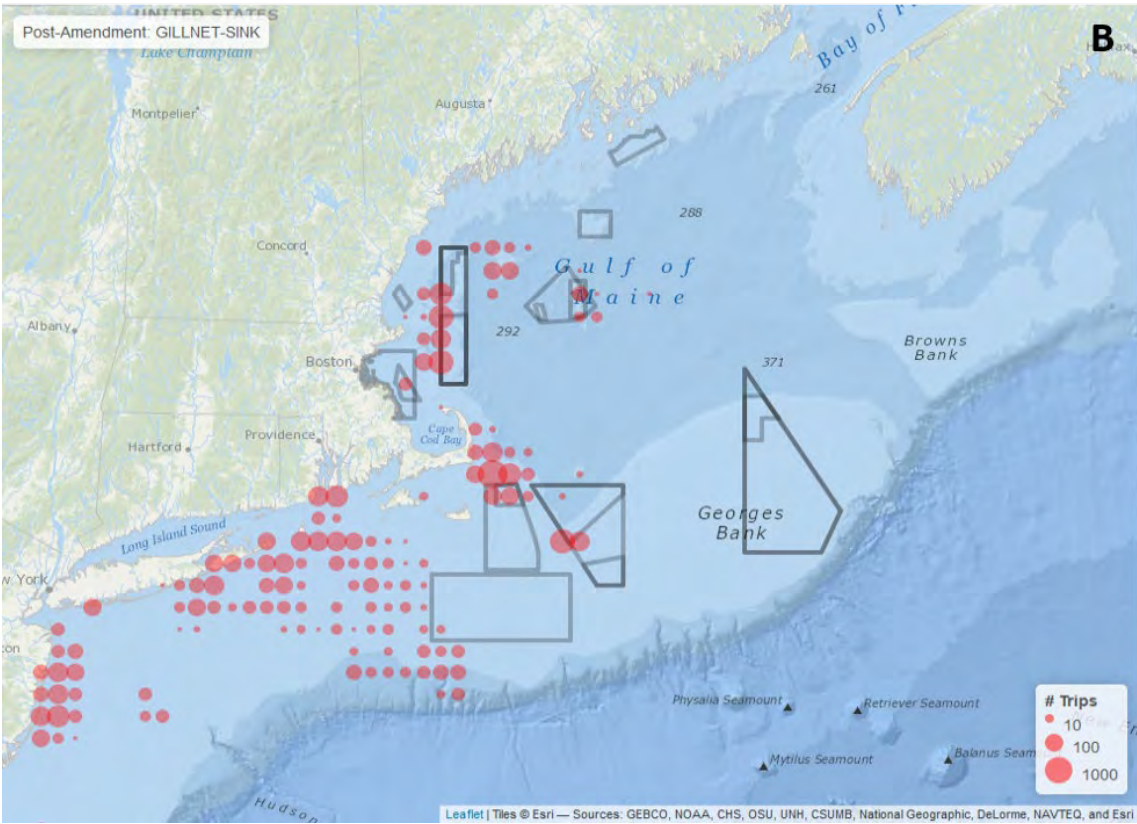
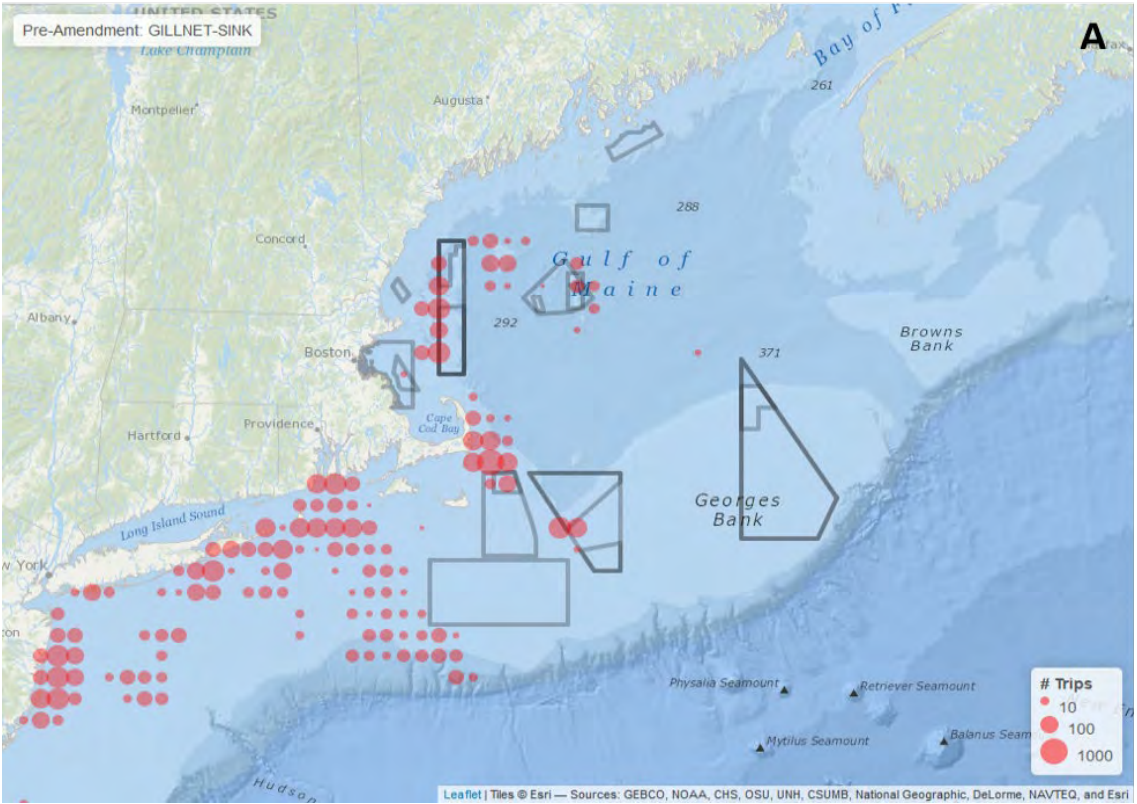
Hydraulic Clam Dredge



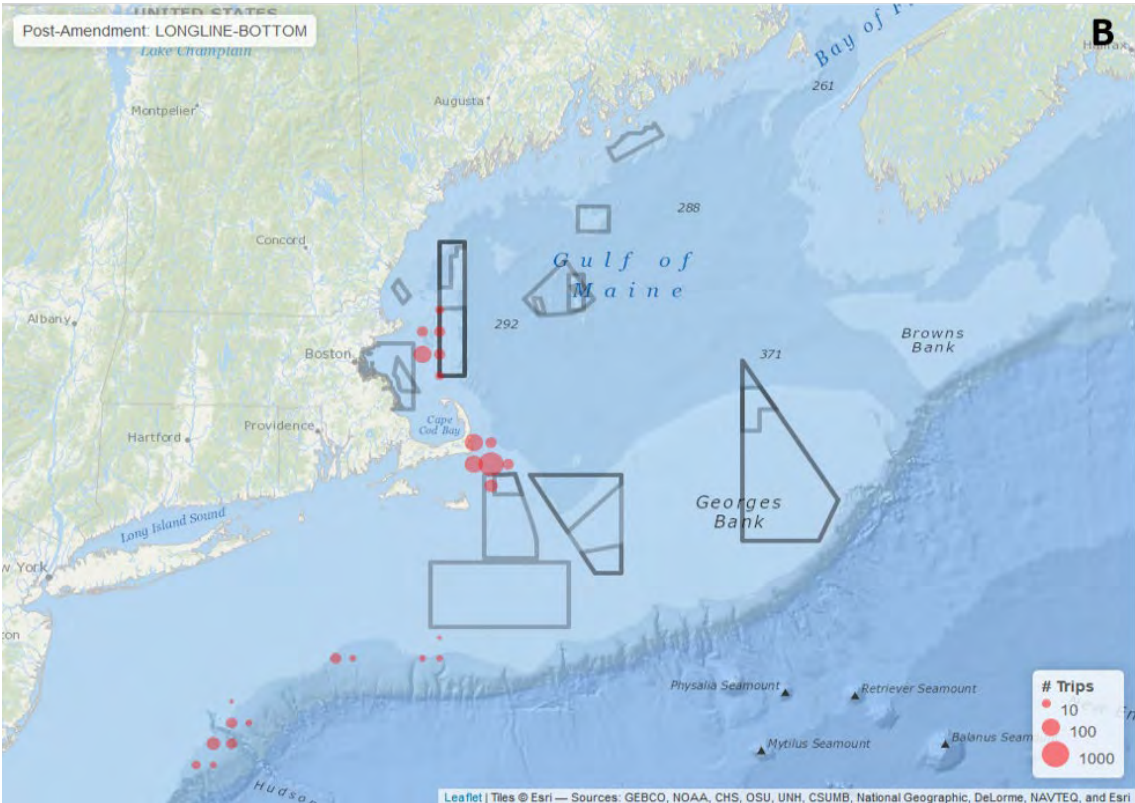
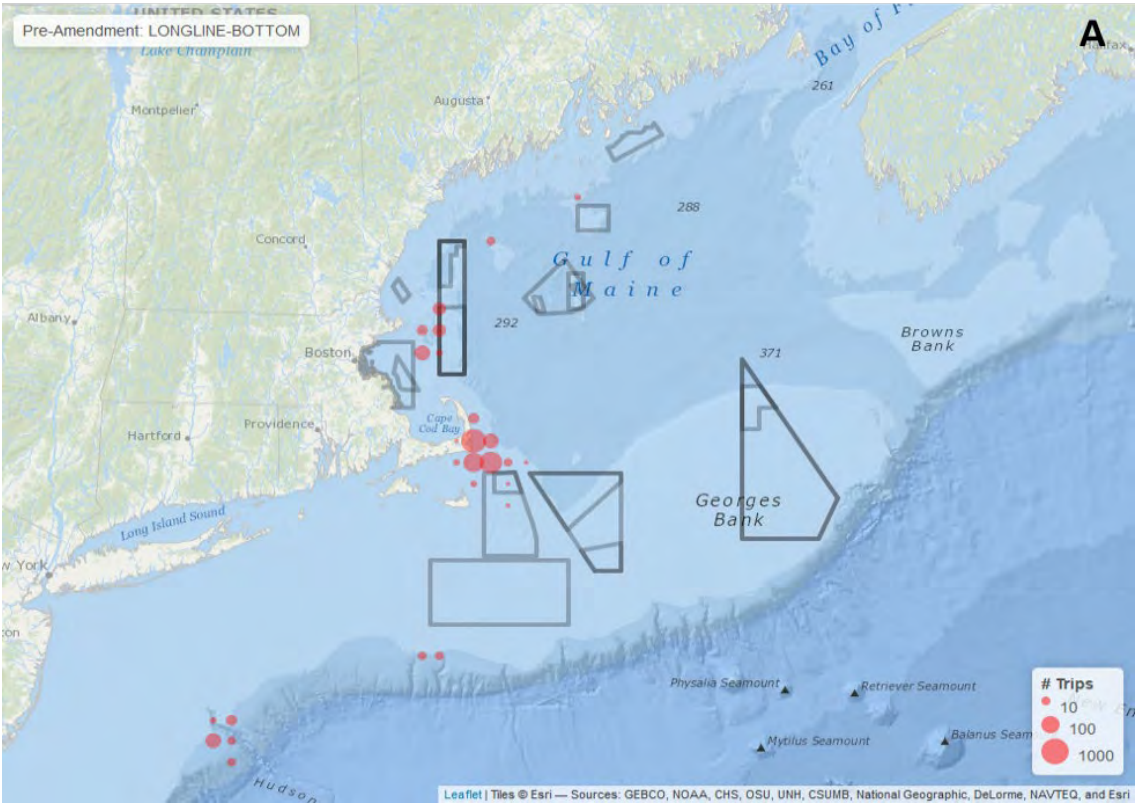
Bottom Trawl



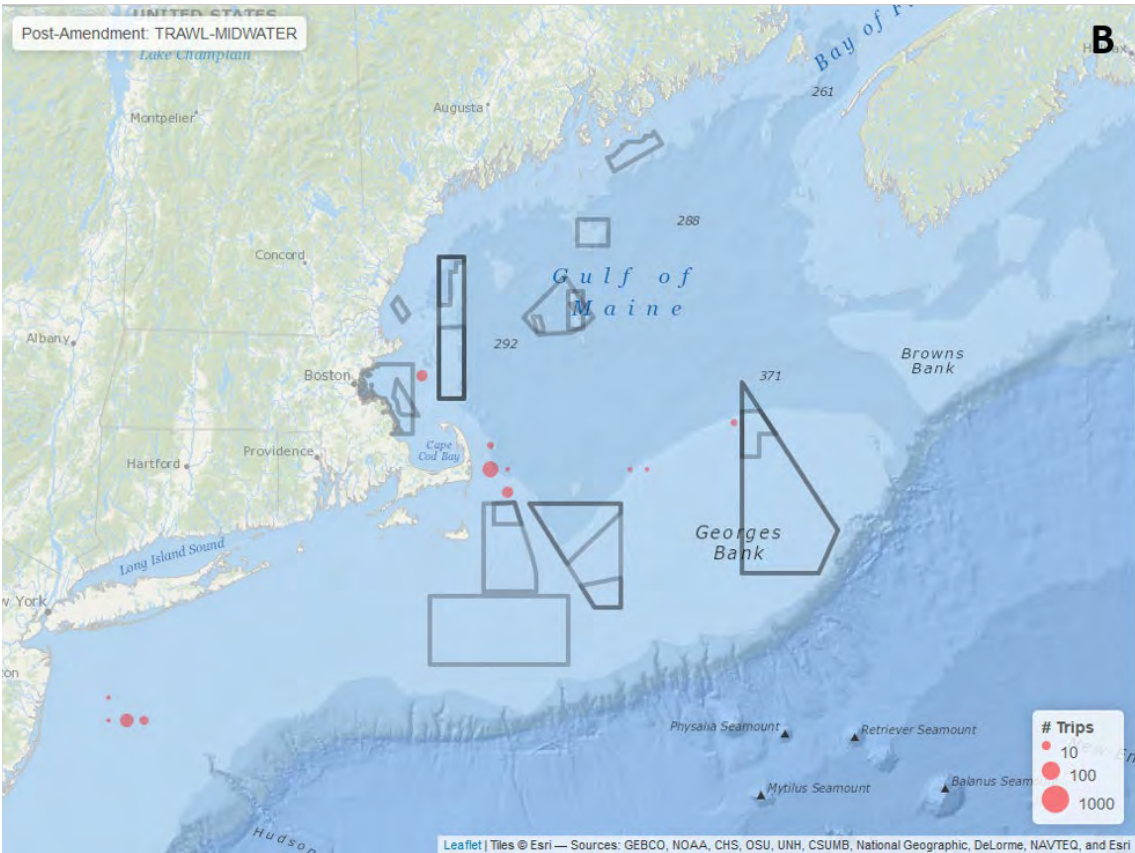
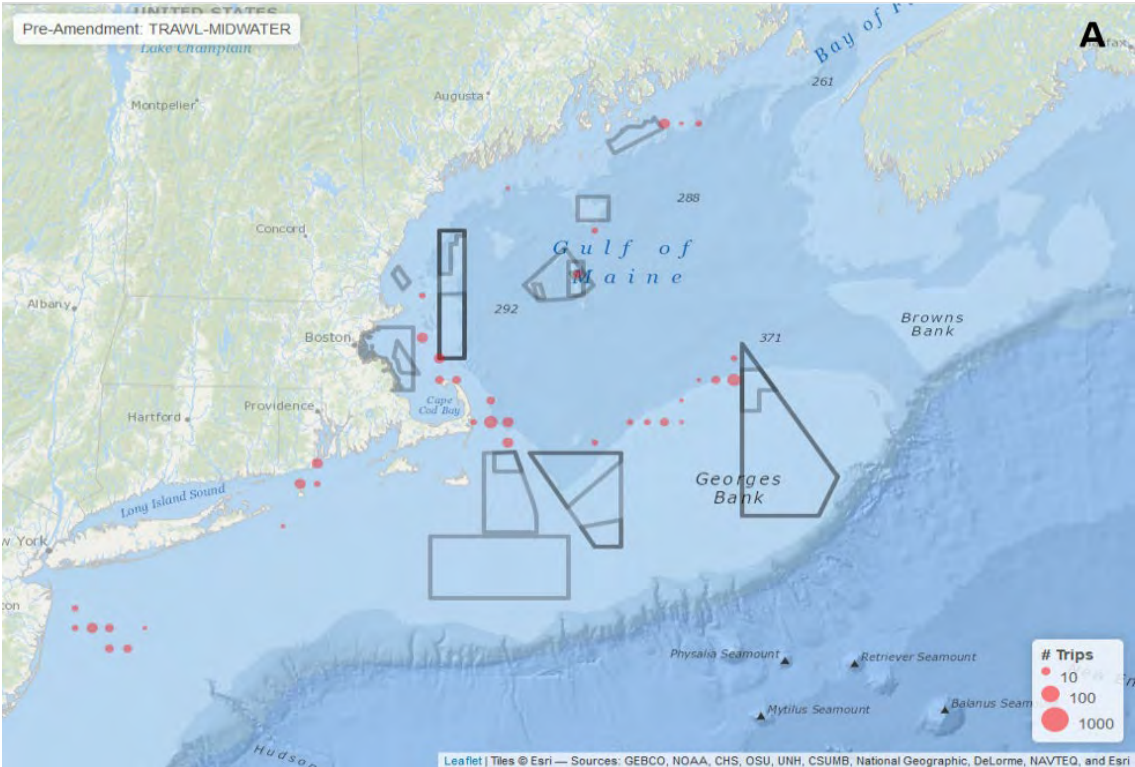
Sink Gillnet



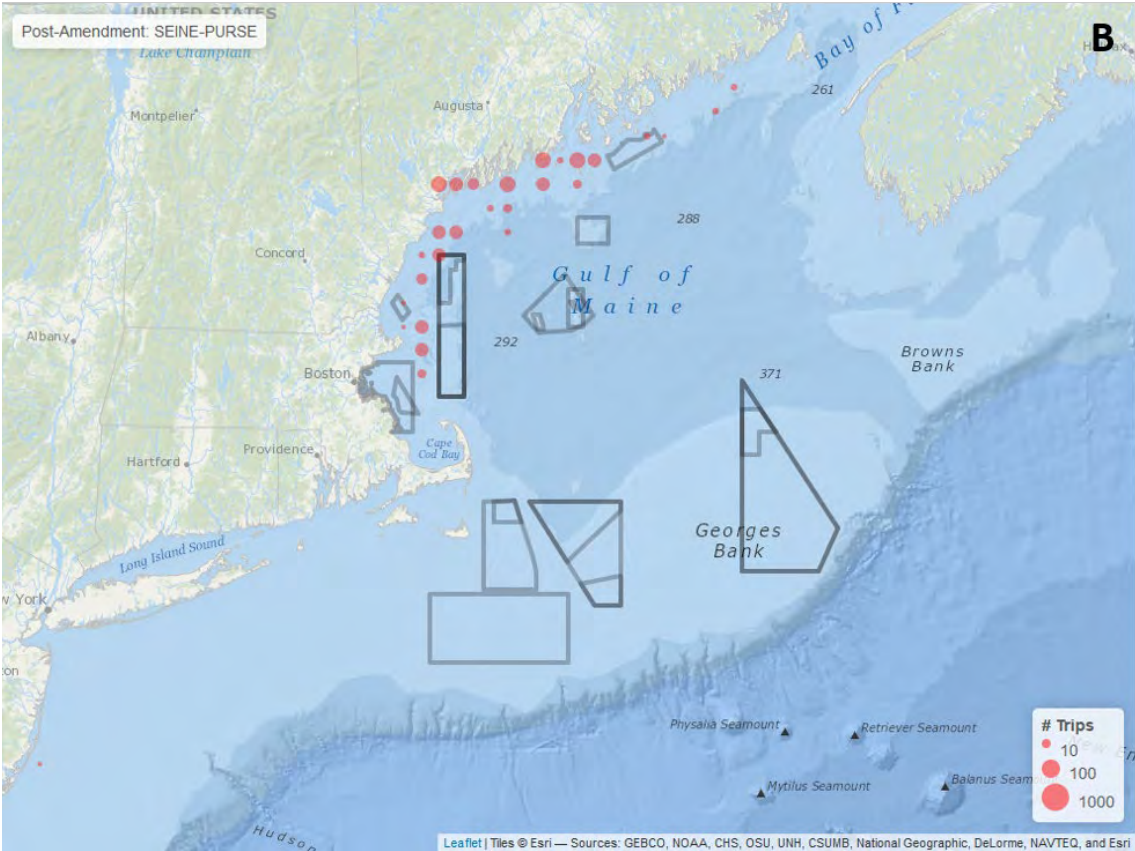
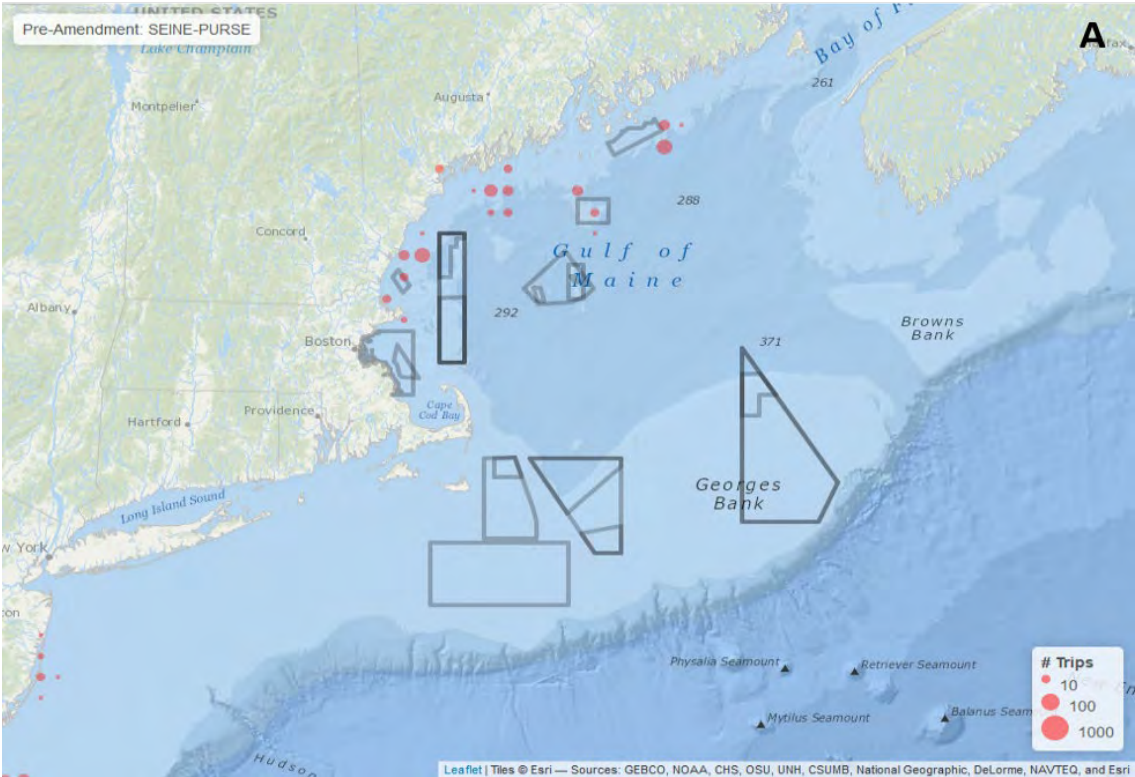
Bottom Longline



Mid-Water Trawl



Purse Seine



**15. APPENDIX C: POPULATION PROJECTIONS OF NORTH ATLANTIC RIGHT
WHALES UNDER VARYING HUMAN-CAUSED MORTALITY RISK AND
FUTURE UNCERTAINTY**

Population projections of North Atlantic right whales under varying human-caused mortality risk and future uncertainty

Daniel W. Linden, NOAA/NMFS/GARFO

6 January 2021

Summary: The population decline of North Atlantic right whales (NARW) over the past decade has been due to high rates of human-caused mortality and low rates of reproduction. We used population projection models to explore how current demographic rates are limiting NARW recovery and whether reductions in human-caused mortality could mitigate a continued population decline into the future. We found that even a 100% reduction in risk from entanglement in the U.S. pot/trap fishery is not likely to prevent future declines given the current low rates of reproduction. A 50% total reduction in human-caused mortality across both the United States and Canada resulted in a positive trajectory on average, requiring ~ 7 fewer NARW mortalities per year to achieve. Despite extensive monitoring, there remain key uncertainties regarding NARW population dynamics that may hinder conservation efforts.

Introduction

The North Atlantic right whale (*Eubaleana glacialis*; NARW) is listed as endangered under the Endangered Species Act and its recovery appears to be limited by human-caused mortality (Corkeron et al. 2018). Additional pressures on the population include environmental changes in prey availability and the resulting effects on calving rates (Meyer-Gutbrod and Greene 2018; Sorocean et al. 2019), which when combined with the high mortality rates have led to a declining population size since 2010 (Pace, Corkeron, and Kraus 2017). Human causes of right whale mortality in the United States and Canada include entanglement in fishing gear (e.g., vertical lines from pots and traps) and vessel strike. Here, we used population projection models (Caswell 2001) to illustrate how human-caused mortality and uncertainty in reproduction lead to varying predictions about the long-term persistence of NARW.

Population projection models (or matrix population models) use information on the demographic parameters of a population (e.g., survival and reproduction) to forecast changes in population size and provide insights on future population growth (Caswell 2001). The application of population projections to NARW served as a motivating example for this modeling framework (Fujiwara and Caswell 2001), and two recent examples of NARW population projection models have relied on updated sightings data to provide contemporary context (Corkeron et al. 2018; Meyer-Gutbrod and Greene 2018). The components of a population projection include: 1) an age- or stage-structured population model (Fig. 1, as used in Corkeron et al. (2018)) that maps how individuals move between classes (ages or

stages) over time; 2) the estimated rates of such movement between classes according to empirical data or hypothetical scenarios; and 3) the initial number of individuals in each class, from which a projection propagates.

Corkeron et al. (2018) approximated the growth potential of NARW in comparison to several populations of southern right whale (*Eubalaena australis*), with the goal of determining whether intrinsic factors or human-caused impacts were constraining the NARW population. Corkeron et al. (2018) used the highest estimated NARW survival probability (for adult females) and an optimal calving rate for their projection, with the initial number of individuals based on a total estimate from 1990 spread among classes (calves, juveniles, adults) according to a stable age distribution. Their projection model was applied in a retrospective manner by simulating the outcomes that may have occurred under optimal conditions for NARW population growth from 1990 to 2015. In contrast, Meyer-Gutbrod and Greene (2018) used estimates from their own fitting of a capture-recapture model to NARW sightings data (1980–2012) for their projections, with a slightly different stage-structured model (depicting deaths and reproductive states explicitly) and initial numbers based on the population estimates from 2012. Their analysis also included a comparison of calving rates during three periods (1980s, 1990s, 2000s) to quantify environmental uncertainty and the addition of increasing adult female NARW mortalities to understand human-caused risks (Meyer-Gutbrod and Greene 2018). In each of these recent examples, the NARW demographic parameters were chosen to represent either current understanding of the population or hypothetical changes to the environment (e.g., resources, risk) to examine the resulting population trajectories.

Important environmental changes within critical NARW habitat have occurred since the time period used for the Meyer-Gutbrod and Greene (2018) projections (Record et al. 2019). In 2010, there was a regime shift in seasonal sea surface temperature in the Gulf of Maine and Georges Bank, followed in 2012 by a shift in the Gulf of Maine zooplankton community (Morse et al. 2017). Changes in zooplankton productivity may be a critical pathway for climate to impact higher trophic levels of the Northeast continental shelf (Morse et al. 2017). The regime shift in 2010 coincided with a noticeable shift in NARW distribution and habitat use (Davis et al. 2017), and a trending decline in population size (Pace, Corkeron, and Kraus 2017). Climate-driven changes in the Gulf of Maine have shifted the seasonal patterns for essential NARW prey (*Calanus finmarchicus*), which likely caused NARW to shift their distribution in search of adequate prey availability (Davis et al. 2017; Morse et al. 2017; Record et al. 2019). There is no information available to suggest when a shift in the zooplankton community may occur again.

We built population projections using the most recent NARW sightings data (2010–2018), encapsulating the post-2010 ecological conditions that coincide with recent population declines. We projected the population forward under our current state of knowledge regarding NARW demographic parameters, along with several risk-reduction scenarios that reduced adult mortality through hypothetical mitigation measures (e.g., restricted fishing effort). Our projections indicate that recent low rates of calving and high rates of human-caused mortality will inhibit NARW population persistence in the absence of mitigation.

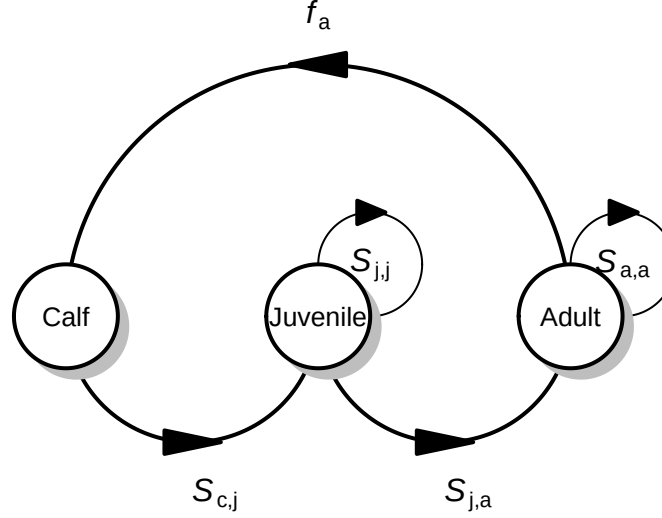


Figure 1: Simple stage-structured demographic model of female North Atlantic right whales, as used in Corkeron et al. 2018.

Methods

Stage-structured population model

Following Corkeron et al. (2018), we used a simple stage-structured population model (Fig. 1) with 3 stages (calf, juvenile, adult) and a focus on females. We assume individual females move between or stay within stages across time as defined by survival transition rates (S), and new individuals (calves) arise according to the fertility rate (f_a) of adults. The survival transitions include a single-year survival probability for a given stage and a stage duration dictating how many years an individual must survive in a given stage before maturing into the next stage. The transition rates are calculated by combining survival probabilities and stage durations using some algebra (Crouse, Crowder, and Caswell 1987). We used stage durations of 1 year for calves and 4 years for juveniles (to accommodate age classes in Pace, Corkeron, and Kraus (2017)), and we assumed a maximum longevity of 69 years for adults (Kraus and Rolland 2007).

The stage-structured population model is translated into a projection matrix by summing a matrix $\mathbf{T}$ of transitions and a matrix $\mathbf{F}$ of fertilities ($\mathbf{A} = \mathbf{T} + \mathbf{F}$), with each resulting matrix element quantifying how the individuals in a given stage (represented by rows) are converted into individuals of the same or different stage (represented by columns) (Caswell 2001). The matrix algebra is then, $\mathbf{n}_{t+1} = \mathbf{A}\mathbf{n}_t$, where $\mathbf{n}_t$ is the vector of individuals within each stage at time t , which converts to the vector of individuals at time $t + 1$ according to the projection matrix $\mathbf{A}$. Here, our projection matrix was as follows:

$$\mathbf{A} = \begin{bmatrix} 0 & 0 & f_a \\ S_{c,j} & S_{j,j} & 0 \\ 0 & S_{j,a} & S_{a,a} \end{bmatrix}$$

Demographic parameter estimates

We used the NARW sightings data collected during 1990–2018 to fit the Pace, Corkeron, and Kraus (2017) state-space mark-recapture model and generate posterior distributions for stage-based population sizes. Sightings data are collected by a large-scale research collaboration known as the North Atlantic Right Whale Consortium (<https://www.narwc.org/>) which maintains an extensive photograph catalog (Hamilton, Knowlton, and Marx 2007). Our approach to fitting the state-space model was fully described in Pace, Corkeron, and Kraus (2017) and is not repeated here. Survival probabilities varied as a fixed effect by sex and age, and randomly by year, while capture probabilities varied by sex and randomly by year and individual. One significant change from Pace, Corkeron, and Kraus (2017) was the addition of a “post-2010” difference in average survival probability that is currently incorporated into the stock assessment (*Richard Pace, NMFS, personal communication*).

The state-space model was fit using Markov chain Monte Carlo (MCMC) methods, allowing the full posterior distributions of any structural or derived parameters to be extracted. The main parameter estimates of interest were the female population sizes for each of 6 age classes (0, 1, 2, 3, 4, 5+), assuming calves = 0, juveniles = 1–4, and adults = 5+. We also extracted the posterior distributions for total female deaths by age class, allowing for a calculation of realized survival as follows:

$$S_t^k = 1 - (D_{t+1}^k / N_t^k)$$

Here, the realized survival S_t^k for age class k in year t was the inverse of the mortality rate, the ratio of dead individuals D_{t+1}^k in year $t + 1$ to live individuals N_t^k in year t . The age class of an individual’s last year alive was the age class to which its death was attributed. The state-space model easily generates posterior estimates for expected survival, specified as ϕ in Pace, Corkeron, and Kraus (2017), without the need for derived calculations of live and dead individuals. These estimates of expected survival were used for calves and juveniles due to small sample sizes. The derived calculations of realized survival were used for adult females to enable manual manipulation of deaths for scenario projections (*see Risk reduction scenarios*).

The fertility rates, or calving rates, were calculated using the ratio of observed calf counts to the estimated population size $N_t^{k=5+}$ of adult (age = 5+) females in a given year t . The extensive survey efforts on the breeding grounds allow for the assumption that observed calf counts are essentially a census of NARW calf production (Kraus and Rolland 2007). Since our population projections were focused on females, we also assumed that half of calves were female, reducing the effective fertility rates by 50%.

The demographic parameters for our projections were based on the state-space model estimates for the 2010–2018 time period. Thus, while the full time series was used to fit the model, the post-2010 parameter estimates were considered most representative of current conditions and used in the population projections. While Pace, Corkeron, and Kraus (2017) indicated little annual variation in NARW survival probability with no apparent trend, the fertility rates have undergone large fluctuations on near-decadal time steps (Meyer-Gutbrod and

Greene 2018). We assessed the influence of using a larger time series (1990–2018) to quantify uncertainty in fertility rates (Supplement 4).

Risk reduction scenarios

The U.S. Atlantic Large Whale Take Reduction Team has recommended mitigation measures for northeast U.S. pot/trap fisheries aimed at reducing NARW mortalities. To examine the outcome of hypothetical mitigation measures, we constructed scenarios that modified the survival probability estimates. We defined two types of mitigation: 1) reduction in mortality due to entanglement in U.S. pot/trap fisheries; and 2) reduction in mortality due to any human-related causes in Canada. Our first set of scenarios considered mitigation due to #1 while the second set considered mitigation due to both #1 and #2. We did not consider cause of mortality in Canada due to insufficient information on whale deaths and uncertainty regarding potential mitigation measures.

We calculated the modified survival estimates by partitioning total mortalities to the United States and Canada, and then quantified U.S. mortalities that were presumed to be pot/trap gear entanglement. The information documented for some observed NARW mortalities contained useful evidence that allowed attribution to a country, and further attribution to a specific cause (e.g., gear entanglement), but some observed mortalities were of unknown cause and origin. In addition, depending on year, the total estimated mortalities could contain a large number of unobserved (or “cryptic”) mortalities. We relied on determinations by the Northeast Fisheries Science Center (NEFSC) and the Greater Atlantic Regional Fisheries Office (GARFO) to attribute country of origin and specific causes for those mortalities without observations. Mortalities with unknown origin were split 1:1 between the countries¹, while 80% of U.S. mortalities with unknown cause, observed or unobserved, were attributed to pot/trap gear entanglement (based on observed ratios²). The total estimated human-caused mortalities for 2010–2018 were therefore assumed to be 75 in Canada and 50 for pot/trap gear in the United States³. Note, the cryptic mortalities were calculated as the difference between the median estimate of total deaths (from the state-space model) and the count of observed mortalities.

For each set of scenarios, the total adult female deaths $D_{2010-2018}^{k=5+}$ were reduced by some percentage (0 to 100%) to reflect different magnitudes of mitigation, either by the United States or both countries (Table 1). We assumed that a given scenario reduced mortalities equally for males and females so mortality reductions were halved to be female specific. Once the total count of “saved females” was calculated for a scenario, the count was distributed at random across the 9 years according to a multinomial distribution, with probabilities determined by the relative number of adult female deaths in each year. For each iteration

¹While the population spends more time in U.S. waters, this split in risk is supported by analysis of recovered entangling gear. The gear causing entanglement in Canada has also been found to be more lethal.

²During 2010–2018 there were ~12 serious injury/mortality (SI/M) events confirmed to be vessel strikes and 47 SI/M confirmed to be entanglement in the United States.

³Other human-caused mortalities in the United States were estimated to be ~14.6 SI/M for vessel strikes and 1.25 SI/M for non-pot/trap gear. These estimates include confirmed and presumed counts, with fractions reflecting how serious injuries are scored by the agency.

Table 1: Mortality reduction scenarios explored in the NARW population projections. The mortalities listed represent the total losses due to pot/trap gear entanglement in the U.S. and all human-related causes in Canada after some hypothetical mitigation measures. The 0% reduction represents the current mortality count (i.e., status quo) for the relevant causes during 2010–2018.

Reduction (%)	NARW mortalities (2010–2018)		
	U.S. (pot/trap)	Canada (all)	Total
0	50	75.0	125.0
10	45	67.5	112.5
20	40	60.0	100.0
30	35	52.5	87.5
40	30	45.0	75.0
50	25	37.5	62.5
60	20	30.0	50.0
70	15	22.5	37.5
80	10	15.0	25.0
90	5	7.5	12.5
100	0	0.0	0.0

of the posterior distribution from the state-space model, the random assortment of saved females was subtracted from $D_{2010-2018}^{k=5+}$ and new values for $S_{2010-2018}^{k=5+}$ were calculated. This procedure effectively lowered the mortality rates (or raised the survival rates) across years. For example, if $N_t = 100$ and $D_{t+1} = 10$, a 50% reduction would *on average* reduce D_{t+1} by 5 and result in the survival rate S_t increasing from 0.90 to 0.95. In instances where an equal or greater number of adult females were “saved” than were predicted to have died, given stochasticity in the random multinomial, we set $S_t^{k=5+}$ to 0.9999 to prevent matrix calculation problems. This conservative choice was meant to counteract both the assumption of an even split in mortality reductions between sexes and the restricted application to adults (5+). Note, the mortality reduction scenarios did not reduce the cumulative deaths from 2010–2018, they simply removed mortality events from individual years based on the total deaths in the 9-yr period.

Population projection analysis and simulations

We evaluated our projection framework to ensure a reasonable representation of the system before exploring future projections. First, we ensured that the population projection matrix model was both irreducible and ergodic (Stott et al. 2010), using mean values of the

demographic parameters estimated for 1990–2018. We calculated eigenvalue elasticities (Caswell 2001) to examine how proportional changes in a projection matrix element influenced the asymptotic population growth rate (i.e., the dominant eigenvalue of the projection matrix) over the period. To further illustrate this influence we calculated population growth rates across observed ranges of values for fertility and adult female survival, changing the values of one parameter while altering the other. Finally, as an approximate validation for the projection framework we fit retrospective projections using baseline demographic estimates from 1991–2009 to compare with the actual estimates of population size during that period. We excluded the 2010–2018 period in this validation recognizing that the hypothesized regime shift in 2010 would not be well represented in the absence of an explicit model structure for the change.

We used the `popbio` package (Stubben and Milligan 2007) in R (R Core Team 2019) to simulate population projections with stochasticity, representing uncertainty in future NARW population dynamics. The stochasticity was manifested in two ways: 1) parameter value assignment in a given time step, representing environmental stochasticity, and 2) random number generation (i.e., births and deaths) given the assigned parameter value, representing demographic stochasticity. The median population size and demographic stage distribution for 2010–2018 according to the state-space model estimates was used as a starting population size.

Each projection spanned 50 time steps (years), and we ran 1,000 stochastic projections for a given reduction scenario. The parameter values for the projection matrix at each time step within a simulation were drawn from the available state-space model estimates for 2010–2018. For the survival transition rates, the full posterior distributions of $S_{2010-2018}^k$ were used to draw a single value and calculate the appropriate transition rate for each stage. For the fertility rates, 1 of 9 values was drawn with equal probability from the calving rate estimates for 2010–2018.

We used the 1,000 stochastic projections to calculate a median population trajectory and probability of decline for a given scenario. The latter was simply the proportion of projections that resulted in a decreased population size at 10-year intervals.

Results

State-space model estimates

Our fit of the state-space mark-recapture model to the NARW sightings data from 1990–2018 indicated convergence and matched closely with the 1990–2015 estimates in Pace, Corkeron, and Kraus (2017) (Supplement 1). A closer look at 2010–2018 (Fig. 2) suggests that a decrease in the juvenile age class has been responsible for the overall decline of females reported by Pace, Corkeron, and Kraus (2017). The low fertility rate in recent years (Fig. 3) suggests that decreases in juveniles are likely due to a lack of new calves that would otherwise replace maturing females. The relatively higher estimates of adult female mortalities since 2015 (Fig. 4) matches the decline in expected survival (Fig. 5).

Table 2: Elasticities of asymptotic population growth rate to projection matrix transitions, using mean NARW demographic parameter estimates for females from 1990–2018.

	calf	juv	adult
calf	0.000	0.000	0.037
juv	0.037	0.100	0.000
adult	0.000	0.037	0.788

Population projections

The elasticities of population growth rate in Table 2 indicated that adult female survival had the greatest potential to affect growth rate, according to the mean demographic parameters from 1990–2018 as specified in the projection matrix. The resulting population growth across the ranges and combination of adult female survival and calf rates illustrate how each contributes to positive or negative growth (Fig. 6). Positive growth was apparent before the 2010 regime shift (“A”; Fig. 6), with negative growth after (“B”; Fig. 6).

Stochastic projections of the retrospective time series (1991–2009) indicated that a random sampling of demographic parameter values was adequate to capture the population change over time (Fig. 7). In the absence of explicit knowledge about temporal mechanisms (e.g., annual prey availability), fluctuations of higher (year = 2009) or lower (year = 2000) growth were not reflected by the average trend.

The initial NARW female population size used in the future projections (beyond 2018) was 183, split among calves (4), juveniles (22), and adults (157). Several individual population projections are available for both the U.S. pot/gear reduction scenarios (Supplement 2) and the combined U.S./Canada reduction scenarios (Supplement 3). As an example, the status quo (0% risk reduction) scenario in Fig. S1 indicates a population decline under current rates of survival and fertility.

The average population trajectory for the U.S. pot/gear reduction scenarios indicated a decline for NARW adult females across all scenarios including that under 100% reduction (Fig. 8). Given the large amount of uncertainty across the $n=1000$ projections for any single scenario (see Fig. S1), even with 100% reduction the probability of a decreasing NARW population in 50 years was >0.37 (Fig. 9).

With a combination of risk reductions for U.S. pot/trap gear and all human-related causes in Canada, the average population trajectory for scenarios with $>40\%$ reduction indicated an increasing trend (Fig. 10). The probabilities of a decreasing NARW population in 50 years were <0.04 for all scenarios reducing risk by $\geq 70\%$ (Fig. 11).

Discussion

The growth of any wild population will be limited by either survival or reproduction (or both), and the difficulty for conservation and management is understanding the context of those limitations and how they interact across time and space. Previous population projections of NARW have suggested that human-caused mortality, specifically that of females, is a limiting factor for the species (Corkeron et al. 2018; Meyer-Gutbrod and Greene 2018). The Meyer-Gutbrod and Greene (2018) projections suggested that the NARW population could recover if the demographic rates observed during 1980–2012 continued, though their conclusions had to be tempered by awareness of the unusual mortality event in 2017 that occurred while their study was in the process of being published. Using population estimates from 2010–2018, our projections indicate that current rates of survival and fertility will lead to a further decline in the absence of effective mitigation (Fig. S1).

This analysis demonstrates that both the United States and Canada must implement measures to mitigate total NARW mortalities across their range to achieve a positive population trajectory. Our projections suggest that hypothetical mitigation involving risk reduction in the U.S. pot/trap fishery alone is unlikely to prevent further population declines even with 100% reduction (Fig. 8). With 100% reduction in entanglement mortalities in the United States, the probability that the NARW population still declines in spite of such efforts is relatively high (>50%; Fig. 9). This result indicates that the NARW population is likely to decline if human-caused mortalities in Canada continue at current rates, regardless of efforts in the United States. With combined efforts by both countries to reduce mortality, a positive NARW population trajectory appears to be more achievable (Figs. 10–11).

A major caveat to the conclusions about targeted mitigation measures is the uncertainty in apportioning mortalities due to entanglement (or any cause) to fisheries effort in waters managed by the United States vs. Canada. The 1:1 ratio was considered a “reasonable assumption” based on a collection of evidence that suggests no better strategy to apportionment (*see* CIE reviews⁴). Our projections could test the sensitivity of the apportioning value used here with additional scenarios (e.g., 3:1 or 1:3), though this exercise would simply introduce more uncertainty in the future projections and not change conclusions about the number of “whales saved” that would be necessary to improve population trajectories. A positive average trajectory is possible at 50% total risk reduction (Fig. 10), which translates to 62.5 whales during 2010–2018 (Table 1) or ~7 whales/year saved from a human-caused mortality event. From a population perspective, the source of the mitigation measures is immaterial. For management purposes, this uncertainty could be important and should be a target for improved information.

Similar to Meyer-Gutbrod and Greene (2018), our conclusions regarding one influential demographic parameter are contingent on the dynamics of another. Using calving/fertility rates from 1990–2018, the average population trajectory increases under all scenarios (Supplement 4). Declines in the availability of *Calanus* spp. (the main prey of NARW) since 2010, coincid-

⁴Center for Independent Experts (CIE) peer review reports from December 2019 for the “North Atlantic right whale DST review”: <https://www.st.nmfs.noaa.gov/science-quality-assurance/cie-peer-reviews/cie-review-2019>

ing with a shift to warming ocean temperatures in the Gulf of Maine (Davis et al. 2017; Morse et al. 2017; Record et al. 2019; Sorocean et al. 2019), together suggests that environmental conditions may no longer approach the cycles of prey availability experienced prior to 2010 (Meyer-Gutbrod and Greene 2018). For these reasons, we caution any interpretation of the population projections using the 1990–2018 calving rates given they are unlikely to be representative of fertility rates going forward, though we acknowledge the importance of such uncertainty.

Finally, the population model does not consider the relationship between entanglement injuries and calving probability (Pettis et al. 2017). It is possible that mitigation measures aimed at reducing the risk of entanglement mortality would also reduce sub-lethal entanglements to reproductive adult females that may be partially responsible for suppressed calving rates in recent years. Thus, the scenarios represented here may be underestimating the benefits of risk reduction to the population by focusing only on mortality. More complex individual-based models may be necessary to explore how retrospective patterns of entanglement and reproduction could manifest into the future under various conditions.

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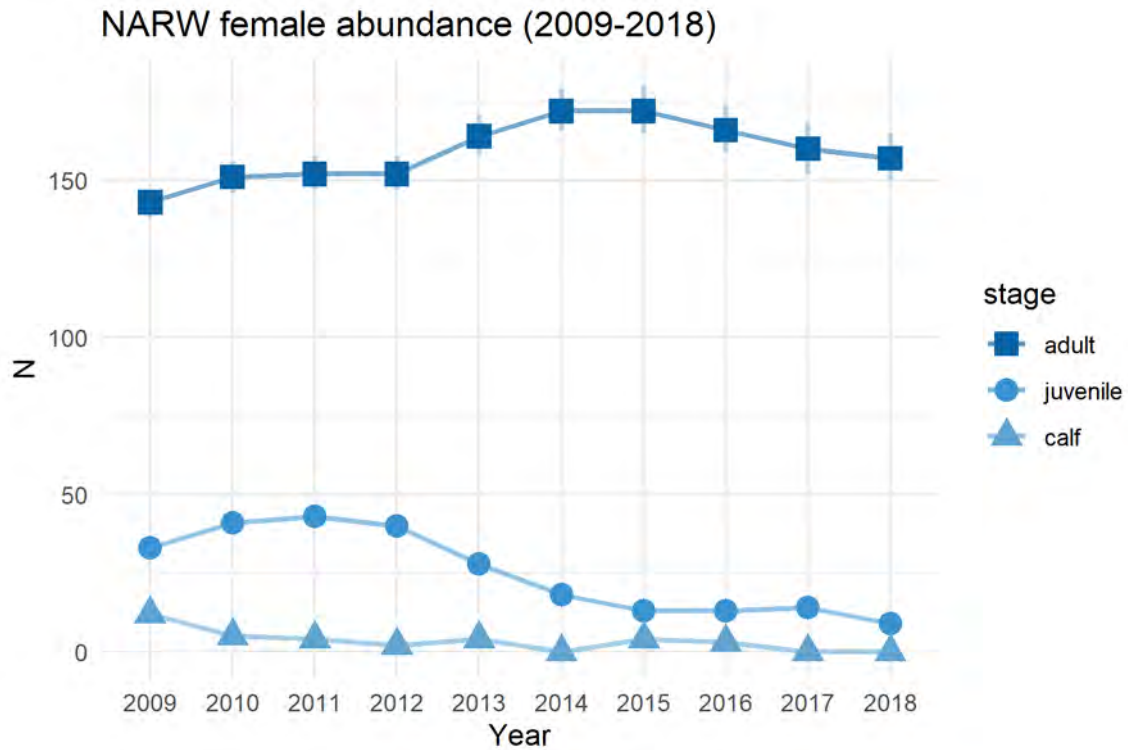


Figure 2: Abundance of NARW females during 2009–2018, as estimated by the state-space mark-recapture model of sightings data. Stages included adult (age = 5+), juvenile (ages = 1–4), and calf (age = 0). Median estimates with 95% credible intervals included. Note that estimates from 2009–2017 were used in calculating realized survival probabilities.

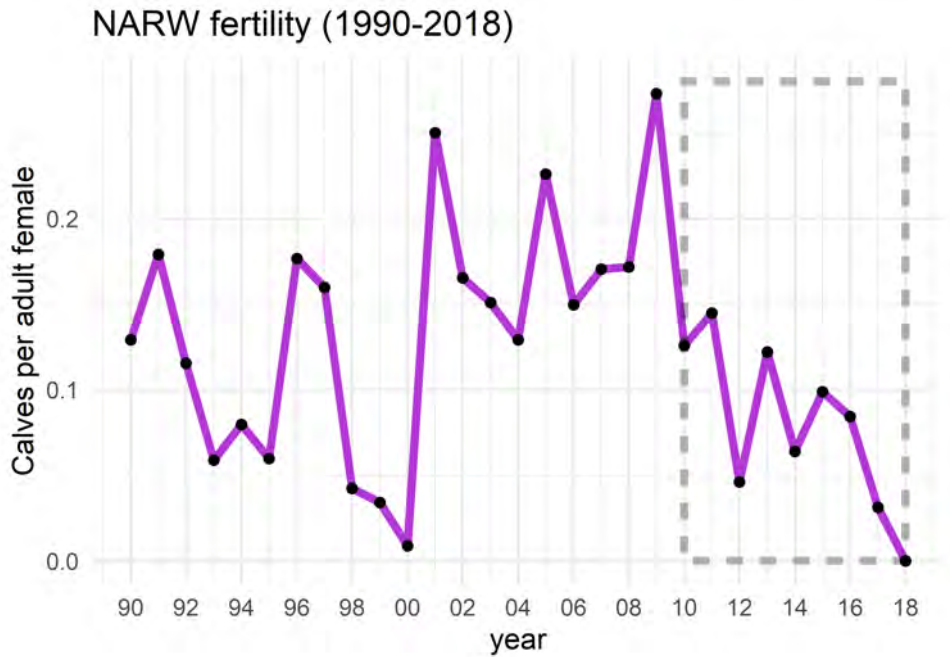


Figure 3: Fertility rate of NARW adult females during 1990–2018. Rates were calculated as the ratio of observed calves to median estimates of adult females (age 5+) from the state-space mark-recapture model. Gray box indicates time period used for main projections.

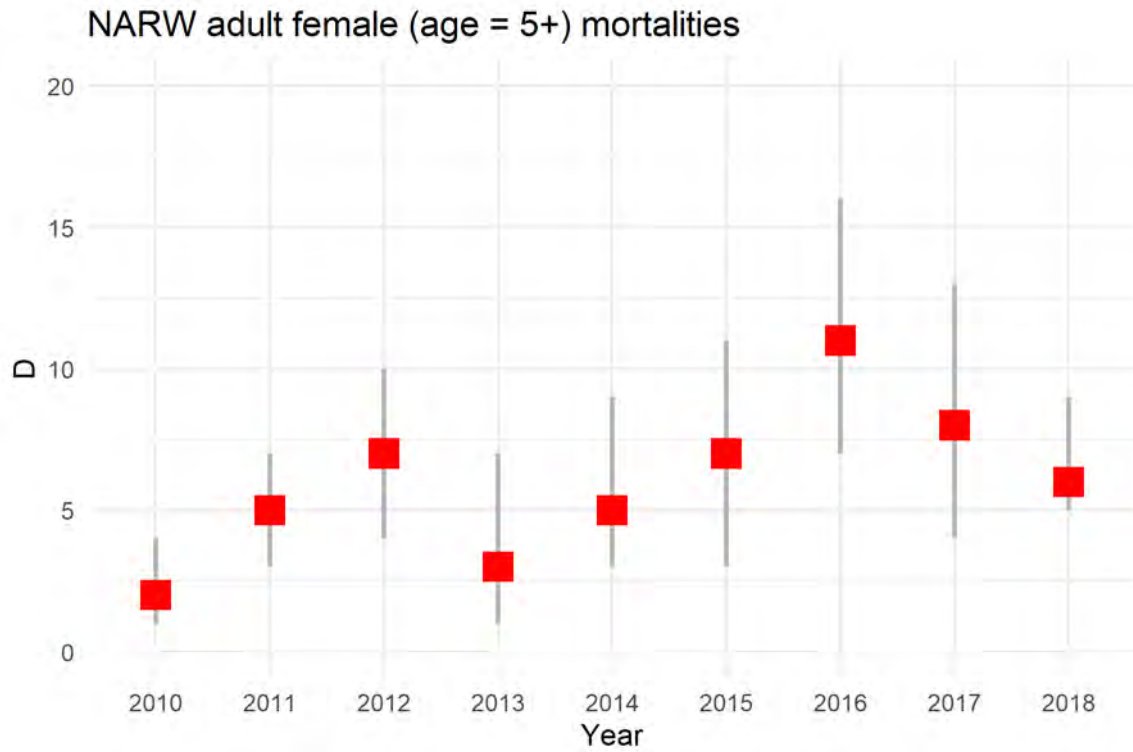


Figure 4: Mortalities of NARW adult females during 2010–2018, as estimated by the state-space mark-recapture model of sightings data. Median estimates with 95% credible intervals included.

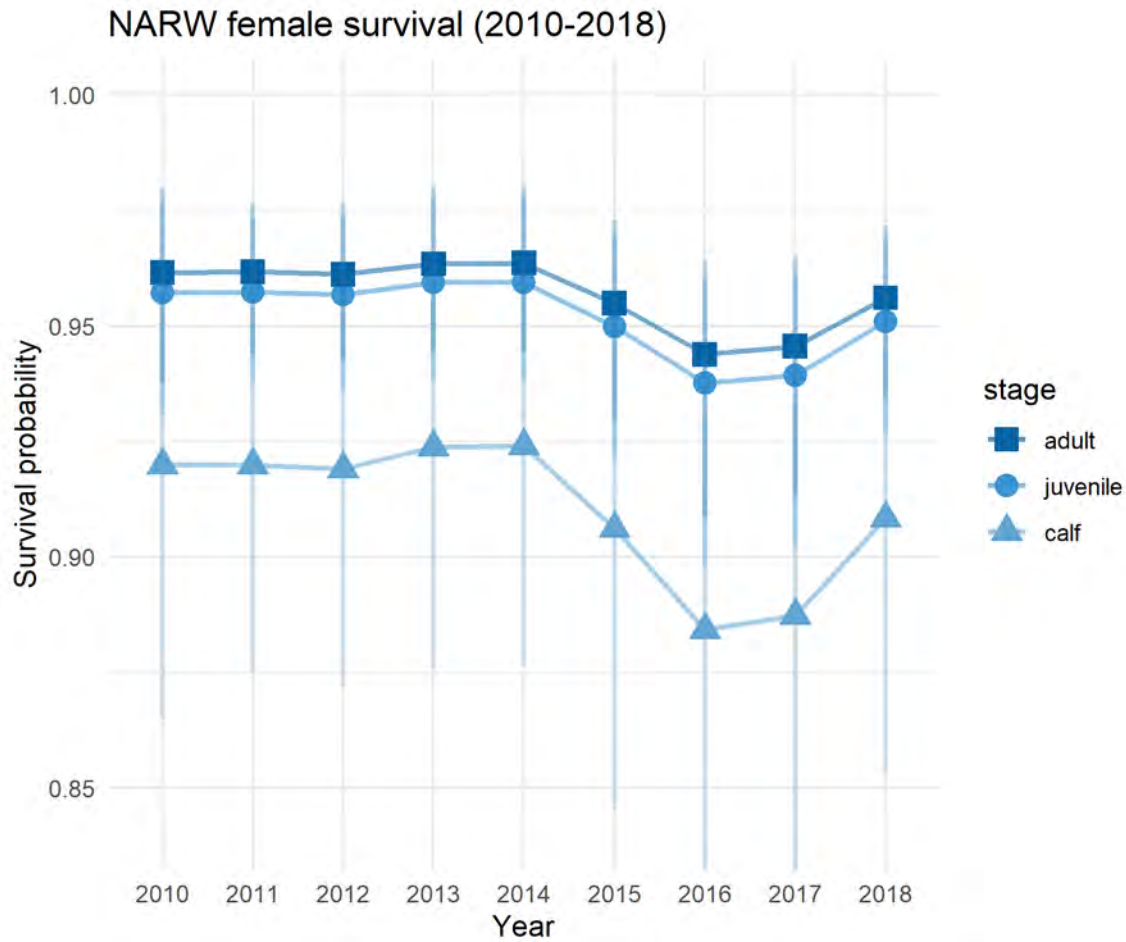


Figure 5: Expected survival probability of NARW adult females during 2010–2018, as estimated by the state-space mark-recapture model of sightings data. Median estimates with 95% credible intervals included. Estimate for a given year (t) represents the probability of surviving from year $t - 1$ to t .

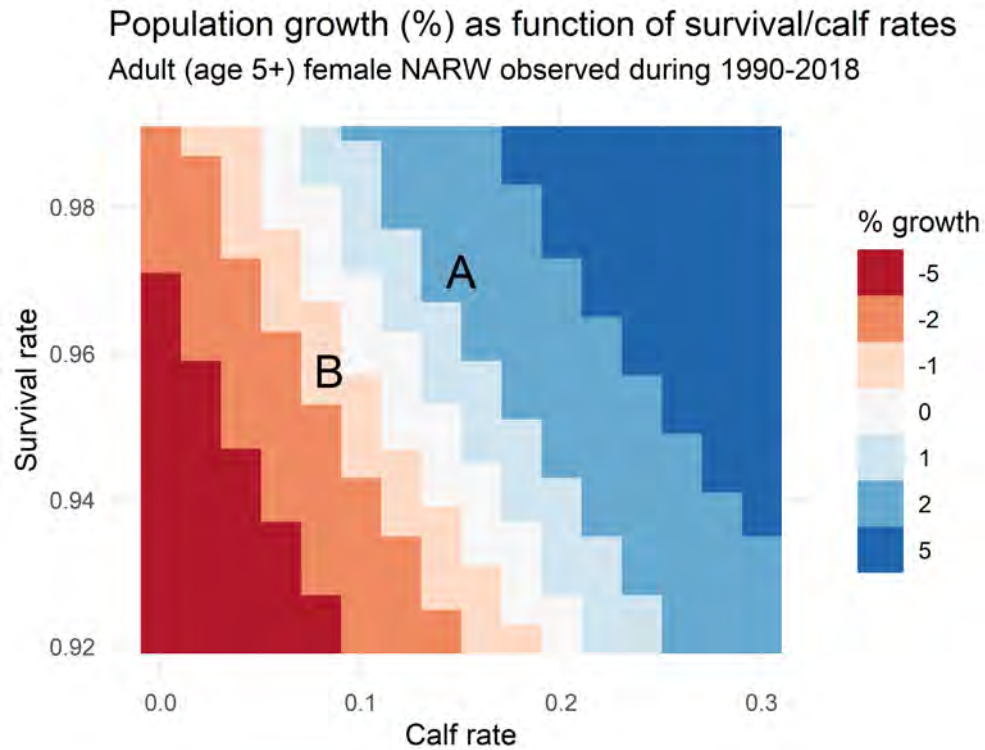


Figure 6: Percent NARW population growth as a function of survival rate and calf rates during 1990–2018. Average values for the pre-2010 (A) and post-2010 (B) regime shift are illustrated.

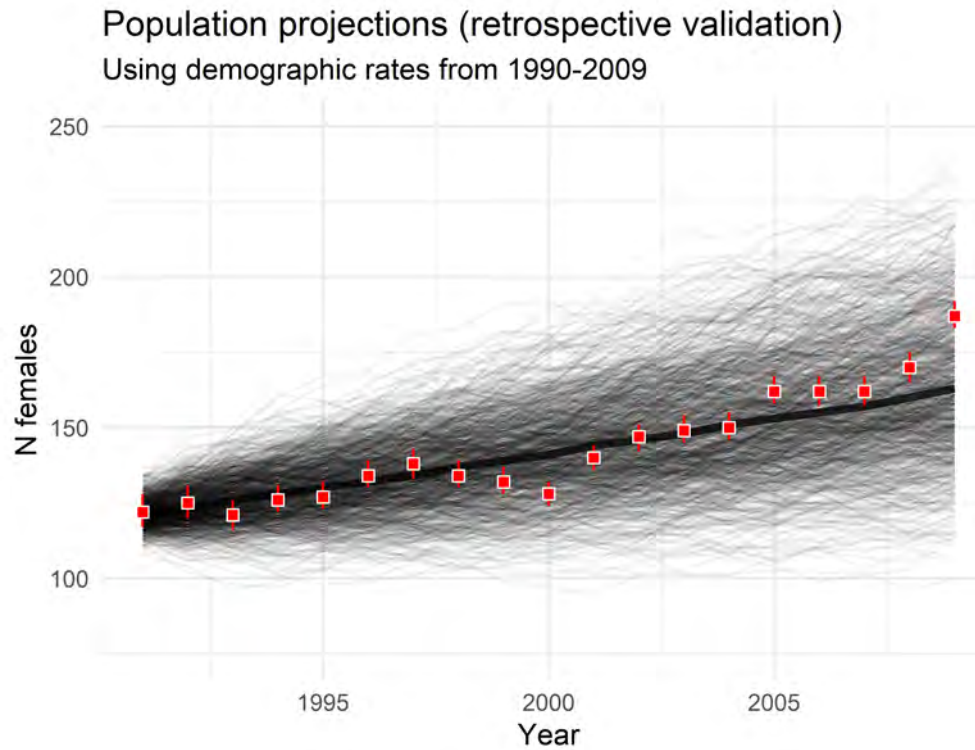


Figure 7: Population projections ($n=1,000$) of NARW females using demographic rates from 1990–2009, with median trend shaded darker. The red squares represent median population estimates from the Pace et al. 2017 state space model, with 95% credible intervals.

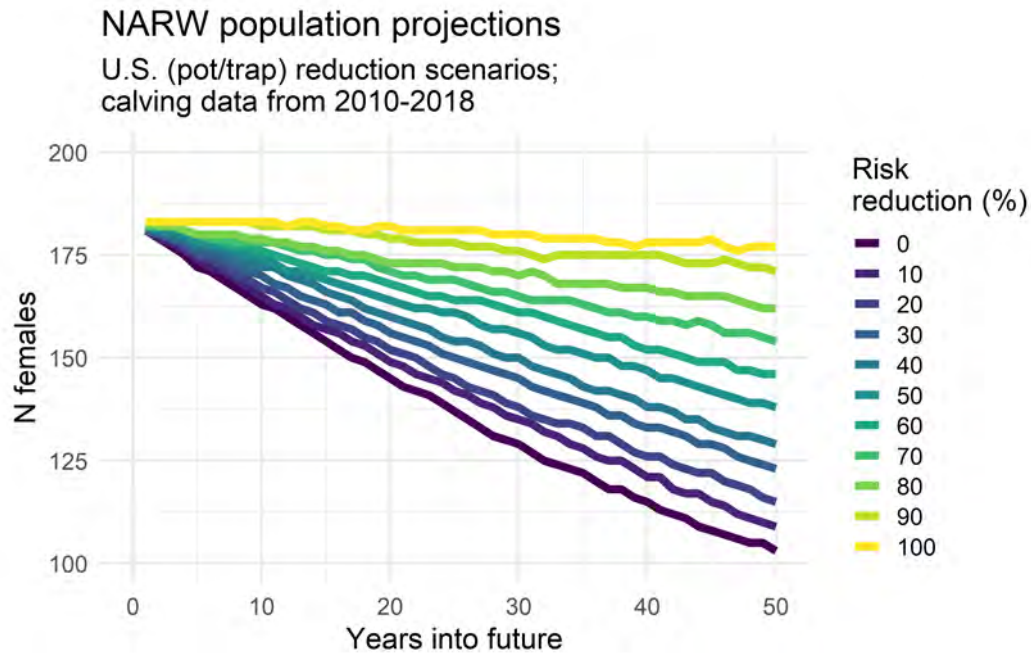


Figure 8: Average trajectory of NARW female population size for each risk reduction scenario using demographic rates from 2010–2018. Each scenario represented a reduction in mortality from U.S. pot/trap gear.

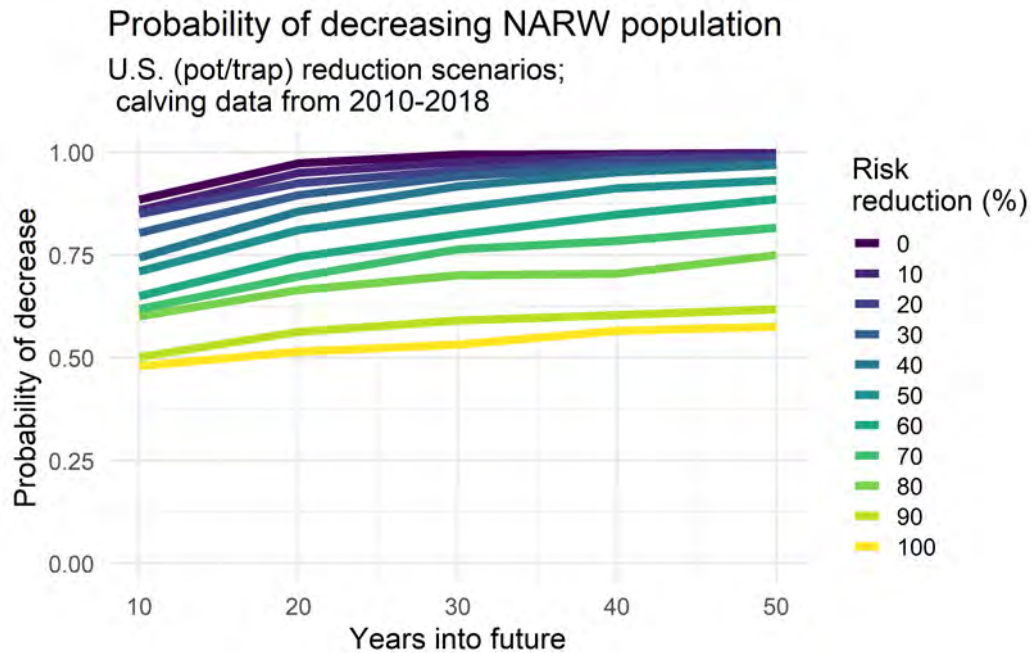


Figure 9: Probability of a decreasing NARW female population size for each risk reduction scenario using demographic rates from 2010–2018. Each scenario represented a reduction in mortality from U.S. pot/trap gear.

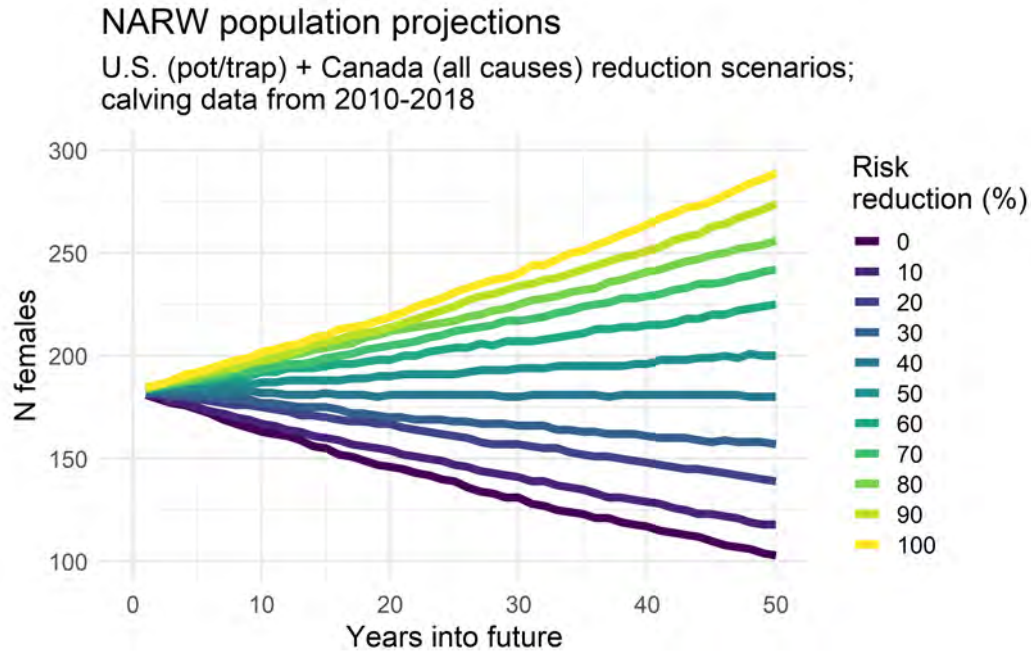


Figure 10: Average trajectory of NARW female population size for each risk reduction scenario using demographic rates from 2010–2018. Each scenario represented a reduction in mortality from U.S. pot/trap gear and all human-related causes in Canada.

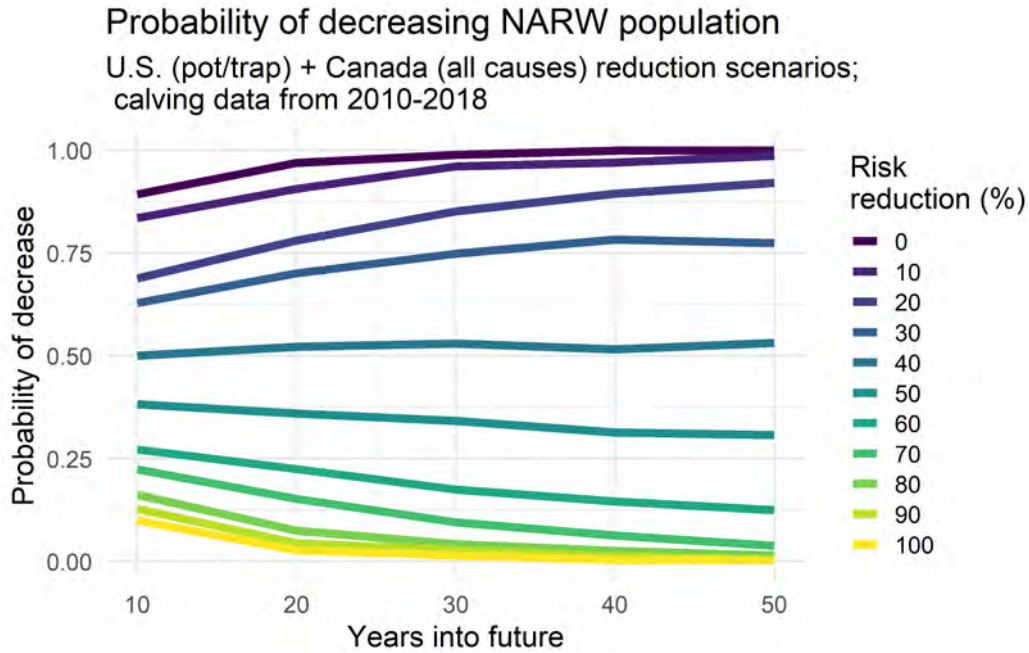


Figure 11: Probability of a decreasing NARW female population size for each risk reduction scenario using demographic rates from 2010–2018. Each scenario represented a reduction in mortality from U.S. pot/trap gear and all human-related causes in Canada.

Supplement 1 - Parameter estimates from the state-space mark-recapture model

Table S1: Medians and 95% credible intervals for major structural parameters of the state-space mark-recapture model for NARW sightings during 1990–2018. Parameter names match those of Pace et al. 2017 and include: the logit-scale parameters of the survival model with an intercept (BetaSex[1]), the effect of adult (age = 5+) females (BetaSex[2]), the linear effect of age (BetaAge) for non-adults, and the effect of the hypothesized regime shift after 2010 (BetaRegime); the annual deviations in survival probability across time (eta[t]); and the population estimates for adult females (NF[6,t]).

	Median	Lower 95%	Upper 95%
BetaSex[1]	2.7797	2.4112	3.1873
BetaSex[2]	-0.5570	-0.8409	-0.2781
BetaAge	0.2690	0.1813	0.3534
BetaRegime	-0.4645	-0.8446	-0.1080
eta[1]	0.0000	0.0000	0.0000
eta[2]	-0.0975	-0.7078	0.3991
eta[3]	0.0796	-0.3928	0.7365
eta[4]	-0.3046	-1.0198	0.1406
eta[5]	0.0298	-0.4704	0.6239
eta[6]	0.0894	-0.3590	0.7201
eta[7]	-0.0125	-0.5378	0.5067
eta[8]	-0.1051	-0.6768	0.3343
eta[9]	0.1026	-0.3290	0.7357
eta[10]	-0.1222	-0.6897	0.3125
eta[11]	-0.0911	-0.6424	0.3598
eta[12]	-0.0010	-0.4935	0.5150
eta[13]	-0.0825	-0.6066	0.3462
eta[14]	-0.0887	-0.6169	0.3471
eta[15]	0.0280	-0.4282	0.5382
eta[16]	0.1801	-0.2305	0.8350
eta[17]	-0.0975	-0.6015	0.3143
eta[18]	-0.0752	-0.5748	0.3449
eta[19]	0.1700	-0.2321	0.7790
eta[20]	0.2080	-0.1825	0.8412
eta[21]	0.1101	-0.2898	0.6593
eta[22]	0.1117	-0.2702	0.6193
eta[23]	0.0990	-0.3112	0.6254
eta[24]	0.1611	-0.2467	0.7753
eta[25]	0.1674	-0.2400	0.7825
eta[26]	-0.0393	-0.5288	0.4530

eta[27]	-0.2681	-0.8624	0.1438
eta[28]	-0.2370	-0.7924	0.1738
eta[29]	-0.0172	-0.4625	0.4191

	Median	Lower 95%	Upper 95%
NF[6,1]	93	88	98
NF[6,2]	95	91	101
NF[6,3]	104	100	109
NF[6,4]	102	98	107
NF[6,5]	113	109	117
NF[6,6]	117	113	122
NF[6,7]	119	115	124
NF[6,8]	119	114	124
NF[6,9]	118	113	123
NF[6,10]	117	113	121
NF[6,11]	114	110	118
NF[6,12]	124	120	128
NF[6,13]	127	123	131
NF[6,14]	126	122	131
NF[6,15]	124	119	128
NF[6,16]	124	120	129
NF[6,17]	127	122	132
NF[6,18]	135	130	140
NF[6,19]	134	130	139
NF[6,20]	143	138	147
NF[6,21]	151	146	156
NF[6,22]	152	147	158
NF[6,23]	152	147	158
NF[6,24]	164	158	171
NF[6,25]	172	166	179
NF[6,26]	172	165	180
NF[6,27]	166	159	174
NF[6,28]	160	152	168
NF[6,29]	157	150	165

Supplement 2 - Population projections for the U.S. pot/gear reduction scenarios

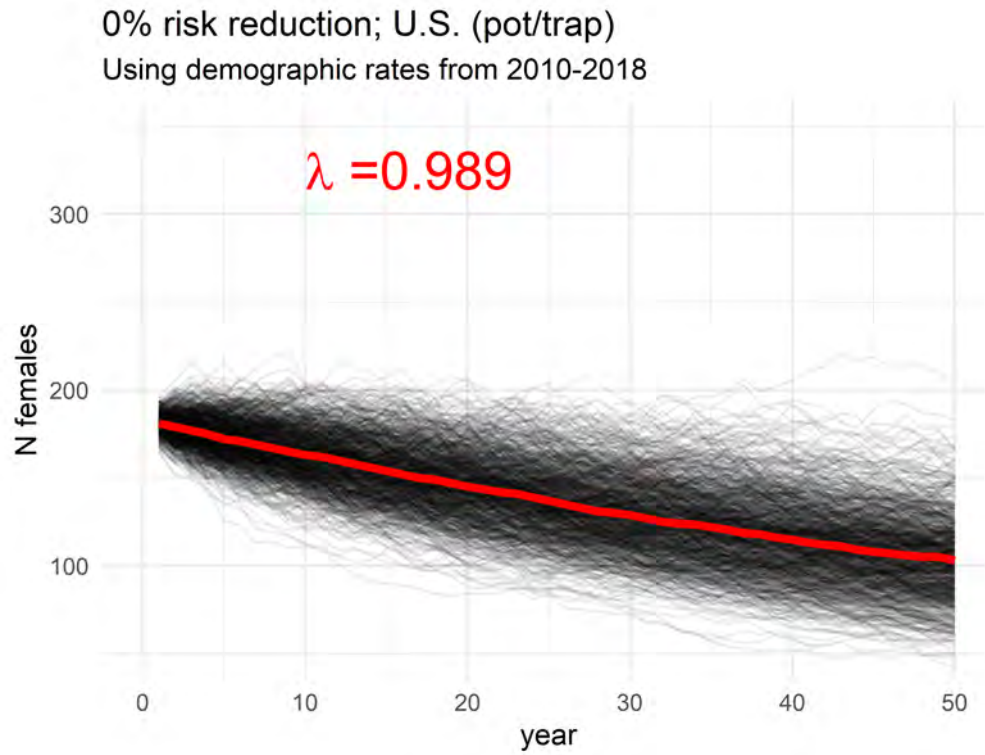


Figure S1: Population projections ($n=1,000$) of NARW females using demographic rates from 2010–2018. Median population size and resulting growth rate (λ) in red. The risk reduction from U.S. pot/trap gear was 0% (status quo).

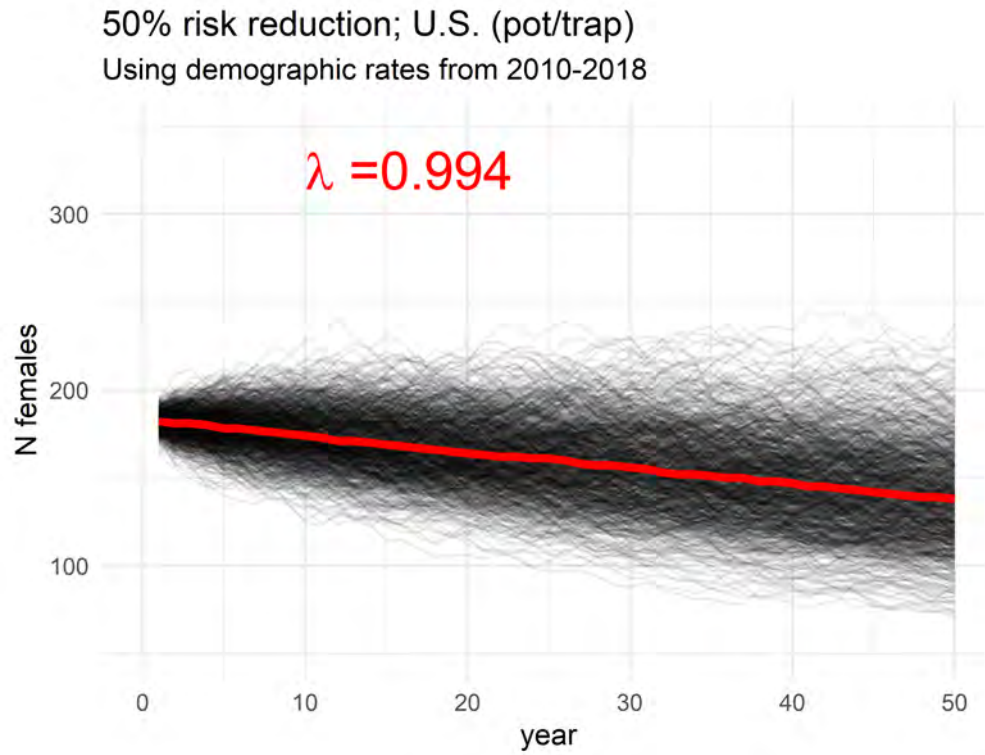


Figure S2: Population projections ($n=1,000$) of NARW females using demographic rates from 2010–2018. Median population size and resulting growth rate (λ) in red. The risk reduction from U.S. pot/trap gear was 50%.

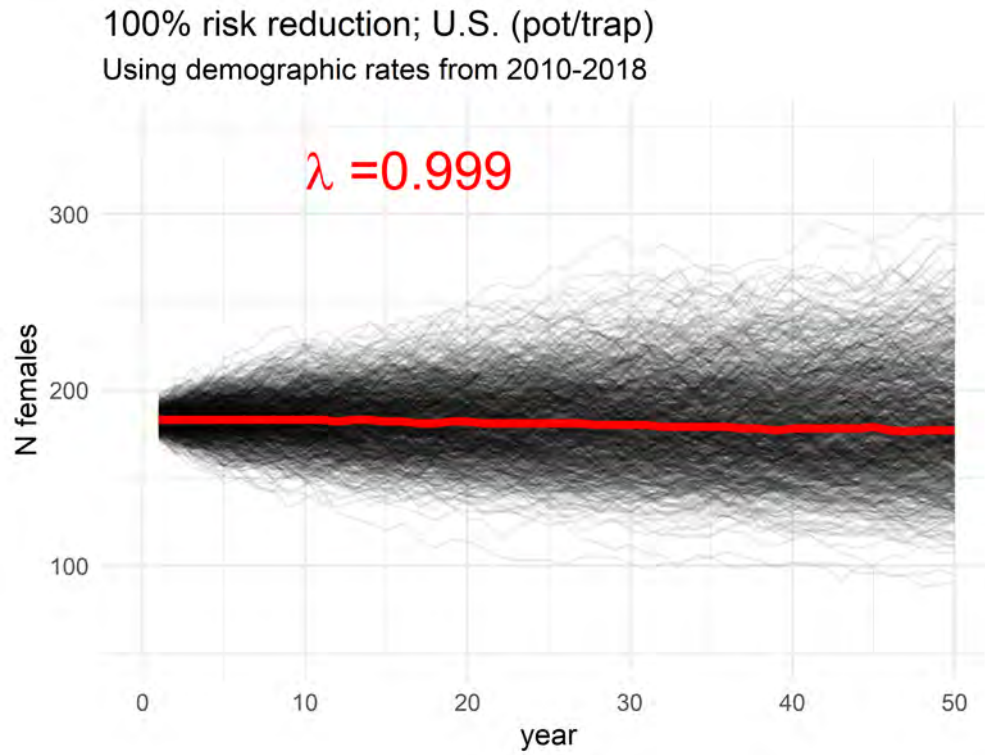


Figure S3: Population projections ($n=1,000$) of NARW females using demographic rates from 2010–2018. Median population size and resulting growth rate (λ) in red. The risk reduction from U.S. pot/trap gear was 100%.

**Supplement 3 - Population projections for the combined
U.S./Canada reduction scenarios**

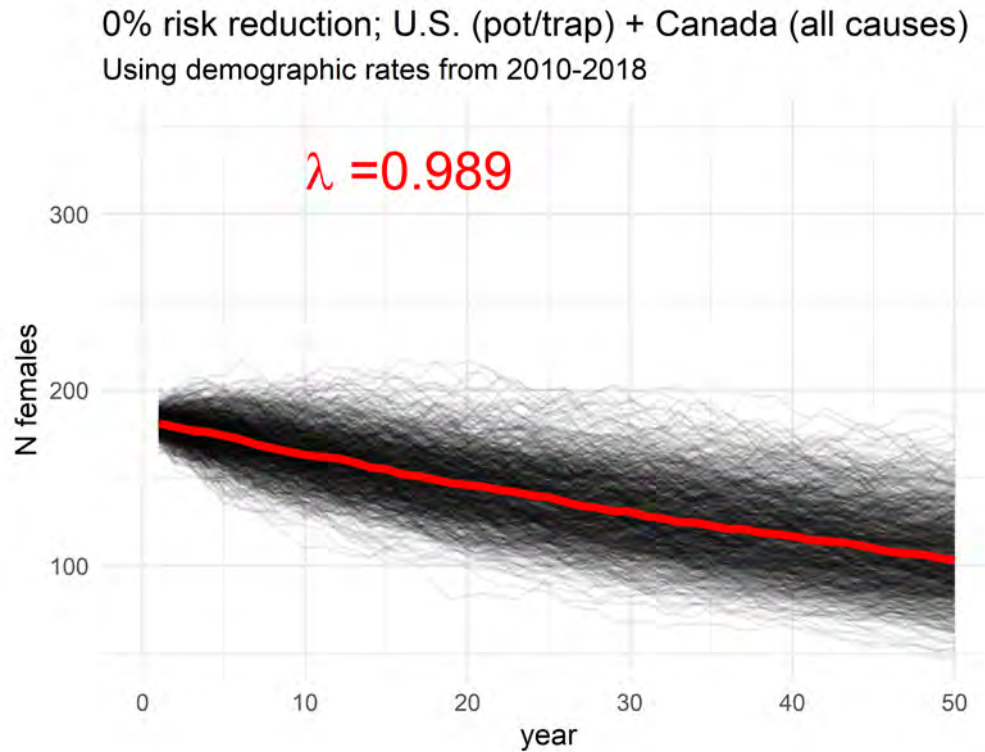


Figure S4: Population projections (n=1,000) of NARW females using demographic rates from 2010–2018. Median population size and resulting growth rate (λ) in red. The risk reduction from U.S. pot/trap gear and all human-related causes in Canada was 0% (status quo).

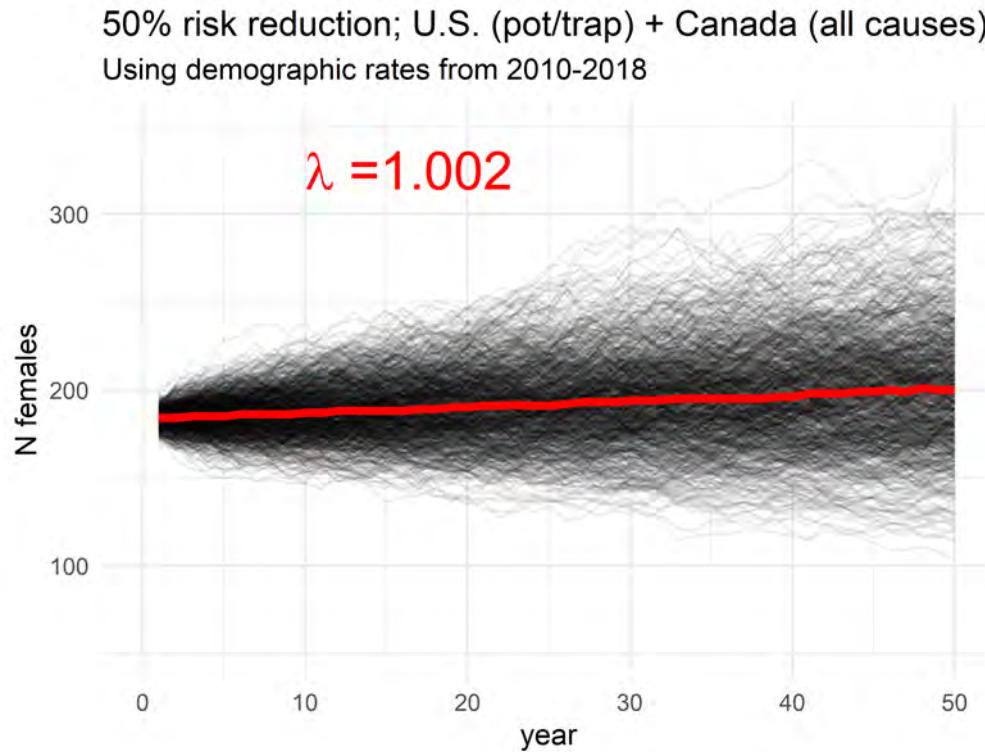


Figure S5: Population projections ($n=1,000$) of NARW females using demographic rates from 2010–2018. Median population size and resulting growth rate (λ) in red. The risk reduction from U.S. pot/trap gear and all human-related causes in Canada was 50%.

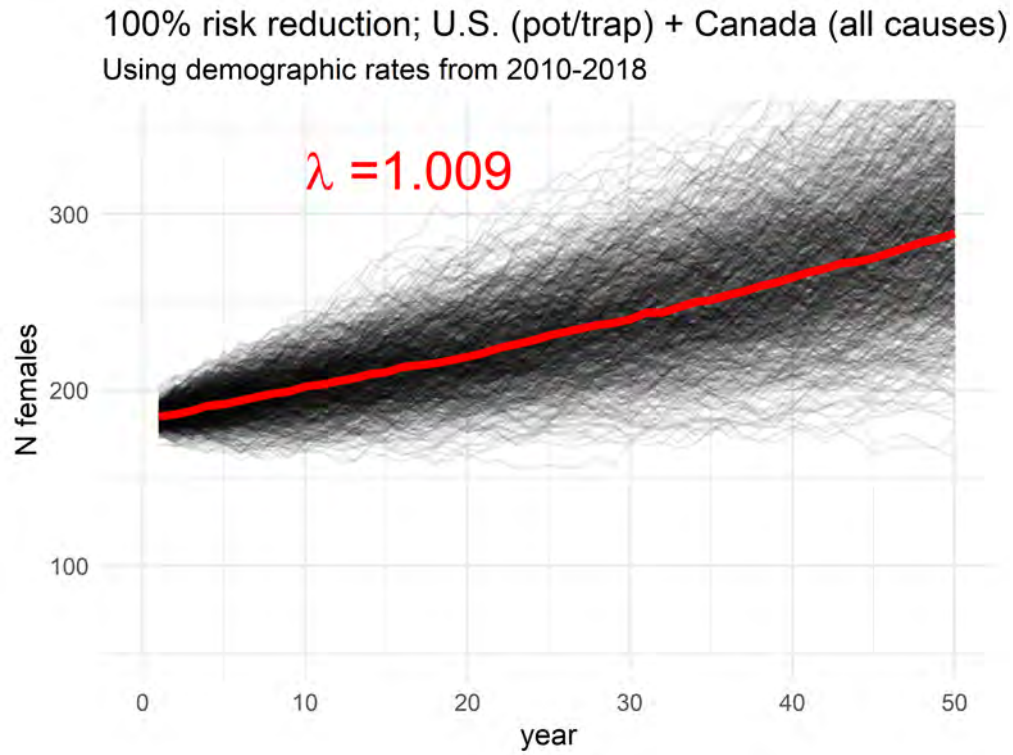


Figure S6: Population projections ($n=1,000$) of NARW females using demographic rates from 2010–2018. Median population size and resulting growth rate (λ) in red. The risk reduction from U.S. pot/trap gear and all human-related causes in Canada was 100%.

**Supplement 4 - Population projections using fertility rates from
1990–2018**

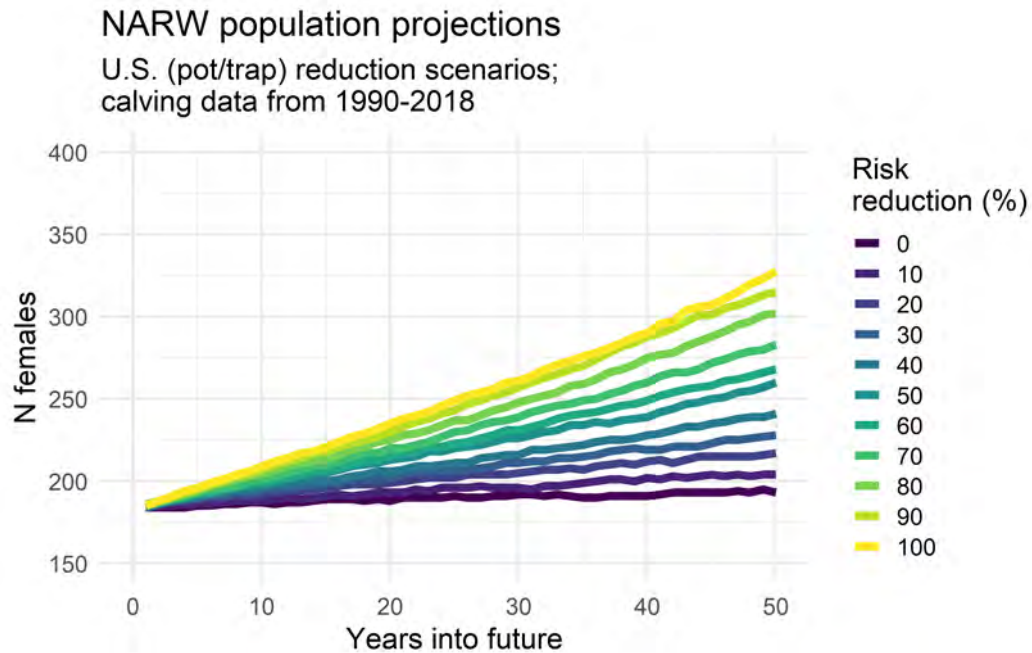


Figure S7: Average trajectory of NARW female population size for each risk reduction scenario using calving rates from 1990–2018. Each scenario represented a reduction in mortality from U.S. pot/trap gear.

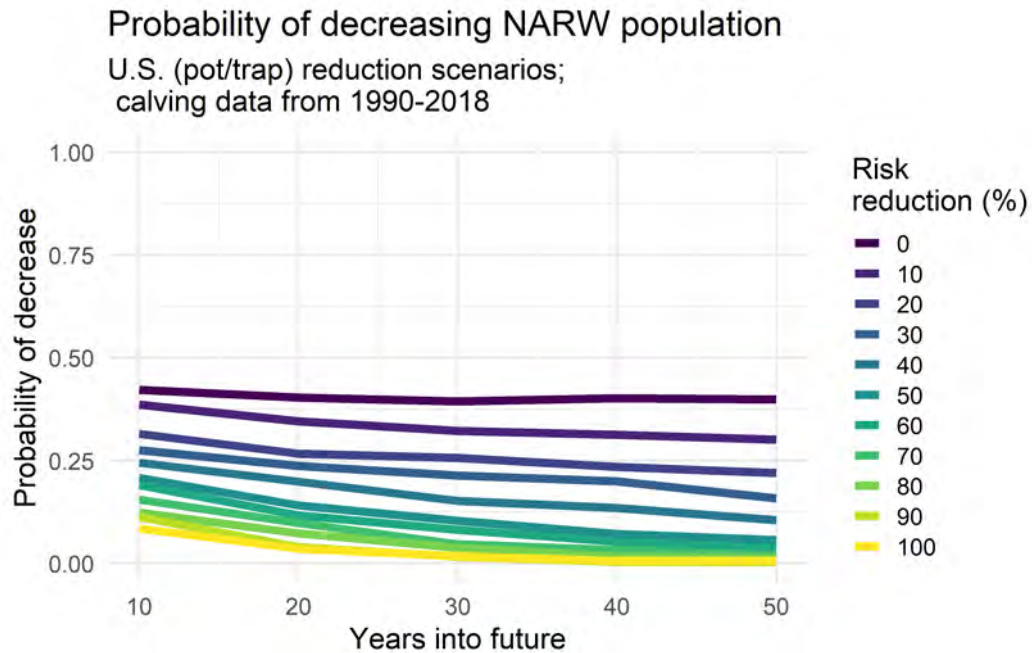


Figure S8: Probability of a decreasing NARW female population size for each risk reduction scenario using calving rates from 1990–2018. Each scenario represented a reduction in mortality from U.S. pot/trap gear.

Supplement 5 - R code for population projections

```

# Script to fit a population projection for NARW
#
# Data use MCMC output from Pace et al. 2017 state
# space models re-run for 1990-2018. Follows similar
# approach to projections in Corkeron et al. 2018.
#
# https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.3406
# https://royalsocietypublishing.org/doi/10.1098/rsos.180892
#
# D.W.Linden (daniel.linden@noaa.gov)
# 05 December 2020

library(ggplot2)
library(plyr)
library(tidyverse)
library(popbio)

# calf data (1990-2018)
dat.calf <- data.frame(
  year = 1990:2018,
  calves = c(12, 17, 12, 6, 9, 7, 21, 19, 5, 4,
             1, 31, 21, 19, 16, 28, 19, 23, 23, 39,
             19, 22, 7, 20, 11, 17, 14, 5, 0),
  #median estimates of adult NF (5+)
  NF = c( 93,  95, 104, 102, 113, 117, 119, 119, 118, 117,
         114, 124, 127, 126, 124, 124, 127, 135, 134, 143,
         151, 152, 152, 164, 172, 172, 166, 160, 157)
)
dat.calf$birth_rate <- dat.calf$calves/dat.calf$NF

# N live adult females 2009-2017 (100 samples of posterior for each year)
NaF <- structure(
  c(142, 141, 143, 145, 138, 146, 140, 138, 142, 144,
    141, 141, 148, 142, 145, 143, 138, 142, 141, 139, 142, 142, 145,
    141, 143, 141, 144, 144, 143, 145, 141, 141, 143, 143, 144, 142,
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163, 162, 161, 164, 161, 162, 160, 168, 162, 160, 158, 163, 157,
153, 166, 161, 155, 161, 156, 171, 162, 159, 158, 161, 160, 157,
158, 164, 158, 158, 163, 158), .Dim = c(100L, 9L))

```

N dead adult females 2010-2018 (100 samples of posterior for each year)

```

NdaF <- structure(
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```

```

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5, 5, 5, 7, 7, 5, 6, 7, 9, 7, 6, 6, 6, 6, 7, 5, 7, 6, 6, 6, 10,
6, 8, 5, 5, 6, 5, 6, 6, 5, 7, 9, 5, 6, 8, 11, 6, 8, 8, 7, 6,
5, 5), .Dim = c(100L, 9L))

```

```
#----- Mortality reductions -----#
```

```
reductions <- seq(0,1,by=0.1)
```

```
# US mortalities (due to entanglement) 2010-2018
```

```
base_morts_US <- 50
```

```
# number of "saved" individuals
```

```
saved_morts_US <- base_morts_US * reductions
```

```
# half of saves are female
```

```
saved_morts_US <- saved_morts_US/2
```

```
# Canada mortalities (all causes) 2010-2018
```

```
base_morts_CAN <- 75
```

```
# number of "saved" individuals
```

```
saved_morts_CAN <- base_morts_CAN * reductions
```

```
# half of saves are female
```

```
saved_morts_CAN <- saved_morts_CAN/2
```

```
# total saved mortalities
```

```
scenarios <- data.frame(
```

```

    reduction = reductions,
    US_saves = round(saved_morts_US),
    US_Canada_saves = round(saved_morts_US+saved_morts_CAN)
  )
n.scenarios <- nrow(scenarios)

fishery.name <- c("US_pot&trap","US&Can_specific")

# "current" age structure (calf, juv, adult)
nzero <- c(4,22,157)

reps <- 20 # number of trajectories/iterations (should be >1,000)
tmax <- 50 # length of the trajectories (years)

##-----##
## start loops across fisheries & starting years
##-----##

# U.S. (pots) only, calf rates starting in 2010
fishery <- 1; start <- 2010

#for (fishery in 1:2){          #US vs. US+Canada
#for (start in c(1990,2010)){

# size of posterior distribution
n.iter <- dim(NaF)[1]; n.yrs <- dim(NaF)[2]
# array of realized survival rates (for adult females)
SaF_array <- array(NA,dim=c(n.iter,n.yrs,n.scenarios))

for(scenario in 1:n.scenarios){
  saved <- as.vector(
    t(rmultinom(n.iter,
               size = scenarios[scenario,fishery+1],
               # probs are distributed according total deaths in year
               prob = apply(NdaF,2,median)/sum(apply(NdaF,2,median))))
  # remove saved whales from realized deaths
  SaF_array[, ,scenario] <- 1-((NdaF-saved)/(NaF))
}
SaF_array[SaF_array >= 1] <- 0.9999

# save simulation objects
scen.df <- data.frame(fishery=NA,scenario=NA,start=NA,year=NA,N=NA)
tdf.list <- list()

```

```

##-----##
## loop through scenarios
##-----##
sim.start <- Sys.time()
for(scenario in 1:n.scenarios){

totalpop <- matrix(0, tmax, reps) # initialize matrix to store trajectories

##-----##
## loop through trajectories
##-----##
for(j in 1:reps){

# starting age structure
n.cja <- nzero

print(paste0("scen ",scenario,"; rep ",j))

##-----##
## iterate across years (50) within trajectory
##-----##
for(i in 1:tmax){

# calf survival (~0.908 for 2010-2018)
S.c <- plogis(rnorm(1,mean=2.3359,sd=0.3457))

# juvenile survival (~0.951 for 2010-2018)
S.j <- plogis(rnorm(1,mean=3.0079,sd=0.3094))

# adult female survival
#S.a <- plogis(rnorm(1,mean=3.1214,sd=0.3097))
S.a <- unlist(SaF_array[,scenario])[
  sample(1:length(unlist(SaF_array[,scenario])),size=1)]

#juvenile state duration 4 years in Pace et al. 2017
d.j <- 4

#taking adult female longevity at 69 given oldest known
d.a <- 59+4

#Pi={[1-(p^(d-1))]/[1-(p^d)]}*p
Pj<-((1-(S.j^(d.j-1)))/(1-(S.j^d.j)))*S.j
Pa<-((1-(S.a^(d.a-1)))/(1-(S.a^d.a)))*S.a

```

```

#Gi=[p^d*(1-p)]/[1-(p^d)]
Gj<-((S.j^d.j)*(1-S.j))/(1-(S.j^d.j))

ppm <- matrix(0,3,3)
ppm[2,1]<-S.c
ppm[2,2]<-Pj  #S_j,j
ppm[3,2]<-Gj  #S_j,a
ppm[3,3]<-Pa  #S_a,a

# calves per year average (for start:2018)
calf_rates <- unlist(dat.calf %>% filter(year %in% c(start:2018)) %>%
                    select(birth_rate))
calf_rate_i <- calf_rates[sample(1:length(calf_rates),size=1)]
# half of calves are F (1/2)
ppm[1,3]<- 1/2 * calf_rate_i

stages<-c('calf','immat','adlt')
ppm<-matrix(ppm,nrow=3,byrow=FALSE,
            dimnames = list(stages,stages))
ppm<-round(ppm,5)

#SURVIVAL transitions only
survm<-splitA(ppm)$T
#fertilities
fertm<-splitA(ppm)$F

#####
#run a stochastic projection
n.cja <- multiresultm(n.cja,survm,fertm)
# i = year, j = sim
totalpop[i,j]<-sum(n.cja)
}
}

tdf <- as.data.frame(totalpop)
names(tdf) <- paste0("iter",1:reps)

tdf$year <- 1:tmax
tdf_long <- tdf %>% pivot_longer(cols=starts_with("iter"),
                                names_to="iteration",
                                names_prefix="iter",values_to="estimate")

scen.df <- rbind(scen.df,
                 data.frame(

```

```

        fishery=fishery.name[fishery],
        scenario=scenarios$reduction[scenario],
        start=start,
        year=1:50,
        N=apply(tdf,1,median)))

tdf.list[[scenario]] <- tdf_long
}
print(Sys.time()-sim.start)

# save the simulated projections
save(tdf.list,scen.df,file=paste0("NARW_50yr_project_",
    fishery.name[fishery],"_reduction_calving",start,"-2018.Rdata"))

#} #end starting yr loop
#} #end fishery loop

##-----##
## Plotting results
##-----##

# U.S. (pots) only, calf rates starting in 2010
fishery <- 1; start <- 2010

#for (fishery in 1:2){          #US vs. US+Canada
#for (start in c(1990,2010)){

load(file=paste0("NARW_50yr_project_",fishery.name[fishery],
    "_reduction_calving",start,"-2018.Rdata"))

lambdas <-
  ((scen.df %>% filter(year==50) %>% group_by(scenario))$N/
  (scen.df %>% filter(year==1) %>% group_by(scenario))$N)^(1/50)

for(scenario in 1:n.scenarios){

tdf.list[[scenario]] %>%
  ggplot(aes(x=year,y=estimate,group=iteration)) +
  geom_line(alpha=0.07,col="black") + theme_minimal() +
  geom_line(data=data.frame(
    year=1:tmax,
    estimate=as.vector(tdf.list[[scenario]] %>%

```



```

        group_by(year) %>%
        summarise(estimate=median(estimate)))[,2],
        iteration=0),
        aes(x=year,y=estimate,col="red",lwd=1.5) +
coord_cartesian(xlim=c(0,50),ylim=c(50,350))+
annotate(geom = "text",x=10,y=325, size=7,color="red",hjust=0,
        label= substitute(paste(lambda, "=", v),
                           list(v=round(lambdas[scenario],3)))
)+
labs(title=paste0(scenarios$reduction[scenario]*100,"% reduction",
        c("; U.S. only","; U.S. + Canada")[fishery]),
      y="N adult females",
      subtitle=paste0("Using demographic rates from ",start,"-2018"))
ggsave(filename=paste0("NARW_proj_",start,"-2018_",fishery.name[fishery],
        "_",scenarios$reduction[scenario],".png"),
        dpi=600,width=5.25,height=4)
}

##-----##
# average projections across all scenarios

scen.df$scenario2 <- as.factor(scen.df$scenario*100)

scen.df %>% filter(!is.na(start)) %>%
  ggplot(aes(x=year,y=N,color=scenario2)) +
  geom_line(lwd=1.5,alpha=1) + theme_minimal() +
  scale_color_viridis_d()+
  coord_cartesian(xlim=c(0,50),
                  ylim=data.frame(
                    y1990=c(150,400),
                    y2010=c(100,300))[,match(start,c(1990,2010))]) +
  labs(color="Risk reduction (%)",title="NARW population projections",
        subtitle=paste0(
          c("U.S. only", "U.S. + Canada")[fishery],
          " reduction scenarios;\n calving data from ",start,"-2018"),
        x="Years into future",y="N adult females")
ggsave(filename=paste0("NARW_proj_",start,"-2018_",
        fishery.name[fishery],"_ALLscenarios.png"),
        width=5.5,height=3.5,dpi=600)

##-----##
# probabilities of population decline

```

```

names(tdf.list) <- scenarios$reduction*100
tdf.df <- ldply(tdf.list,.id="Reduction")

tdf_10yr <- tdf.df %>% filter (year %in% seq(10,50,by=10)) %>%
  mutate(decrease = as.numeric(estimate < sum(nzero))) %>%
  group_by(Reduction,year) %>% summarise(prop_decrease=mean(decrease))

tdf_10yr %>%
  ggplot(aes(x=year,y=prop_decrease,color=factor(Reduction)))+
  geom_line(lwd=1.5,alpha=1) + theme_minimal() +
  scale_color_viridis_d()+
  coord_cartesian(xlim=c(10,50),ylim=c(0,1)) +
  labs(color="Risk reduction (%)",
        title="Probability of decreasing NARW population",
        subtitle=paste0(
          c("U.S. only", "U.S. + Canada ")[fishery],
          " reduction scenarios;\n calving data from ",start,"-2018"),
        y="Probability of decrease",x="Years into future")
ggsave(filename=paste0("NARW_proj_",start,"-2018_",
                        fishery.name[fishery],
                        "_ALLscenarios","_declineprob.png"),
        width=5.5,height=3.5,dpi=600)

#} #end starting yr loop
#} #end fishery loop

```

**16. APPENDIX D: ANALYSIS OF ATLANTIC SEA SCALLOP FISHERY IMPACTS ON
THE NORTH ATLANTIC POPULATION OF LOGGERHEAD SEA TURTLES**



NOAA Technical Memorandum NMFS-NE-207

**Analysis of Atlantic Sea Scallop
(*Placopecten magellanicus*) Fishery
Impacts on the North Atlantic
Population of Loggerhead Sea Turtles
(*Caretta caretta*)**

**U. S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, MA
February 2008**

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NOAA Technical Memorandum NMFS-NE-207

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Analysis of Atlantic Sea Scallop (*Placopecten magellanicus*) Fishery Impacts on the North Atlantic Population of Loggerhead Sea Turtles (*Caretta caretta*)

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Northeast Fisheries Science Center
Woods Hole

February 2008

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ABSTRACT

An estimated 619 loggerhead turtles of various age and sex classes were taken annually during 1989-2005 in all components of the US Atlantic sea scallop (*Placopecten magellanicus*) fishery. We provide here a quantitative assessment of the potential for these takes to jeopardize the continued existence of the US Atlantic Ocean population of loggerhead sea turtles (*Caretta caretta*). A population viability analysis (PVA) was used to estimate quasi-extinction likelihoods under conditions with and without fishery effects. This PVA used US index nesting beach data for 1989-2005 to estimate the loggerhead population trend μ (mean growth rate) and variance σ^2 . The starting population (N_0) for the exercise was the sum of nesting females estimated from the 2005 nest count in the North Carolina to Florida area. The base model (with fishery bycatch) was developed by using estimates of μ (-0.022), σ^2 (0.012), N_0 (34,881) and a quasi-extinction threshold of 250 adult females. Quasi-extinction likelihoods were bootstrapped (1000 iterations) under baseline conditions to derive confidence intervals. The μ for each bootstrap iteration was drawn from a normally distributed random sampling of μ values lying within the 95% confidence interval around the original μ . The model was then rerun with the estimated annual fishery mortality of adult females (102 turtles) added back into the population, thus changing the trend ($\mu = -0.019$, $\sigma^2 = 0.012$, and $N_0 = 34,881$). Results of the two models were similar; the quasi-extinction probabilities were zero at 25, 50, and 75 years, and 0.01 at 100 years for both analyses. Median times to quasi-extinction were 207 years versus 240 years, and the number of bootstrap simulations with extinction probabilities greater than 0.05 in 100 years was 258 and 178, respectively. These results suggest that the annual take of loggerhead sea turtles in the US fisheries for Atlantic sea scallops, though detectable, does not significantly change the calculated risk of extinction of the population of adult female Western North Atlantic loggerheads over the next 100 years.

INTRODUCTION

Loggerhead sea turtles (*Caretta caretta*) are incidentally captured in US dredge and trawl fisheries for Atlantic sea scallops (*Placopecten magellanicus*) in the US Mid-Atlantic region. Increased federal observer coverage of these fisheries allowed the National Marine Fisheries Service (NMFS) to estimate the annual bycatch of loggerhead turtles in the fisheries through 2005 (Murray 2004a, 2004b, 2005, 2007). Recent observer reports document takes through 2007. As loggerhead turtles are a threatened species under the US Endangered Species Act (ESA), NMFS, under Section 7 of the ESA, must ensure that continuation of the sea scallop fisheries is not likely to jeopardize the continued existence of the species.

Impacts of US fisheries (e.g., Atlantic sea scallop, Mid-Atlantic bottom trawl, pelagic longline, and Gulf of Mexico/Southern Atlantic commercial shrimp) on the western North Atlantic loggerhead sea turtle population have been analyzed by Southeast Fisheries Science Center (SEFSC) staff and the loggerhead sea Turtle Expert Working Group (TEWG 1998, 2000; SEFSC 2001; Epperly et al. 2002). However, reduced loggerhead nesting on southeastern US beaches suggests these analyses require updating. The TEWG is currently working on a reanalysis, but the limited data available on current population parameters (e.g., stage specific survival) suggest that the previous demographic models may be difficult to revise.

We provide here an alternative quantitative approach to the assessment of the risk the US Atlantic sea scallop fisheries have of jeopardizing the continued existence of the western North Atlantic Ocean populations of loggerhead sea turtles. This approach is simpler than previously used for western North Atlantic (WNA) loggerheads and is similar to that used by Snover (2005) in her analysis of the impact of the Western Pacific Pelagics Fisheries on several Pacific sea turtle species. We use a population viability analysis (PVA) to estimate quasi-extinction likelihoods under conditions with and without fishery effects. The PVA is count-based (Dennis et al. 1991; Morris et al. 1999; Holmes 2001; Morris and Doak 2002; Snover 2005) which will allow the use of the only relatively complete and available population time series—index nesting beach¹ counts for 1989-2005. As such, the analyses focus on the viability of the adult female portion of the population and should not be considered to model viability of the entire population.

We first present the PVA results under baseline conditions by using the rate of change of the adult female population (which implicitly includes the mortalities from the scallop and other fisheries) and the 2005 count of adult females estimated from all beaches in the Southeast based on an extrapolation from nest counts. We then adjust the rate of change by adding back the fisheries take and rerunning the PVA. The results of these two analyses are then compared by using the probability of quasi-extinction at 100 years to assess the impact of the takes in the Atlantic sea scallop fisheries.

At the outset, we point out three caveats to the interpretation of these analyses. First, the current negative nesting beach trends are at odds with some in-water survey results (e.g., Epperly et al. 2007). Secondly, the current negative trend in adult female abundance has likely been

¹ Index beaches are a limited series of beaches which are regularly monitored for nesting activity. In Florida, the Index Nesting Beach Survey (INBS) has coordinated a detailed monitoring program since 1989 to measure seasonal productivity, allowing comparisons between beaches and between years. In Florida, 33 beaches (of 190 surveyed beaches) are included in the INBS program. Similar programs exist in states further north.

influenced by mortality events that have occurred over several decades. As such, a model based on current nesting beach trends may overestimate the effect of current takes on the likelihood of extinction for the population. Finally, we stress that our analyses should not be used to assess the likely fate of the population but should only be used to assess the impact of the fisheries for Atlantic sea scallops on the population trajectory of adult female loggerhead sea turtles. A thorough review of loggerhead population trends is provided by Witherington et al. (2006, in review).

METHODS

Data

Population trend data

A time series of population counts (or some index of the population) was needed through 2005 to estimate the population trend for the PVA. The time series needed to be longer than 10 years for the PVA to be more than marginally useful (Morris et al. 1999; Morris and Doak 2002).

Loggerhead nest counts (a proxy for the adult female population) are available for southeastern US index nesting beaches from 1989 to 2005 for the Northern (NC, SC, and GA) and Peninsular Florida subpopulations (NMFS in review, FWRI 2007). These are the subpopulations with the greatest nesting populations. Two other southeastern United States subpopulations have index beach nest counts available from 1996 (Dry Tortugas FL) and 1998 (Northern Gulf [AL, FL]) onwards (NMFS in review). These are the two smallest subpopulations, and since at least 1996 they have constituted a small fraction of the population (e.g., in 2005 they accounted for only 3% of the total number of index beach nests). Because nest counts were available for only a relatively brief period, these two subpopulations were excluded from the trend analysis for 1989-2005. Note that we did include the nest counts for all four subpopulations as part of a supporting analysis for the 1996-2005 period. Finally, these count data were used directly, without any adjustments for remigration² or nests per female, to determine the population trend.

Current abundance data

An estimate of adult female abundance in 2005 was necessary for use as the starting point for the PVA. The 2005 estimate of adult female abundance was derived by first summing nest counts from all beaches surveyed in the southeastern United States, including all beaches surveyed in 2005 in NC, SC, GA, FL, and AL (NMFS in review, FWRI 2007, SCDNR 2007). Only index beach nests counts were available for the Dry Tortugas and Northern Gulf subpopulations, so the total nest count is biased low. We then adjusted the sum to estimate adult females:

$$N_{AF} = (\text{Number of nests}/\text{Nests per female}) * \text{Remigration interval}$$

² Remigration is used here to mean the number of years between visits by adult females to nesting beaches and is not to be confused with the repeat visits within a single year which are included in the nests per female estimate.

Use of a constant value for nests per female and remigration interval is problematic as both parameters vary to some degree. For example, limited food resources can lead to decreased reproductive fitness because of natural and human driven fluctuations in prey availability. Moreover, if the age structure of the population changes, the number of nests per female will change. The available datasets do not characterize this variability, nor is it known whether such variability is random or associated with environmental change. Because of these uncertainties, we generally used conservative parameter values.

Estimates of nests per female vary widely, in part because of observational issues. Estimates adjusted for missed nesting suggest the mean number of nests per female per season in US waters ranges from 2.8 to 4.2 (Frazer and Richardson 1985; Schroeder et al. 2003). We used 4.2 nests per female.

Published estimates for the average remigration intervals of WNA loggerhead sea turtles on US beaches vary from 2.5 to 2.7 years (Richardson et al. 1978; Bjorndal et al. 1983; Schroeder et al. 2003). We used the 2.5 year remigration estimate.

Fishery mortality data

Estimates of loggerhead bycatch in the US Atlantic sea scallop fisheries are available for 2003-2005 for scallop dredge gear and for 2004-2005 for scallop trawl gear (Murray 2004a, 2004b, 2005, 2007). There is a wide range amongst the annual values, and two approaches for deriving an estimate for our model were considered. One approach was based on using the mean annual sea scallop dredge fishery bycatch for 2003-2005 $([749+180+0]/3=310)$; Murray 2004b, 2007) added to the midpoint of the range of estimated sea scallop trawl fishery bycatch from six bycatch estimates for 2004-2005 (136 turtles; Murray 2007) as the estimate of average annual total loggerhead sea turtles caught in the sea scallop fisheries (446 turtles). An additional 20 loggerheads were estimated to have been caught in groundfish bottom trawl fisheries where sea scallops were the primary catch (Murray 2006). Summing across fisheries suggests that the annual loggerhead bycatch in sea scallop related fisheries in 2004-2005 might be 466 animals.

The second approach used the take estimates in the Atlantic Sea Scallop Fishery Management Plan (FMP) Biological Opinion. This included only the 2003-2004 sea scallop dredge fishery bycatch (biennially 929 loggerhead sea turtles) added to one of the sea scallop trawl fishery bycatch estimates (268 loggerhead sea turtles biennially) and the 20 turtles estimated to be taken annually in groundfish bottom trawls for an average annual bycatch of 619 loggerhead sea turtles in the fishery.

We used the value of 619 loggerhead sea turtles as our estimate of the annual bycatch in the sea scallop fisheries of loggerhead sea turtles of various age and sex classes.

This total loggerhead sea turtle bycatch estimate ($N_B=619$ turtles) then needed to be adjusted downward to estimate the annual mortality of adult female loggerheads (N_{AF}) associated with the US sea scallop fisheries:

$$N_{AF} = (N_B * F_{US} * F_M * F_{M-F} * F_L) + (N_B * F_{US} * [1-F_M] * F_{IM-F} * F_{IM-R} * F_L)$$

where:

F_{US} = proportion of the bycatch from the US population

F_M = proportion of bycatch mature

F_{M-F} = proportion of the adult bycatch assumed to be female

F_{IM-F} = proportion of the immature bycatch assumed to be female

F_{IM-R} = relative reproductive value of juvenile neritic turtles

F_L = proportion of the bycatch considered as lethal takes

Again, where there was a range of parameter values, we selected the value that generated the greatest impact by the sea scallop fisheries on the loggerhead population:

1. F_{US} - Genetic samples taken from loggerhead sea turtles captured in the sea scallop fisheries indicated that 88-93% of the animals are from the US nesting population (Haas et al. in review). This is comparable to the ~92% reported by Bass et al. (2004) for the Albemarle-Pamlico Sounds area of NC. We used a value of 93%.
2. F_M - Loggerheads captured in both gear types are expected to be of the same age classes. Loggerhead sea turtles observed bycaught in sea scallop fisheries ranged in size from 62 cm to 107 cm curved carapace length (CCL)(mean = 79.2 cm CCL, SD = 11.6, NE Fishery Observer Program database). The cutoff between sexually immature and mature loggerhead sea turtles appears is in the range of 87 to 100 cm CCL (NMFS in review; SEFSC 2001). CCL data were available for 42 turtles taken in the fishery; 35 (83.3%) were less than 87 cm CCL. As such, we used 0.833 as the proportion of immatures taken in the fisheries.
3. F_{M-F} and F_{IM-F} - There are few data available on the sex classes of loggerheads bycaught in the sea scallop fisheries. We, therefore, used data available from loggerhead captures and strandings. These data suggest that the mature and immature sex ratio in Northeast waters is approximately two females per male (TEWG 2000).
4. F_{IM-R} - Estimated bycatch of immature loggerheads was adjusted to account for the natural mortality expected prior to their recruitment as breeding adults. Wallace et al. (in press) present estimates in the range of 0.28 to 0.32 for the relative reproductive value of the neritic juvenile stage of loggerhead sea turtles found stranded along the US Atlantic coast (mean CCL = 78.5, SD = 16.6). Given the similarity in size of these loggerheads to those taken in the sea scallop fishery (mean CCL = 79.2, SD = 11.6), it appears reasonable to use this estimation of reproductive value for immature juvenile turtles taken in the sea scallop fishery. We, therefore, used 0.32 as the estimate for juvenile reproductive value.
5. F_L - Observer reports from the 2003-2005 fisheries suggest that the percentage of loggerhead sea turtles released alive and uninjured was 22.7-25% for scallop dredge gear and 100% for trawl gear (Murray 2004a, 2004b, 2005, 2007). This compares to the 36% and 88.5% used in the Atlantic Sea Scallop FMP Biological Opinion. We, therefore, used 0.227 and 0.885 for dredge and trawl gear, respectively.

Because of the differences in loggerhead captures in the trawl and dredge fisheries, the number of adult female mortalities was estimated separately for each fishery and then combined.

Together this series of adjustments provides an estimate of the annual mortality (in numbers) of US adult female loggerheads caused by the bycatch in the US Atlantic sea scallop fisheries.

Model

The Dennis Model is a density-independent model of population growth, which uses a diffusion approximation to compute the probability of quasi-extinction (i.e., reaching a low threshold population size) in a randomly varying environment:

$$N_{t+1} = N_t \lambda_t$$

Application of the model requires that two key parameter values be estimated to make inferences regarding population growth rates and quasi-extinction risks:

μ – the arithmetic mean of the log population growth rate
 σ^2 – variance of the log population growth rate

Holmes (2001) suggests the use of running sums as a means of reducing bias associated with sampling error and stage-specific counts. We calculated running sums as:

$$R_j = N_i + N_{i+1}$$

where $j=1,2,3 \dots (q-1)$, q is the number of censuses in dataset, N represents the population size, and R_j represents the population size at time j from the running sums. Without using the running sums approach (1 yr intervals), the trend was -0.0063 and the variance was 0.038. We evaluated running sums of 2 yr, 3 yr, and 4 yr to calculate the annual estimate of R_j and found that the 3 and 4 yr running sums produced the same rate of change (-0.0216), which was slightly different from the 2 yr interval (-0.0220). With the smaller variance in the trend for the 3 and 4 yr running sums (0.006 and 0.003, respectively), the result would be that a 3 or 4 yr interval would lead to reduced probabilities of quasi-extinction in 100 yrs. Following our rule of using conservative parameter values, we decided to use a 2 yr interval for the final analysis.

Then μ was calculated as:

$$\mu = (\sum \log(R_{j+1}/R_j))/t$$

Similarly, σ^2 is calculated as the variance over the series of $\log(R_{i+1}/R_i)$ values. The μ and σ^2 are then used to estimate r (the instantaneous rate of change) and λ (Dennis et al. 1991):

$$r = \mu + \sigma^2/2$$

$$\lambda = e^{(r)}$$

Estimation of the extinction risk requires a population size at extinction (N_{ext}). The population size at extinction can assume several values, with 0 equal to the true extinction. Rather than focusing entirely on total extinction ($N_{ext} = 0$), the concept of quasi-extinction risk has been developed (Ginzburg et al. 1982), where quasi-extinction risk is the probability that a

population will fall below a given threshold ($N_{ext} > 0$). There is no generally agreed upon level for quasi-extinction, though it is commonly considered to be a threshold population size below which the population would be critically endangered or effectively extinct. For large vertebrates, a variety of numerical values have been considered for this threshold (e.g., from 20 to 500). We considered using either 50 or 250 adult females as our estimate of quasi-extinction. Our reasons for considering fifty animals were: (1) there is general consensus in the conservation genetics community that large vertebrate populations cannot fall below 50 breeding animals and still maintain genetic integrity (Shaffer 1981; Franklin 1980), (2) the International Union for Conservation of Nature (IUCN)(2008) considers this to be one of the two threshold numerical values for a “critically endangered” population category, and (3) to provide comparability with the value used in the 2004 Pacific sea turtle bycatch PVA prepared by Snover (2005). IUCN uses 250 mature animals as an alternative threshold value for “critically endangered” populations when there is evidence of a population decline. Given the apparent decline in nesting in the southeastern United States, it appears reasonable to use 250 as our threshold value for quasi-extinction. The IUCN includes all mature animals in this value and not just adult females, so using 250 adult females as the threshold provides a doubly conservative threshold.

Morris and Doak (2002) describe the probability of reaching a quasi-extinction threshold (N_{ext}) by using the following function:

$$g(t|\mu, \sigma^2, d) = \frac{d}{\sqrt{2\pi\sigma^2 t^3}} \exp\left[\frac{-(d + \mu t)^2}{2\sigma^2 t}\right]$$

with $d = \log(N_0/N_{ext})$, and N_0 is the population size at the beginning of the analysis period. To calculate the total probability of reaching N_{ext} at some future time T , the cumulative distribution function (which is the preceding function integrated from $t = 0$ to T) is applied:

$$G(T|\mu, \sigma^2, d) = \exp\left[\frac{-2\hat{\mu}d}{\hat{\sigma}^2}\right] \Phi\left[\frac{-d + \hat{\mu}T}{\sqrt{\hat{\sigma}^2 T}}\right] + \Phi\left[\frac{-d - \hat{\mu}T}{\sqrt{\hat{\sigma}^2 T}}\right]$$

where $\Phi(z)$ is the standard normal cumulative distribution function (Morris and Doak 2002).

Morris and Doak (2002) outlined an approach for deriving the quasi-extinction time cumulative distribution function confidence intervals by using bootstrap estimation procedures. We used a similar approach, sampling from a random distribution drawn from within the 95% confidence interval for μ and σ^2 and replicated 1000 times to estimate the confidence intervals around the cumulative probability of reaching N_{ext} at some future time T .

Modeling Steps

The base model (with fisheries bycatch) was run over a 1,000 yr period with the estimates of μ , σ^2 , N_0 beginning in 2005 and quasi-extinction threshold of 250 adult female loggerheads (Dennis et al. 1991; Holmes 2001; Morris and Doak 2002; Snover 2005). The 1,000 year time horizon was necessary so that we could determine the median time to extinction. Quasi-extinction likelihoods were then bootstrapped under baseline conditions to derive confidence

intervals. The μ for each bootstrap iteration was drawn from a normally distributed random sampling of μ values lying within the 95% confidence interval around the original μ .

The model was modified to add back in the annual loggerhead bycatch in the Atlantic sea scallop fisheries. First, we adjusted the annual estimated bycatch in the fisheries (dredge and trawl) of loggerhead sea turtles for all age and sex classes to derive an estimate of total adult females removed from the population. We then calculated the rate of adult female removals for 2005 by dividing the bycatch by the total adult female population in 2005. This rate was then added into the population instantaneous growth rate (r) for each year from 1989 to 2005, and a revised μ and σ^2 was calculated. The model (without fishery bycatch) was then run with the revised estimates of μ , σ^2 , and N_0 . We bootstrapped quasi-extinction likelihoods under the new model's conditions to derive confidence intervals.

Evaluation of Results

The primary metric we used to compare the results of the two PVAs (with and without the fishery mortalities) was the cumulative probability of quasi-extinction at 100 years (based on recommendations on acceptable risk of extinction in DeMaster et al. 2004). Secondary metrics included the number of bootstrap replicates with a probability of extinction > 0.05 in 100 years and the median times to extinction³. We analyzed the sensitivity of the 1989-2005 model to changes in the population trend by comparison with the trend from 1996-2005. We also compared extinction probabilities at take levels that were two and ten times the documented levels of takes in the sea scallop fisheries.

RESULTS

Population Trends to Present

Loggerhead nest counts from the Northern and Peninsular subpopulations were summed (Fig. 1) and analyzed to develop the annual rates (λ) of population change for 1989-2005 (Table 1). The trend ($\mu = -0.022$, $\sigma^2 = 0.012$, Table 2) for 1989-2005 for the US Atlantic Ocean loggerhead adult female population suggests the adult female population is declining.

We used an estimate of 58,602⁴ nests in 2005 in the southeastern United States (North Carolina to Alabama). This produced an estimate of 34,881 adult females when adjusted for nests per female (4.2 nests per female) and remigration interval (2.5 years).

The annual sea scallop fisheries bycatch mortality of adult female loggerheads was estimated to be 102 turtles (97 in the dredge fishery and 5 in the trawl fisheries). This estimate was derived from the total annual take of 619 loggerheads prorated for area of origin (0.930 from United States), maturity (0.833 immature), female proportion (0.67), reproductive value of juveniles (0.32), and fishery specific mortality (dredge = 0.773 and trawl = 0.115).

Given the 2005 population estimate of 34,881 adult females and a fishery-induced mortality of 102 adult females per year, the rate of adult female removals in the sea scallop

³ The time when the quasi-extinction probability is 0.50

⁴ This includes 2005 counts for all beaches in the Northern (NC = 560, SC = 4,233, GA = 1,145 nests) and Peninsular Florida (51,636 nests) subpopulations and index beaches in the Dry Tortugas (159 nests) and Northern Gulf (869 nests) subpopulations (NMFS in review; FWRI 2007; SCDNR 2007).

fishery was 0.0029 in 2005. These mortalities were added back into the population to produce a revised 1989-2005 μ of -0.019 ($\sigma^2 = 0.012$, Table 2).

Viability Analyses

Using the 1989-2005 model, the risk of quasi-extinction ($N_{ext} = 250$ adult females) at 100 years was 0.01 (Table 2, Fig. 2) with a median time to extinction of 207 years (Table 2). Over 1000 iterations of the model, 258 produced a probability of extinction at 100 years greater than 0.05.

Adding the Atlantic sea scallop fisheries-related loggerhead mortalities back into the population had only a small effect on population trajectory and extinction probabilities. The μ was -0.022 and -0.019 for the analyses with and without the fishery takes. The risk of quasi-extinction at 100 years remained 0.01 (Table 2, Fig. 3). The median time to extinction grew to 240 years (Table 2). Over 1000 iterations of the model, 178 produced a probability of extinction at 100 years greater than 0.05.

Results of the two analyses were similar (Table 2, Fig. 4). Both had quasi-extinction probabilities of zero (0) at 25, 50, and 75 and a probability of 0.01 at 100 years. Median times to quasi-extinction were similar (207 years versus 240 years). The number of simulations with extinction probabilities at 100 years greater than 0.05 was 258 and 178, respectively.

Model Sensitivity

An incorrect estimate of the population trend would significantly affect the model results. Therefore, we repeated this analysis with just the 1996-2005 time series. While this would generally be considered to be too short a time series for analysis, it does provide some insight into the capability of the model to detect risk of extinctions.

Loggerhead nest counts from all four subpopulations were summed (Table 3) and analyzed to develop the annual rates (λ) of population change for 1996-2005 (Table 4). The trend ($\mu = -0.049$, $\sigma^2 = 0.011$, Table 2) for 1996-2005 for the US Atlantic Ocean loggerhead adult female population suggests even more strongly than the 1989-2005 analysis that the adult female population is declining. Again with the 2005 population estimate of 34,881 adult females and a fishery-induced mortality of 102 adult females per year, the rate of adult female removals in the sea scallop fishery was 0.0029 in 2005. These mortalities were added back into the population to produce a revised 1996-2005 μ of -0.046 ($\sigma^2 = 0.011$, Table 4).

There was little difference between the 1996-2005 analyses with and without the sea scallop fisheries mortalities (Tables 4, Fig. 5). The population trend remains similar; μ equals 0.049 and 0.046 for the two analyses. Cumulative probabilities of extinction are identical up until approximately the 75th year, and the median times to extinction were very similar for both 1996-2005 models (i.e., 98 versus 102 years). The number of simulations with extinction probabilities at 100 years greater than 0.05 was 940 and 922, respectively.

We also evaluated the model's sensitivity to changes in fishery mortality rates. Given that the 1989-2005 model showed probabilities of extinction at 100 years equal to zero for both the original model and the model with takes added back in, it was necessary to use the 1996-2005 model for this evaluation. We compared the results of adding the loggerhead mortalities caused by the Atlantic sea scallop fisheries (102 adult females) with adding back in mortalities that were two and ten times greater than that observed in the sea scallop fisheries (Fig. 6).

Ultimately, it appears that the probability of extinction at 100 years would be reduced to zero if ten times the number of adult females estimated to be taken by the Atlantic sea scallop fisheries were added back to the population.

DISCUSSION

These results suggest that mortalities of loggerhead sea turtles in the US Atlantic sea scallop dredge and trawl fisheries are detectable but have a relatively small effect on the trajectory of the adult female components of the WNA loggerhead sea turtles over the next 100 years. The 1989-2005 population trends, with and without the mortalities, were not significantly different, and the probability of reaching the quasi-extinction threshold (250 adult females) under both scenarios was 0.01. Median times to extinction for both were greater than 200 years. The only obvious difference was in the number of bootstrap simulations with a probability of extinction > 0.05 in 100 years.

The relatively large population size of adult females (34,881), the relatively small negative trend in the adult female population over 1989-2005 ($r = -0.022$ per year), and the number of adult female mortalities in the fisheries (102 per year) all contribute to the lack of effect. This lack of impact occurred despite the use, wherever possible, of values which generated the greatest consequence of the sea scallop fisheries takes of loggerheads. If less stringent values had been used, the effect would have been less. Patterson and Murray (2008) provide commentary on the effect that application of the precautionary principle to a PVA may have on “robust inference” and defensible policy.

Even a model as simple as the Dennis model is sensitive to parameter values and data inputs. Values calculated or selected for μ , N_{ext} , and σ^2 were all influential. With respect to μ , we found that relatively small changes in the population trend produced profound changes in the probability of quasi-extinction at 100 years. For example, doubling the rate of decline in the base model (from -0.022 to -0.049) greatly increased the probability of extinction at 100 years from 0.01 to 0.54. In contrast, the level of bycatch mortality value removed from the population would need to be much greater than that observed in the sea scallop fisheries to have a major effect on the population trajectory. The comparison of the effect of different background mortalities (Fig. 6) suggests that up to ten times the level of loggerhead mortality in the sea scallop fisheries needs to be removed to stabilize the population. This small effect is important in that it suggests the relatively steep declining trend for 1996-2005 is being driven by some other, larger source of mortality.

Recognizing the influence of the population trend to the analysis, it is important to point out our assumption that the nesting beach data used in this analysis were representative of trends of the US loggerhead population. This was a practical decision; only the index beaches are counted annually in a systematic fashion. However, there is a risk in this assumption. We noted earlier the problem of juvenile in-water counts being at odds with the nesting trends. There is also some concern about the representativeness of the nest counts. If loggerhead nesting shifts systematically between years (either inside or outside of the index beach areas), then trends in the index nesting beach data may not represent the overall trend. For example, if loggerhead nesting is becoming more aggregated at the index sites (because of issues such as habitat protection), then the estimates may be biased high. Alternatively, if turtles nest outside of the time period (for example, earlier nesting caused by warmer climate conditions), then the index site estimates would be biased low. Work underway by the loggerhead TEWG and Florida's

Fish and Wildlife Research Institute will provide a substantive review of these trends. Our focus here was with evaluating the impact of the bycatch mortality in the Atlantic sea scallop fisheries on the future of the loggerhead population, and the impact of such biases on our analysis are likely immaterial. These biases could, however, significantly influence an analysis of population status and perhaps result in inappropriate management decisions.

The quasi-extinction value selected was also influential, but not as dramatically as the population trend. We evaluated N_{ext} values of 50 and 250 adult females. With the 1989-2005 base model, the probabilities of extinction at 100 years were 0.00 and 0.01 for 50 and 250 animals, respectively. Larger differences were observed in the 1996-2005 base model, where the values were 0.07 and 0.42 respectively. The latter, larger effect is likely due to the increased negative population trend. We also considered using the percent of decline approach suggested by Snover and Heppell (in press). We estimated the probability of reaching 50% of the current population size. Although risks of reaching the threshold were much higher (0.97 and 0.95 in 100 years) than with the 50 or 250 animal threshold, there were no significant differences between the base model and the model with takes added back in. Ultimately, we decided to use an absolute value of $N_{ext} = 250$ adult females largely because this analysis was designed to evaluate the risk of extinction resulting from mortalities in the scallop fisheries, and 250 animals better represents a threshold extinction value than does 50% of the current population size ($N_{ext} = 17,441$ adult females).

The model is also sensitive to changes in the variance; as the variance increases, the probability of extinction at any point in time increases, and as the variance decreases, probabilities of extinction decrease. Here it was assumed that the variance in the population trend is largely the same with and without the sea scallop fishery takes. Violations of this assumption would not change the interpretation of the sea scallop fisheries impacts, unless the take estimates were much higher relative to the population size and the variance in the takes was large.

However, the largest issue with variance was not the influence on the outcome but the difficulty of providing meaningful tests of significance with large confidence intervals. Using bootstrap techniques produced much tighter confidence intervals, but trajectories would need to vary considerably to find statistical differences.

Finally, this analysis was undertaken to provide a simple evaluation of the effect that loggerhead bycatch in the Atlantic sea scallop fisheries could have on the future viability of the WNA loggerhead population. It was not designed to and should not be used to evaluate population status. For example, here we implicitly assume that adult female recruitment will not change in the future. This is a particularly troublesome assumption because there are data suggesting that the number of juvenile loggerhead sea turtles is increasing (e.g., Epperly et al. 2007). If the increase in juvenile abundance translates into increased adult female recruitment, then our estimates of extinction probabilities would be overestimated; however, the relationship between the models with and without fishery takes would not be fundamentally changed. A staged matrix model, incorporating age-class survival and fecundity, would provide a much better evaluation tool to assess population status (and fishery impacts).

An example of such an evaluation is provided by the US Fish and Wildlife Service's (USFWS) recent quantitative threats analysis for the Florida manatee (*Trichechus manatus latirostris*; Runge et al. 2007). The basis of this threats assessment is a comparative population viability analysis, which involves forecasting the Florida manatee population under different scenarios regarding the presence of threats, while accounting for process variation

(environmental, demographic, and catastrophic stochasticity) and parametric and structural uncertainty. Several steps were required: modifying an existing population model to accommodate the threats analysis framework, updating survival rates, estimating the fractions of mortality from various causes, modeling the threats themselves, and developing metrics to measure the impact of the threats. While the conceptual process followed in our analysis of loggerhead sea turtles and that used by the USFWS are similar, the additional information available from the USFWS exercise results from a stage-based projection model for Florida manatees, incorporating environmental and demographic stochasticity, catastrophes, density-dependence, and long-term change in carrying capacity.

However, recent data to support such an analysis of loggerhead sea turtles are incomplete. A comprehensive program to collect these data should be developed and implemented so that scientific analyses, such as those presented here, can be improved and the best possible scientific advice can be provided to NOAA managers tasked with conserving both turtle populations and fisheries.

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Table 1. Counts of loggerhead sea turtle (*Caretta caretta*) nests at index beaches for 1989-2005 by subpopulation, biannual totals, and rates of change (λ and r) by year (NMFS in review, FWRI 2007).

Year	Northern (NC, SC, GA)	Peninsular Florida	Total (N_i)	Two-year Running Sum (R_j)	Rate of Change (λ)	Inst. rate of change (r)
1989	1,421	39,091	40,512			
1990	2,466	50,266	52,732	93,244		
1991	2,127	52,802	54,929	107,661	1.1546	0.14377
1992	1,844	47,567	49,411	104,340	0.9692	-0.0313
1993	931	41,808	42,739	92,150	0.8832	-0.1242
1994	2,207	51,168	53,375	96,114	1.0430	0.04212
1995	1,484	57843	59,327	112,702	1.1726	0.15921
1996	1,969	52811	54,780	114,107	1.0125	0.01239
1997	1,100	43156	44,256	99,036	0.8679	-0.1417
1998	1,812	59918	61,730	105,986	1.0702	0.06782
1999	2,173	56471	58,644	120,374	1.1358	0.1273
2000	1,475	56277	57,752	116,396	0.9670	-0.0336
2001	1,242	45941	47,183	104,935	0.9015	-0.1037
2002	1,543	38125	39,668	86,851	0.8277	-0.1891
2003	1,998	40726	42,724	82,392	0.9487	-0.0527
2004	549	29547	30,096	72,820	0.8838	-0.1235
2005	1,766	34872	36,638	66,734	0.9164	-0.0873

Table 2. Model results based on 1989-2005 2-year running sum trend with a starting population size of 34,881 adult female loggerhead sea turtles (*Caretta caretta*) and quasi-extinction threshold equal to 250 adult females for base model and model with Atlantic sea scallop (*Placopecten magellanicus*) fishery takes added back into population.

	Base Model	With Fishery Takes Added Back In
Population Trend	-0.022	-0.019
Variance of trend	0.012	0.012
Upper confidence limit	0.039	0.042
Lower confidence limit	-0.084	-0.080
Quasi-extinction risk with 95% confidence interval in parentheses		
@ 25 years	0.00 (0, 0)	0.00 (0, 0)
@ 50 years	0.00 (0, 0)	0.00 (0, 0)
@ 75 years	0.00 (0, 0.09)	0.00 (0, 0.02)
@ 100 years	0.01 (0, 0.46)	0.01 (0, 0.31)
Median time to extinction	207 years	240 years

Table 3. Counts of loggerhead sea turtle (*Caretta caretta*) nests at index beaches for 1996-2005 by subpopulation, biannual totals, and rates of change (λ and r) by year (NMFS in review, FWRI 2007). Number in italics were interpolated from adjacent counts.

Year	Northern (NC, SC, GA)	Peninsular Florida	Dry Tortugas (Florida)	Northern Gulf (FL, AL)	Total (N_i)	Running sum (R_j)	Rate of change (λ)	Inst. rate of change (r)
1996	1,969	52,811	249	166	55,195			
1997	1,100	43,156	258	166	44,680	99,875		
1998	1,812	59,918	249	149	62,128	106,808	1.0694	0.0671
1999	2,173	56,471	292	235	59,171	121,299	1.1357	0.1272
2000	1,475	56,277	242	181	58,175	117,346	0.9674	-0.0331
2001	1,242	45,941	213	143	47,539	105,714	0.9009	-0.1044
2002	1,543	38,125	210	149	40,027	87,566	0.8283	-0.1883
2003	1,998	40,726	208	95	43,027	83,054	0.9485	-0.053
2004	549	29,547	159	114	30,369	73,396	0.88371	-0.1236
2005	1,766	34,872	159	120	36,917	67,286	0.91675	-0.0869

Table 4. Model results based on 1996-2005 2-year running sum trend with a starting population size of 34,881 adult female loggerhead sea turtles (*Caretta caretta*), and quasi-extinction threshold equal to 250 adult females for base model and model with Atlantic sea scallop (*Placopecten magellanicus*) fishery takes added back into population.

	Base Model	With Fishery Takes Added Back In
Population trend	-0.049	-0.046
Variance of trend	0.011	0.011
Upper confidence limit	0.037	0.040
Lower confidence limit	-0.135	-0.1322
Quasi-extinction risk with 95% confidence interval in parentheses		
@ 25 years	0.00 (0, 0)	0.00 (0, 0)
@ 50 years	0.00 (0, 0.03)	0.00 (0, 0.02)
@ 75 years	0.10 (0, 0.67)	0.06 (0, 0.57)
@ 100 years	0.54 (0.02, 0.98)	0.42 (0.01, 0.996)
Median time to extinction	98 years	102 years

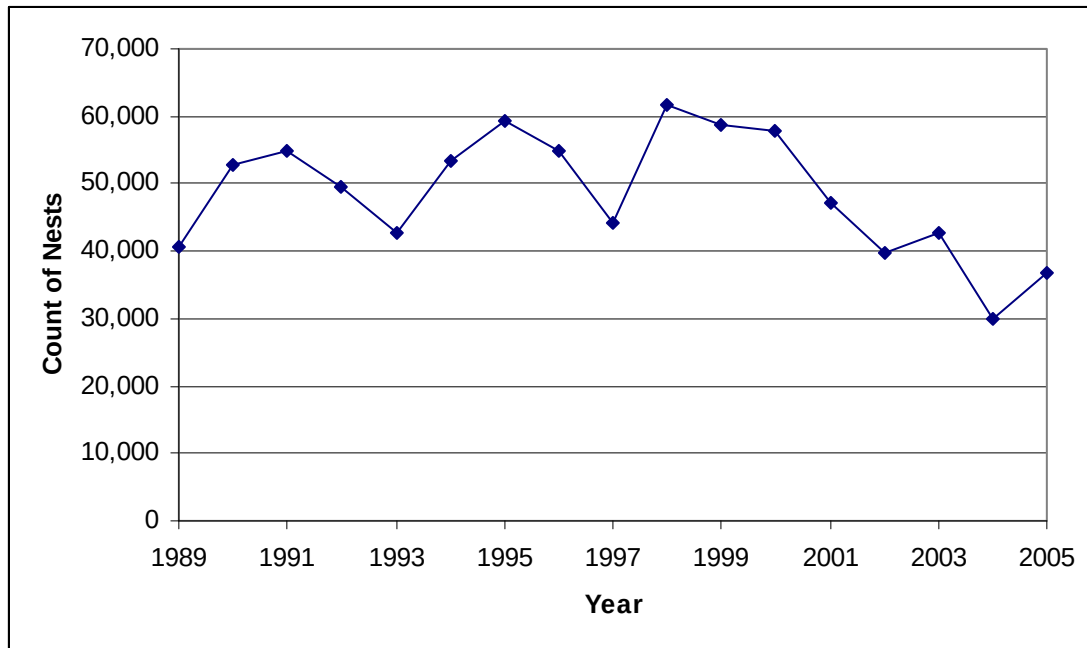


Figure 1. Number of Atlantic Ocean loggerhead sea turtle (*Caretta caretta*) nests recorded at US Northern (NC, SC, GA) and Peninsular Florida index beaches from 1989 to 2005 (NMFS in review, FWRI 2007).

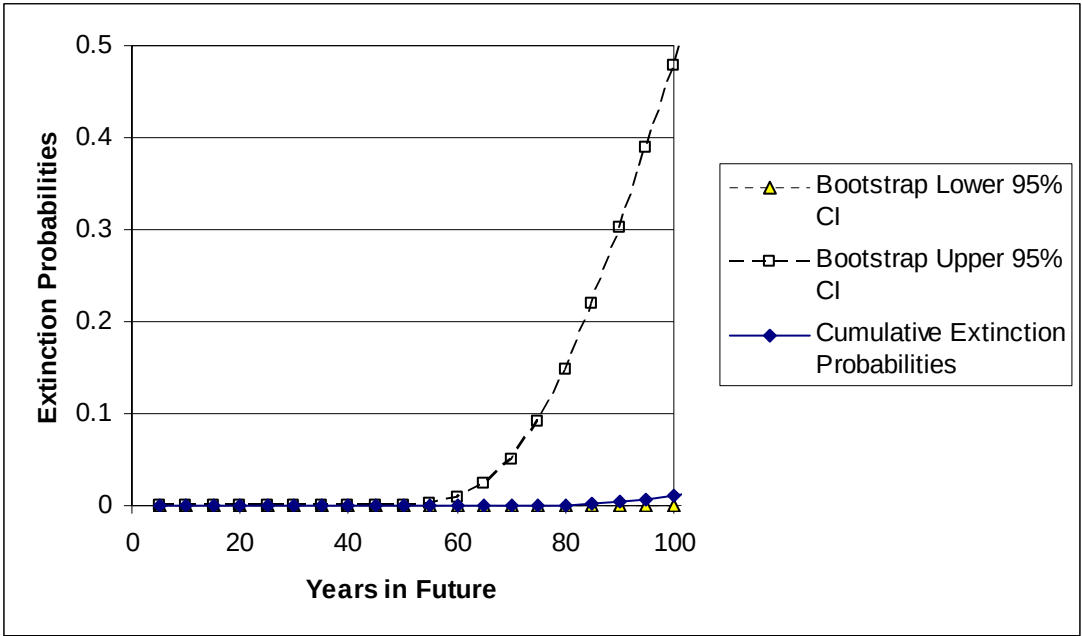


Figure 2. Cumulative quasi-extinction probabilities and confidence intervals (CI) for 1989-2005 base model with Atlantic sea scallop (*Placopecten magellanicus*) fishery takes for adult female western North Atlantic loggerhead sea turtles (*Caretta caretta*). Quasi-extinction is equal to 250 adult female loggerhead sea turtles.

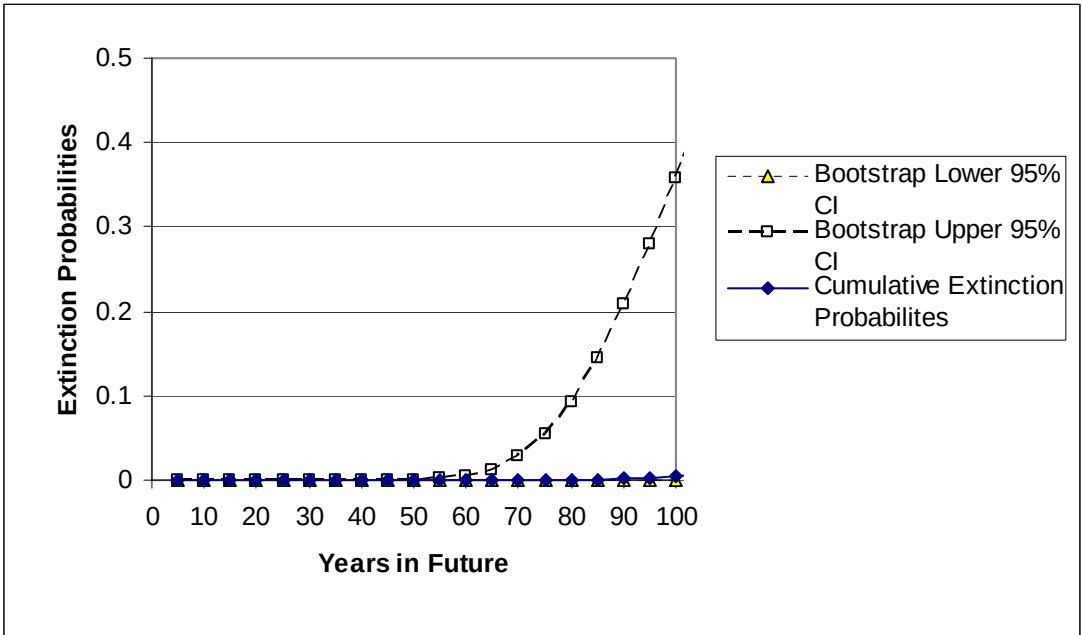


Figure 3. Cumulative quasi-extinction probabilities and confidence intervals (CI) for 1989-2005 model with Atlantic sea scallop (*Placopecten magellanicus*) fishery takes for adult female western North Atlantic loggerhead sea turtles (*Caretta caretta*) added back into population. Quasi-extinction is equal to 250 adult female loggerhead sea turtles.

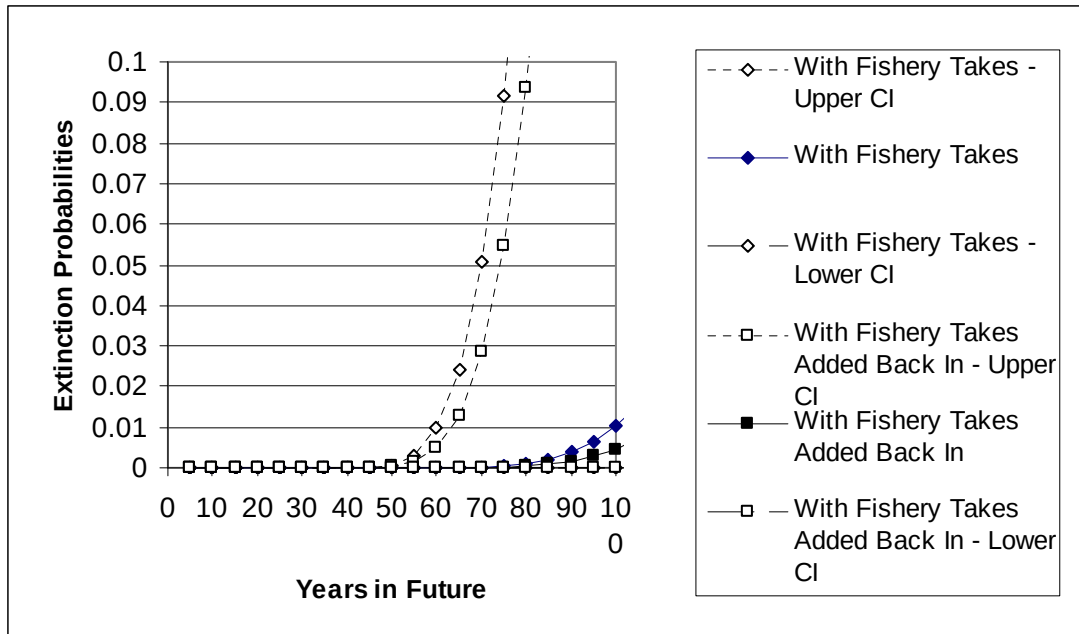


Figure 4. Comparison of cumulative quasi-extinction probabilities and confidence intervals (CI) of 1989-2005 models with and without Atlantic sea scallop (*Placopecten magellanicus*) fishery takes. Quasi-extinction is equal to 250 adult female loggerhead sea turtles (*Caretta caretta*). Note vertical scale runs only through $P_{EX} = 0.10$.

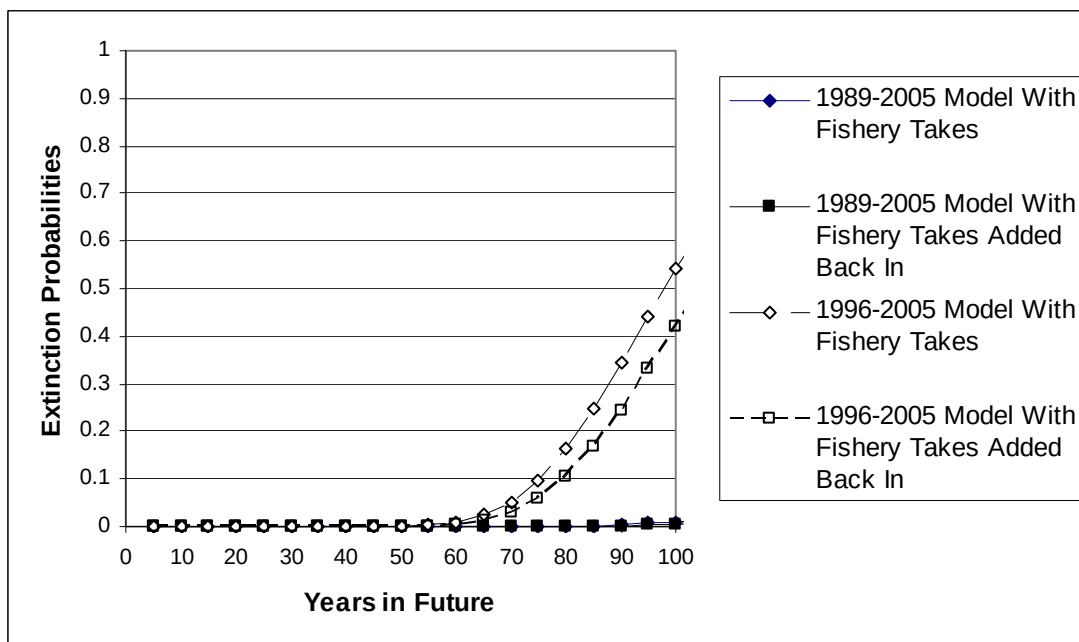


Figure 5. Extinction trajectories for models with and without Atlantic sea scallop (*Placopecten magellanicus*) fishery takes with original 1989-2005 population trajectory compared to 1996-2005 trajectory. Quasi-extinction is equal to 250 adult female loggerhead sea turtles (*Caretta caretta*).

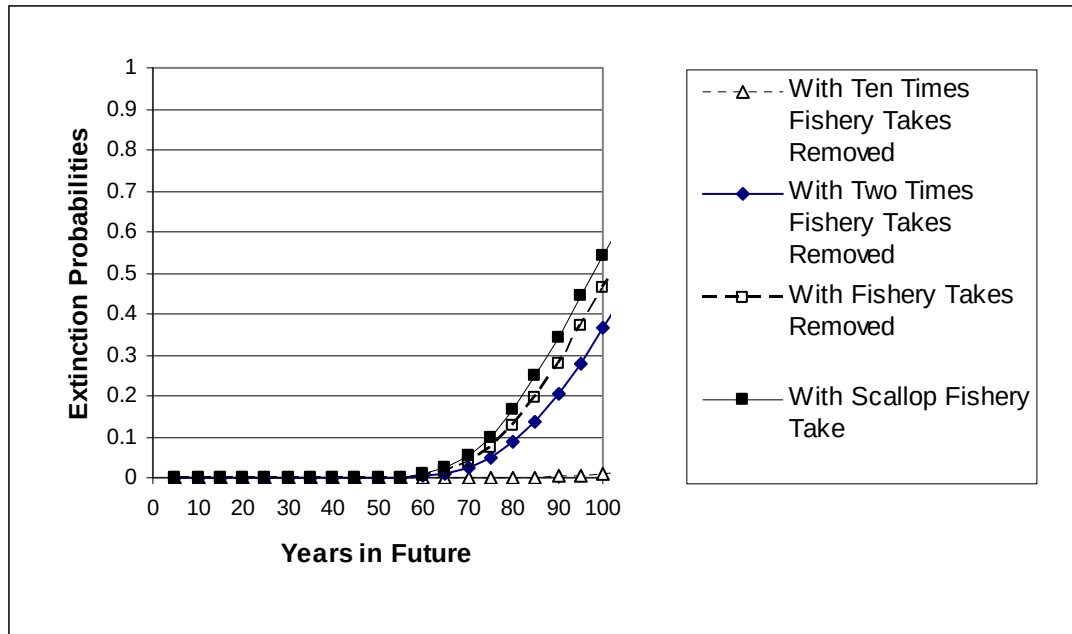


Figure 6. Cumulative quasi-extinction probabilities for 1996-2005 models with various levels of mortality removed from the trend. Fishery takes estimated as one time (the Atlantic sea scallop [*Placopecten magellanicus*] fisheries) versus two and ten times the original sea scallop fishery take level. Quasi-extinction equal to 250 adult females loggerhead sea turtles (*Caretta caretta*).

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EXHIBIT 7

EXHIBIT D

FINAL ENVIRONMENTAL IMPACT STATEMENT,
REGULATORY IMPACT REVIEW, AND
FINAL REGULATORY FLEXIBILITY ANALYSIS
FOR AMENDING
THE ATLANTIC LARGE WHALE TAKE REDUCTION PLAN:
RISK REDUCTION RULE
VOLUME I



*Images collected under MMPA Research permit number MMPA 775-1875 Photo Credit:
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National Marine Fisheries Service National Oceanic and Atmospheric Administration
DEPARTMENT OF COMMERCE

Prepared by: NOAA's National Marine Fisheries Service and Industrial Economics, Incorporated
Final EIS: June 2021

RESPONSIBLE AGENCY:

Assistant Administrator for Fisheries
National Oceanic and Atmospheric Administration
U.S. Department of Commerce Washington, DC 20235

PROPOSED ACTION:

Implementation of amendments to the Atlantic Large Whale Take Reduction Plan to reduce the risk of serious injury and mortality to Atlantic large whales due to incidental interactions with commercial fishing gear from Maine through Rhode Island and the Northeast portion of LMA 3.

ABSTRACT:

The Atlantic Large Whale Take Reduction Plan (ALWTRP) was developed pursuant to Section 118 of the Marine Mammal Protection Act to reduce the serious injury and mortality of right, humpback, and fin whales due to incidental interactions with commercial fisheries. NMFS is preparing a Draft Environmental Impact Statement for the proposed amendments to the ALWTRP regulations (50 CFR 229.32). The proposed gear set modifications are designed to further reduce the risk and severity of serious injury and mortality to Atlantic large whales due to incidental interactions with commercial fishing gear.

TYPE OF STATEMENT:

() DRAFT (X) FINAL

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CHAPTER 1 INTRODUCTION AND EXECUTIVE SUMMARY

The Atlantic Large Whale Take Reduction Plan (ALWTRP or Plan) includes measures to reduce the impacts of U.S. fixed gear fisheries on three large whale species – North Atlantic right whales (hereafter referred to as right whales), humpback whales, and fin whales, as well as on minke whales. The Plan consists of both regulatory and non-regulatory measures that, in combination, were designed to reduce the risk of serious injury and death caused by entanglement in commercial fishing gear to a rate below each species potential biological removal level (PBR), prescribed by the Marine Mammal Protection Act (MMPA) as the maximum number of animals that can be removed annually while allowing a marine mammal stock to reach or maintain its optimal sustainable population level. Since the Plan's implementation in 1997, the Plan has been modified on several occasions to address the risk of large whale entanglement in gear employed by commercial fixed gillnet and trap/pot fisheries. In light of a low population level and persistent mortalities and serious injuries caused by incidental entanglements at rates above the right whale's PBR, most of the Plan's regulatory measures were designed to reduce the risk of fisheries to right whales, with collateral benefits to humpback and fin whales. The National Marine Fisheries Service (NMFS) intends to modify the Plan, including additional regulatory requirements, to further reduce the risk of entanglement related mortalities and serious injuries of right whales in the Northeast Region Trap/Pot Management Area (Northeast Region) lobster and Jonah crab trap/pot gear.

This Final Environmental Impact Statement (FEIS) evaluates the biological, economic, and social impacts of alternatives for modifying the Plan, including NMFS' Preferred Alternative and the Final Rule that would implement that alternative. The biological impacts to large whales from ongoing or reasonably foreseeable complementary risk reduction measures are also analyzed for their contribution toward right whale incidental entanglement risk reduction. Those include trap limits and other measures being implemented to manage the lobster fishery, as well as measures that will be implemented in Maine exempted areas by the state of Maine and in Massachusetts state waters by the state of Massachusetts.

The discussion that follows briefly summarizes the FEIS content and key findings. Specifically:

- Section 1.1 provides information on the status of Atlantic large whale species and the nature of entanglements;
- Section 1.2 describes current ALWTRP requirements, as well as the requirements of the state measures, reasonably foreseeable fishery management measures, and new regulatory alternatives considered in this analysis;
- Section 1.3 summarizes the conclusions of the biological, economic, and social impact analyses and identifies NMFS' preferred federal regulatory alternative;
- Section 1.4 discusses areas of controversy that may influence interpretation of the report's findings; and
- Section 1.5 describes the organization of the report's remaining chapters.

1.1 Status of Large Whales and the Nature of Entanglements

Right whales (*Eubalaena glacialis*) and fin whales (*Balaenoptera physalus*) are listed as endangered species under the Endangered Species Act, and are, therefore, considered strategic stocks under the Marine Mammal Protection Act (MMPA). Section 118(f)(1) of the MMPA requires the preparation and implementation of a Take Reduction Plan for any strategic marine mammal stock that interacts with Category I or II fisheries. A Category I fishery is one in which the human-caused mortality and serious injury rate of a strategic stock is greater than or equal to 50 percent of the stock's PBR—defined under the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. A Category II fishery is one in which the mortality and serious injury rate of a strategic stock is greater than one percent but less than 50 percent of the stock's PBR. A strategic stock is one that is listed as threatened or endangered under the ESA or designated as depleted under the MMPA, is declining and likely to be listed within the foreseeable future, or is one for which human-caused mortality exceeds PBR.

Because right whales and fin whales interact with Category I and II fisheries, under the MMPA a Take Reduction Plan is required to assist in their recovery. The measures identified in the Plan are also beneficial to the Gulf of Maine humpback whale (*Megaptera novaeangliae*) population and Canadian east coast stock of minke whales (*Balaenoptera acutorostrata*). Humpbacks were intentionally protected by the Plan because they were listed as endangered until 2016, when the Gulf of Maine stock was considered sufficiently recovered to be removed from ESA listing. Currently neither species is listed as endangered or threatened under the ESA, or considered a strategic stock under the MMPA.

The status of each of these species is discussed in Chapter 4 and summarized below.

- **Right Whale:** The western North Atlantic right whale (*Eubalaena glacialis*) is one of the rarest of all large cetaceans and among the most endangered species in the world. The most recent population model estimates a population size of 368 as of 2019 (Pace 2021). Pettis et al. (2021) gives an estimate of 356 in 2020 removing known mortalities since the latest population estimate used in the report (366). Since 2019, there have been 10 additional documented mortalities or serious injuries. NMFS believes that the stock is well below the optimum sustainable population, especially given apparent declines in the population; as such, the stock's PBR has been set to 0.8 (Pace et al. 2017, Hayes et al. 2020, Pettis et al. 2021, Pace 2021).
- **Humpback Whale:** As noted above, the North Atlantic humpback whale (*Megaptera novaeangliae*) is no longer listed as an endangered species under the ESA but is still protected under the MMPA. For the Gulf of Maine stock of humpback whales, the best population size is 1,396 and the minimum population size is 1,380 at the end of 2017, and has established a PBR of 22 whales per year (Hayes et al. 2020).
- **Fin Whale:** NMFS has designated one population of fin whale (*Balaenoptera physalus*) as endangered for U.S. waters of the North Atlantic, although researchers debate the

possibility of several distinct subpopulations. NMFS estimates a best population size of 7,418 at the end of 2017, a minimum population size of 6,029, and PBR of 12 (Hayes et al. 2020)

- **Minke Whale:** As previously noted, the minke whale (*Balaenoptera acutorostrata*) is not listed as endangered or threatened under the ESA. The best estimate of the population of Canadian east coast minke whales is 24,202 at the end of 2017, with a minimum population estimate of 18,902 and PBR of 189 (Hayes et al. 2020).

Range-wide, Atlantic large whales are at risk of becoming entangled in fishing gear because the whales feed, travel, and breed in many of the same ocean areas utilized for commercial fishing. Fixed fishing gear such as traps and pots and fixed gillnets are set and fished continuously, using vertical lines that connect buoys at the surface to gear set on the bottom. While fishing gear is in the water, whales may become incidentally entangled in the lines and the nets that make up trap/pot and gillnet fishing gear. The effects of entanglement can range from no permanent injury to some scarring, or serious injury or death. While any interaction would be considered a “take” under both the ESA and the MMPA, the takes counted against PBR are those that cause mortalities and serious injuries.

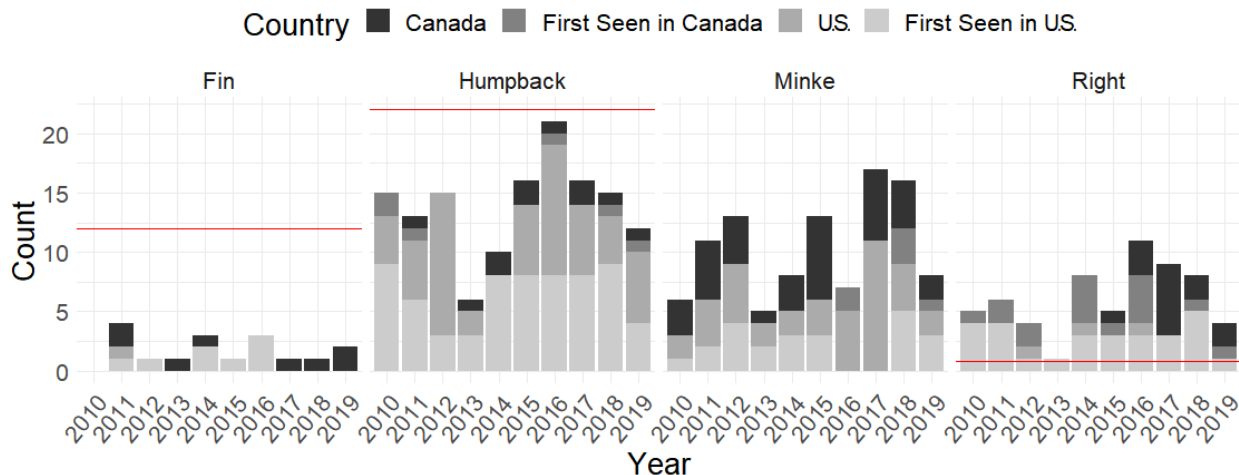


Figure 1.1: Entanglements that resulted in mortality of serious injury, according to the country of origin or country where the incident was first sighted. Incidents with prorated injuries and where serious injury was averted by disentanglement response are included as mortalities and serious injuries. The red line represents the current potential biological removal level (PBR) for the stock (PBR for minke whales is 189 and not pictured due to scale).

Figure 1.1 summarizes all mortality, serious injuries, and serious injuries averted through disentanglements of right, humpback, fin, and minke whales from entanglements between 2010 through 2019 documented in U.S. and Canadian waters, compared to PBR for each species as shown by the red line. Note that Canada prioritizes documentation of right whale interactions but other species are likely underreported. Over this period, documented minke whale mortalities and serious injuries have been higher than the other large whale species (287), followed by humpback (268), right (89), and fin whales (67). Of all large whale species, only right whale serious mortalities and injuries exceed PBR nearly every year. As Figure 1.1 illustrates, PBR has been exceeded in every year except for one (2013) considering only entanglements in U.S. gear or entanglements first seen in U.S. waters since 2010. Actual mortalities and serious injuries of

right whales in U.S. fisheries are likely higher than the number observed in the Stock Assessment Reports, with an estimated 64 percent of all mortalities going undetected between 1990 and 2017 (Pace et al. 2021). That is, despite modifications to the Plan (notably including the use of sinking groundlines effective in 2009; efforts to reduce the number of vertical buoy lines and an expansion of the Massachusetts Restricted Area (MRA), effective in 2014 and 2015) mortalities and serious injuries of right whales in U.S. gear and first seen in the U.S. at levels above PBR persist.

In this same timeframe, between 2009 and 2017, Pettis et al. (2018a) observed an increased calving interval from an average of four to 10 years. Recent low birth rates are an increasing concern for right whale recovery, with the detection of only 5 births in 2017 (Pettis et al. 2018b), no births in 2018 (Pettis et al. 2018a), only 7 births in 2019 (Pettis et al. 2020), and 10 births in 2020 (Pettis et al. 2021). During the 2020/2021 calving year there were 17 live calves documented in 2021 (B. Zoodsma pers. comm.). While the number of births is encouraging, it is lower than would have been forecasted from the large number of calves born over a decade ago and follows persistent low birth years that are insufficient to counteract current population mortality rates (Pace 2021), increasing concern regarding current levels of entanglement mortality. Many factors could explain the low birth rate, including poor female health (Rolland et al. 2016, Christiansen et al. 2020) and reduced prey availability (Meyer-Gutbrod et al. 2015, Johnson et al. 2018, Meyer-Gutbrod et al. 2018, Meyer-Gutbrod and Greene 2018). Entanglement in fishing gear also can have substantial health and energetic costs that affect both survival and reproduction (Robbins et al. 2015, Pettis et al. 2017, Rolland et al. 2017, van der Hoop et al. 2017, Hayes et al. 2018a, Hunt et al. 2018, Lysiak et al. 2018, Christiansen et al. 2020).

An obvious change during this period is the increase in entanglement related mortalities and serious injuries in Canadian gear or first seen in Canada. Since 2010, there has been a documented change in right whale prey distribution that has shifted right whales into new areas with nascent risk reduction measures, increasing documented anthropogenic mortality (Plourde et al. 2019, Record et al. 2019). As described in Chapters 4 and 8, mortalities and serious injuries by ship strike in Canada and the U.S. have also been documented in recent years. During a period of lower calving rates, a sharp increase in mortalities and serious injuries by ship strike and entanglements in Canadian waters, and persistent mortalities and serious injuries of right whales above PBR in U.S. waters, is not sustainable.

The primary purpose of the alternatives analyzed in this FEIS is to reduce mortality and serious injury by entanglements in U.S. Northeast Region lobster and Jonah crab trap/pot gear to below PBR. The vast majority of buoy lines along the east coast belong to lobster and crab trap/pot fisheries in northeast waters. The 2017 IEC Line Model, which was developed to estimate the number of buoy lines fished by fisheries managed under the Plan (documentation in Appendix 5.1), estimated 93 percent of the buoy lines in U.S. waters are fished by the Northeast Region lobster and Jonah crab fishery (IEC 11/9/2019 model run). Because multi-fishery coast-wide regulations require more scoping and analysis, this FEIS focuses on the northeast lobster and Jonah crab fisheries to facilitate rapid rulemaking. The Atlantic Large Whale Take Reduction Team (ALWTRT or Team) has been informed of the intention to consider other fixed gear fisheries, coast-wide during the next ALWTRT deliberations.

NMFS estimated in 2019 that to reduce mortality and serious injury below PBR, entanglement risk across U.S. fisheries needed to be reduced by 60 to 80 percent. As described in more detail in Chapter 2, there is no gear present or retrieved from most documented incidents of dead or seriously injured right whales. When gear is retrieved it can rarely be identified to a fishery or to a location. For the purposes of creating a risk reduction target, NMFS assigned half of these unknown incidents to U.S. fisheries to calculate the 60 percent minimum target, which assumed 50 percent of all entanglements occurred in the U.S. (i.e., lower bound). The 80 percent upper bound of the target range considered estimated undocumented mortalities generated by a population model available at the time that estimates unobserved mortality (Hayes et al. 2020), and assumed 50 percent of all incidents occurred in U.S. waters. However, given the assumptions and other sources of uncertainty in the 80 percent target, as well as the challenges achieving such a target without large economic impacts to the fishery, the ALWTRT focused on recommendations to achieve the lower 60 percent target.

This risk reduction range discussed in Chapter 2 differs from those presented in the Draft Environmental Impact Statement (DEIS) and those presented to the Team in 2019 due to the incorporation of new data. New population models now suggest that up to 64 percent of right whale mortalities and serious injuries are unobserved (Pace et al. 2021), which were used to estimate new upper bound risk reduction estimates. This FEIS explores updated draft mortality and serious injury determinations for 2012 through 2020 to determine how the target might change using more recent information and varying apportionment assumptions. NMFS considered several new methods for determining a minimum and maximum risk reduction target by testing different country and cause attributions to see how robust the 60 to 80 percent target is to these assumptions (see Table 2.4 in Chapter 2). The lower bound estimates ranged from 47 to 66 percent and the upper bound from 78 to 90 percent using data between 2010 and 2018. The lower of these estimates would assume only 30 percent of entanglements occur in the US and as low as 50 percent of those would be entanglements at the upper bound. Because it is known that unknown and unobserved mortality occurs to some extent, the lowest estimate of 47 percent risk reduction would very likely be insufficient so NMFS is retaining the 60 percent minimum risk reduction target. For the upper target, our updated analyses demonstrate this target should be around 80 percent or more. Therefore, 80 percent is still the upper target risk reduction considered in this FEIS but as new data are finalized the minimum and maximum targets may change in the future.

Large whale entanglement data and the rationale for the scope of the alternatives considered in this FEIS are described in greater detail in Chapter 2: Purpose and Need. As mentioned, while entanglement is a significant source of mortality and serious injury for Atlantic large whales, other factors influence whale survival. Historically, commercial whaling has presented the greatest threat to whale stocks, and is largely responsible for reducing the populations of certain species to endangered status. Broad adherence to a voluntary international ban on commercial whaling has reduced this threat along the U.S. Atlantic coast. However, other human-caused threats remain, including primarily collisions between whales and ships, as well as the adverse effects that water pollution, noise pollution, climate change, offshore wind farm development, oil and gas development, reductions in prey availability, and mortality and serious injury outside of

U.S. waters may have on whale stocks. These threats are discussed further in Chapter 8: Cumulative Effects Analysis.

1.2 Atlantic Large Whale Take Reduction Plan & Current Requirements

In response to its obligations under the MMPA, NMFS established ALWTRT in 1996 to develop a plan to reduce the incidental take of large whales in commercial fisheries along the Atlantic Coast. The Team consists of representatives from the fishing industry, state and Federal resource management agencies, the scientific community, and conservation organizations. The work of the Team is to provide recommendations to NMFS in developing and amending the Plan.

The ALWTRP seeks to reduce serious injury to or mortality of large whales due to incidental entanglement in U.S. commercial fishing gear. Because of their low population numbers and persistent human-caused mortality and serious injury above PBR, Plan measures focus on reducing the risk of entanglements to right whales while ensuring it benefits other Atlantic large whale species. In its entirety, the Plan consists of state and federal regulatory components including restrictions on where and how gear can be set, as well as non-regulatory components, including research into whale populations, whale behavior, and fishing gear; outreach to inform fishermen of the entanglement problem and to seek their help in understanding and solving the problem; enforcement efforts to help increase compliance with Plan measures; and a program to disentangle whales that do get caught in gear. The Category I and II fisheries currently regulated under the Plan that this FEIS seeks to modify include the Northeast Region trap/pot American lobster and Jonah crab fisheries. Chapter 2 of this EIS reviews the current Plan requirements.

1.3 Alternatives Considered

NMFS is currently considering suites of regulatory measures under two alternatives that would modify existing Plan requirements to address ongoing large whale entanglements. The primary purpose of the Plan modifications is to reduce the mortality and serious injury of the right whale in the Northeast Region Trap/Pot Management Area (Northeast Region) lobster and Jonah crab trap/pot gear, which fishes approximately 93 percent of the buoy lines in U.S. waters in which right whales occur, to below PBR. Measures considered include reducing the number of lines in the water (e.g. via increasing the number of traps per trawl, areas restricted from buoy lines, or a cap and allocation of buoy lines in federal waters) and reducing mortality and serious injury in remaining lobster and crab trap/pot buoy lines by specifying a low (no greater than 1,700 pounds/771 kilograms) maximum breaking strength for buoy line or inserts within the buoy line, depending on gear configurations. The alternatives would affect lobster and Jonah crab trap/pot fisheries currently covered under the Plan within the Northeast Region. Although the ALWTRT did not include seasonal buoy line restricted areas in the near-consensus recommendations that the Team provided to NMFS at their April 2019 meeting, wide application of weak rope and buoy line reductions were the primary risk reduction elements recommended.

Table 1.1: A summary of the regulatory elements of the risk reduction alternatives analyzed in the FEIS, arranging the requirements by lobster management area and geographic region (where appropriate). The dark gray highlighted text represents regulations that will be implemented by a state or through ongoing or upcoming fishery management practices. OC = Outer Cape

Component	Area	Alternative 2 (Preferred)	Alternative 3
Restricted Areas	All existing and new closures become closed to buoy lines	Allow trap/pot fishing without buoy lines. Will require exemption from fishery management regulations requiring buoys and other devices to mark the ends of the bottom fishing gear. Exemption authorizations will include conditions to protect right whales such as area restrictions, vessel speed, monitoring, and reporting requirements. All restricted areas listed here would require an exemption. Federal waters in the Outer Cape LMA would remain closed to all lobster fishing consistent with the ASMFC lobster FMP.	Allow trap/pot fishing without buoy lines. Will require exemption from fishery management regulations requiring buoys and other devices to mark the ends of the bottom fishing gear. Exemption authorizations will include conditions to protect right whales such as area restrictions, vessel speed, monitoring, and reporting requirements. All restricted areas listed here would require an exemption. Federal waters in the Outer Cape LMA would remain closed to all lobster fishing consistent with the ASMFC lobster FMP.
	LMA 1 Restricted Area, Offshore ME LMA 1/3 border, zones C/D/E	Oct – Jan	Oct – Feb
	South Island Restricted Area	Feb – April: Area from Non-preferred A in DEIS.	Feb – May: L-shaped area closed to buoy lines.
	Massachusetts Restricted Area	Credit for Feb-Apr, state water in MRA have a soft opening until May 15th, until no more than three whales remain as confirmed by surveys	Federal extensions of restricted area throughout MRA and LMA 1/OC state waters unless surveys confirm that right whales have left the area.
	Massachusetts Restricted Area North	Feb-Apr: Expand MRA north in MA state waters to NH border	Feb-Apr: Expand MRA north in MA state waters to NH border
	Georges Basin Restricted Area	-	Closed to buoy lines May through August.
Line Reduction	ME exemption line – 3 nm (5.6 km), Zones A, B, F, G	3 traps/trawl	-
	ME exempt area – 3 nm (5.6 km), Zones C, D, E	Status quo (two traps/trawl)	-
	ME 3 (5.6 km) – 6 nm*, Zone A West**	8 traps/trawl per two buoy lines or 4 traps/trawl per one buoy line	Line allocations capped at 50 percent of average monthly lines in federal waters
	ME 3 (5.6km) – 6 nm*, Zone B	5 traps/trawl per one buoy line	
	ME 3 (5.6 km) – 6 nm*, Zones C, D, E, F, G	10 traps/trawl per two buoy lines or 5 traps/trawl per one buoy line	Same as above
	ME 3 (5.6 km) – 12 nm (22.2 km), Zone A East**	20 traps/trawl per two buoy lines or 10 traps/trawl per one buoy line	Same as above
	Line ME 6* – 12 nm (22.2	15 traps/trawl per two buoy lines or 8 traps/trawl per	Same as above

Component	Area	Alternative 2 (Preferred)	Alternative 3
Reduction Continued	km), Zone A West**	one buoy line	
	ME 6* – 12 nm (22.2 km), Zone B, D, E, F	10 traps/rawl per two buoy lines or 5 traps/rawl per one buoy line (status quo in D, E, & F)	Same as above
	ME 6* – 12 nm (22.2 km), Zone C, G	20 traps/rawl per two buoy lines or 10 traps/rawl per one buoy line	Same as above
	MA LMA 1, 6* – 12 nm (22.2 km)	15 traps/rawl	Same as above
	LMA 1 & OC 3 – 12 nm (5.6 – 22.2 km)	15 traps/rawl	Same as above
	LMA 1 over 12 nm (22.2 km)	25 traps/rawl	Same as above
	LMA 3, North of 50 fathom line on the south end of Georges Bank	Year-round: 45 traps/rawl, increase maximum trawl length from 1.5 nm (2.78km) to 1.75 nm (3.24 km)	May - August: 45 trap trawls; Year-round increase of maximum trawl length from 1.5 nm (2.78 km) to 1.75nm (3.24 km)
	LMA 3, South of 50 fathom line on the south end of Georges Bank	Year-round: 35 traps/rawl, increase maximum trawl length from 1.5 nm (2.78km) to 1.75 nm (3.24 km)	Same as above
	LMA 3, Georges Basin Restricted Area	Year-round: 50 traps/rawl, increase maximum trawl length from 1.5 nm (2.78km) to 1.75 nm (3.24 km)	Same as above
	LMA 2	Existing 18% reduction in the number of buoy lines	-
Other Line Reduction	LMA 3	Existing and anticipated 12% reduction in buoy lines	-
Buoy Weak Link	Northeast Region	For all buoy lines incorporating weak line or weak insertions, remove weak link requirement at surface system	Retain current weak link/line requirement at surface system but allow it to be at base of surface system or, as currently required, at buoy
Weak Line	ME Exempt State Waters	1 weak insertion 50% down the line	Full weak rope in the top 75% of both buoy lines
	ME exemption line – 3 nm (5.6 km)	1 weak insertion 50% down the line	Same as above
	MA State Waters	Weak inserts every 60 ft (18.3 m) or full weak line in top 75% of line	Same as above
	NH State Waters	1 weak insertion 50% down the line	Same as above
	RI State Waters	Weak inserts every 60 ft (18.3 m) in top 75% of line or full weak line	Same as above
	ME Zone A West**, B, C, D, E; federal waters 3 – 12 nm (5.6 – 22.2 km)	2 weak insertions, at 25% and 50% down line	Same as above
	ME Zone A East**, F, and G; federal waters 3 – 12 nm (5.6 – 22.2 km)	1 weak insertion 33% down the line	Same as above

Component	Area	Alternative 2 (Preferred)	Alternative 3
	MA and NH LMA 1 , OC; federal waters 3 – 12 nm (5.6 – 22.2 km)	2 weak insertions, at 25% and 50% down line	Same as above
	LMA 1 & OC over 12 nm (22.2 km)	1 weak insertion 33% down the line	Same as above
	LMA 2	Weak inserts every 60 ft (18.3 m) or full weak line in top 75% of line	Same as above
	LMA 3	One buoy line weak year round to 75%	May - August: one weak line to 75% and 20% on other end. Sep – Apr: two weak “toppers” down to 20%
Gear Marking	State Waters	One 3 ft (91.4 cm) long state-specific colored mark in surface system within 2 fa of buoy in addition to at least two 1 ft (30.5 cm) marks that must be changed to state color	One 3 ft (91.4 cm) long state-specific colored mark in surface system within 2 fa of buoy and require identification tape indicating home state and fishery woven through buoy line
	Federal waters, except LMA3	Add one 3 ft (91.4 cm) long state specific colored mark within 2 fa of the buoy, at least three 1 ft (30.5 cm) marks that must be changed to state color, and four 1 ft (30.5 cm) long green marks must be added within 6 in. of each state specific mark	One 3 ft (91.4 cm) long state-specific colored mark in surface system within 2 fa of buoy and require identification tape indicating home state and fishery woven through buoy line
	LMA3	Add one 3 ft (91.4 cm) long black mark within 2 fa of the buoy line to existing three 1 ft (30.5 cm) marks in black and add four 1 ft (30.5 cm) long green marks within 6 in. of each black mark	One 3 ft (91.4 cm) long black mark in surface system within 2 fa of buoy and require identification tape indicating home state and fishery woven through buoy line

*Notes: See 50 CFR 229.32 for delineations of regulated waters and associated terms, such as exempted waters. The 6 mile line refers to an approximation, described in 50 CFR 229.32 (a)(2)(ii).

**Maine Zone A East is the portion of Zone A that is east of 67°18.00' W and Maine Zone A is west of this longitude.

Chapter 3 describes in detail the regulatory alternatives including how they were created and analyzed in this FEIS. Briefly, NMFS used the Decision Support Tool (DST) created by the Northeast Fisheries Science Center to compare the effectiveness of state and federal regulatory elements in reducing the risk of entanglement to right whales relative to Alternative 1, the status quo. The DST aids in the comparison of spatial management measures by calculating right whale entanglement risk based on three components: the density of lines in the water, the distribution of whales, and a gear threat model to determine the relative threat of gear based on gear strength (see Appendix 3.1). The proposed suites of risk reduction elements achieve at least the 60 percent minimum risk reduction target. This target was identified by NMFS as the minimum target necessary to reduce mortalities and serious injuries to below PBR. Alternative 2 (Preferred) is largely made up of recommendations from the states, the Atlantic Offshore Lobstermen's Association, public scoping, and public comment. The alternatives in this FEIS were modified from the Draft Environmental Impact Statement (DEIS) in response to comments that take into account whale density, safety concerns, and conservation equivalencies. See Section 1.5 for a summary of comments received and 1.6 for the changes in the alternatives in this FEIS from the DEIS.

The primary risk reduction features of the selected alternatives are summarized below and outlined for comparison in Table 1.1. These include some regulatory measures that are ongoing through state and federal lobster fishery management measures or that will be implemented by the states only (dark gray) and measures that would be implemented through federal rulemaking analyzed within this FEIS. For reference, Figures 1.2 and 1.3 show the scope of the Northeast Region and include the new seasonal restricted areas that would allow fishing without buoy lines, analyzed under each alternative.

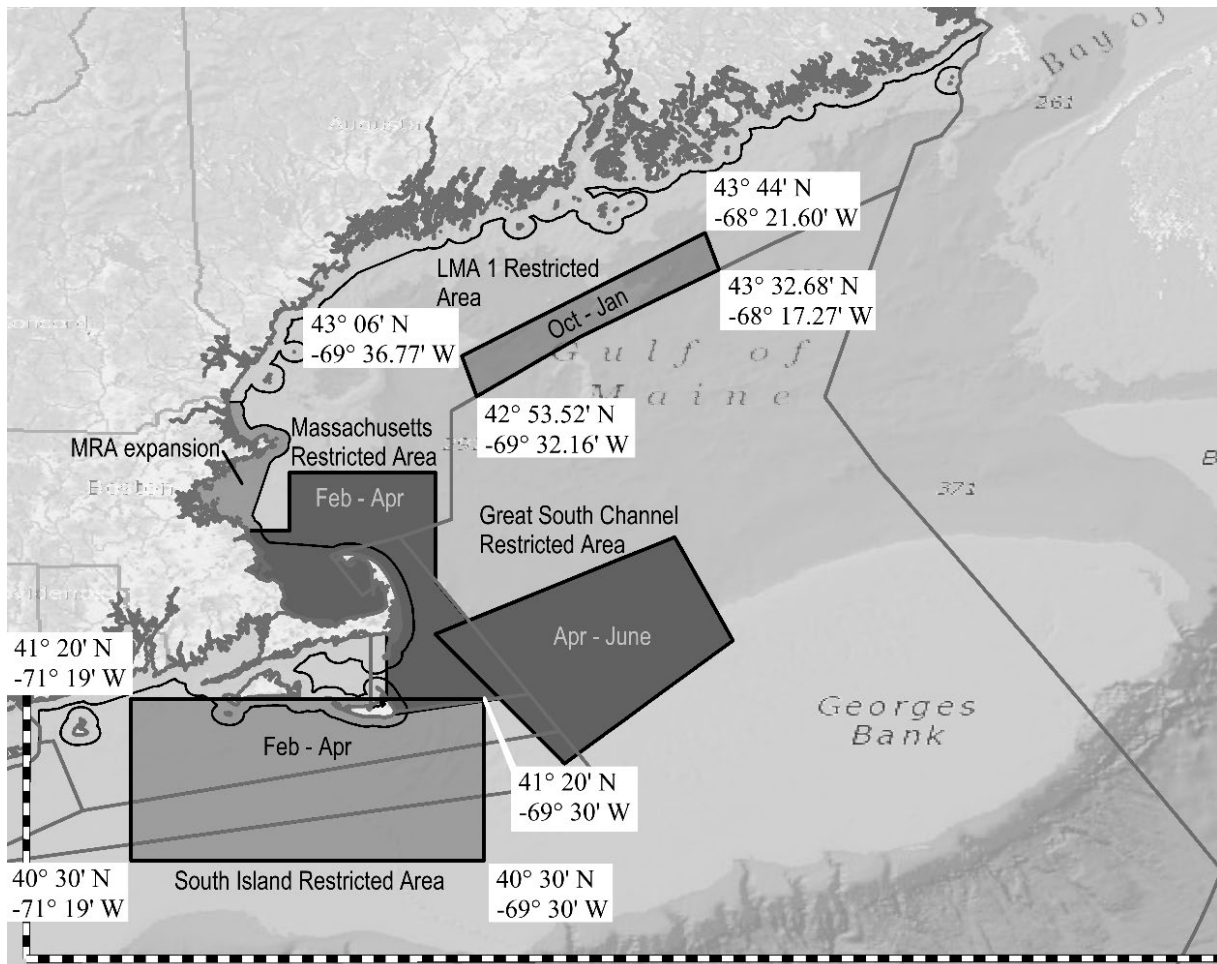


Figure 1.2: The trap/pot buoy line closure areas in Alternative 2 (Preferred). LMAs are delineated by the grey lines. The new South Island Restricted Area would be closed to trap/pot buoy lines from February through April and the LMA 1 Restricted area from October through January. An expansion of the MRA into Massachusetts state waters to the New Hampshire border and extended in state waters in LMA 1 and the Outer Cape through at least May 15th, with a potential opening if whales are no longer present, is also included. In dark gray are existing seasonal restricted areas that would become areas with restrictions to fishing with buoy lines, with the exception of federal waters in the Outer Cape LMA from February through March. This change may encourage some ropeless gear testing and accelerate the development of ropeless fishing and associated long-term benefits to right whales. The area north and east of the checked line and west of the EEZ encompasses the Northeast Region.

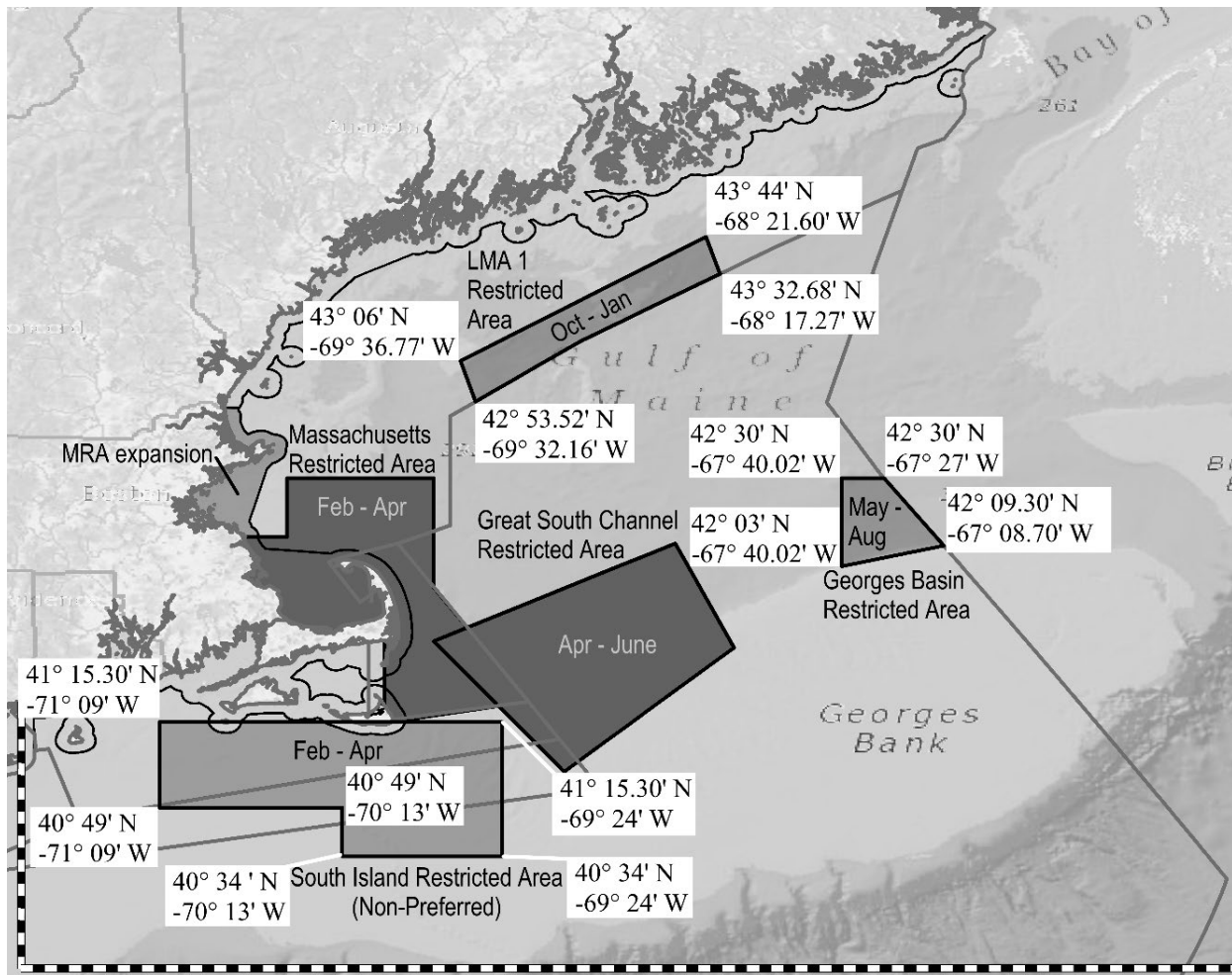


Figure 1.3: The buoy line restriction options in Alternative 3 (Non-preferred). There are two different options for a restricted area south of Cape Cod from February through April, a large restricted area (3a) and an L-shaped restricted area (3b). The LMA 1 Restricted Area would be from October through February. The Georges Basin Restricted Area would be from May through August. An extension of the Massachusetts Restricted Area through May, with a potential opening if whales are no longer present, is also included. In dark gray are existing seasonal restricted areas that would become areas with restrictions to fishing with buoy lines, with the exception of federal waters in the Outer Cape LMA from February through March. This change may encourage some ropeless gear testing and accelerate the development of ropeless fishing and associated long-term benefits to right whales. The area north and east of the checked line and west of the EEZ encompasses the Northeast Region.

Alternative 1 (No Action): Under Alternative 1, NMFS would continue with the status quo Plan requirements currently in place (Appendix 2.1).

Alternative 2 (Preferred): This alternative would increase the number of traps per trawl based on area fished and miles fished from shore in the Northeast Region (Maine to Rhode Island). Trawling up regulations in all coastal regions would be managed based on distance from shore, primarily outside of exempt or state waters as detailed in Table 1.1. Under this alternative, existing closure areas would be modified to be closed to fishing with persistent buoy lines. The Massachusetts Restricted Area would be expanded into Massachusetts state waters north to the New Hampshire border from February through April in both state regulations and the final rule. Additionally, all state waters within the Massachusetts Restricted Area would be closed by

Massachusetts until May 15th until surveys demonstrate that whales have left the area. Two new seasonal restricted areas would be created that would allow fishing without the use of persistent buoy lines: one in LMA 1 from October through January and one south of Cape Cod from February through April. Fishing without the use of persistent buoy lines would be allowed during these seasons, outside of Cape Cod Bay and the Outer Cape Cod Lobster Management area. Measures also include conversion of a vertical buoy line to weak rope, or insertions in buoy lines of weaker rope or other weak inserts, with a maximum breaking strength of 1,700 pounds (771 kilograms). This Alternative also includes more robust gear marking requirements that differentiate buoy lines by state, includes unique marks for federal waters, and expands into areas previously exempt from gear marking.

Alternative 3: This alternative would reduce the amount of line in the water via a line cap allocation capped at 50 percent of the lines fished in 2017 in federal waters throughout the Northeast except in offshore LMA 3. A seasonal increase in the minimum traps per trawl requirement would be implemented in LMA 3. Additionally, under this alternative, existing closures would be modified to allow fishing without the use of persistent buoy lines. The Massachusetts Restricted area would be extended into state waters north to the New Hampshire border and the entire area would allow a soft closure through May, opening if surveys demonstrate whales have left the restriction area. Three new seasonal restricted areas would be created, including a longer seasonal restricted period for the LMA 1 Restricted Area, an extended restricted period for the South Island Restricted Area, and a summer restricted area north of Georges Bank within Georges Basin. Fishing without the use of persistent buoy lines would be allowed during these seasons, outside of Cape Cod Bay and the Outer Cape Cod Lobster Management area. Additional measures include conversion of the top 75 percent of all lobster and crab trap/pot buoy lines outside of LMA 3 to weaker rope with a maximum breaking strength of 1,700 pounds (771 kilograms). Within LMA 3, buoy lines would be required to convert the top 20 percent of all lines to a maximum of 1,700 pounds (771 kilograms) breaking strength or the equivalent with a seasonal requirement for the extension of one of two weak buoy lines down to 75 percent. The alternative also includes more robust gear marking throughout the buoy line that differentiates buoy lines by state and fishery and expands into areas previously exempt from gear marking.

1.4 Major Conclusions and Preferred Alternative

1.4.1 *Biological Impacts of Alternatives*

As delineated in Table 1.1, gear modification requirements, buoy line seasonal restricted areas, and gear marking are key components of the ALWTRP modifications under consideration. Section 5.3 of this FEIS discusses the potential impact of these requirements on reducing the risk of large whale entanglements and associated mortality and serious injury. The major strategies to reduce risk include:

Line Reduction Requirements: Measures to reduce the number of buoy lines fished benefit large whales by reducing co-occurrence and associated opportunity for entanglement in buoy lines and associated gear. Both alternatives include requirements to increase the minimum number of traps per trawl in the Northeast to reduce the number of vertical buoy lines in the

water without necessarily having to reduce the number of traps. The 50 percent cap for line allocations in federal waters considered in Alternative 3 would reduce the number of lines fished but would allow states and their permitted fishermen to choose their own strategies for achieving line reduction (i.e. trawling up, ropeless on one end, trap reductions) rather than specifying how gear would need to be configured.

Seasonal Restricted Areas: Seasonal restricted areas, which are open to fishing without buoy lines but closed to fishing with persistent buoy lines, are intended to protect areas of predictable seasonal aggregations of right whales. The potential regulatory changes analyzed include several restrictions on when and where trap/pot gear can be set with persistent buoy lines. Two existing closures to trap/pot fishing would be modified to be closed to fishing trap/pot gear with persistent buoy lines, allowing “ropeless” fishing. Ropeless fishing is usually done by storing buoy lines on the bottom and remotely releasing the buoy to retrieve the line when fishermen are on site to haul in their trawl of traps, or other bottom gear. Alternative 2 (Preferred) considers two new seasonal restricted areas and Alternative 3 proposes three new seasonal restricted areas. Both alternatives would expand the MRA north into LMA 1 state waters to the New Hampshire border.

Weak Line Requirements: The potential regulatory changes analyzed include provisions to require that lobster and crab trap/pot gear modify buoy lines to use rope that breaks at a maximum of 1,700 pounds (771 kilograms) for substantial lengths of the buoy line or to require weak insertions at varying depths on the buoy line. The specified maximum strength of rope or weak inserts is based on a study that suggested that, if a right whale does become entangled, it is more likely to exert enough force to break the rope before a severe entanglement occurs, reducing risk of serious injury or mortality.

The general objective of the risk reduction elements analyzed is to use feasible measures that limit the frequency and severity of interactions between whales and regulated trap/pot gear in the Northeast. The measures assessed were selected to reduce risk of right whale mortality and serious injury caused by entanglement in the lobster and crab trap/pot fisheries in the northeast by at least 60 percent in order to achieve PBR. The measure of risk reduction used is a product of the spatiotemporal distribution of lobster and Jonah crab trap/pot buoy lines, predicted right whale habitat density (Roberts et al. 2020), and risk of different gear configurations. In developing the alternatives, the DST was used as described in Chapter 3 to estimate that Alternative 2 (Preferred) achieves greater than 60 percent risk reduction (at least 68 percent with the inclusion of the MRA credit) and Alternative 3 achieves over 70 percent risk reduction.

Risk reduction was an essential measure for selecting alternatives that are sufficiently broad to reduce right whale serious and mortality below PBR. The biological impact analysis uses both quantitative (produced by the DST) and qualitative indicators to facilitate a comparison of the regulatory alternatives for all large whales as related to the objectives above. First, percent reduction of buoy lines and reduction in co-occurrence between whales and buoy lines to reduce entanglement likelihood. Second, the mean line strength and change in gear threat of rope in buoy lines that are weakened to reduce the likelihood of a serious injury or mortality in the event of an entanglement. The co-occurrence value estimated in the NMFS DST used in this FEIS is an index, integrated across the northeast spatial grid, indicating the degree to which whales and the

buoy lines employed in lobster and crab trap/pot fisheries coincide in the Northeast Region waters subject to the Plan. Biological impacts anticipated are a reduction in buoy line and whale interactions, characterized by the percentage reduction in the overall co-occurrence indicator each alternative would achieve. Habitat density models produced by Duke University were used to examine co-occurrence for right, humpback, and fin whales (Roberts et al., 2020). Co-occurrence does not consider the risk of different gear configurations, which is integrated into the total risk reduction estimate.

Table 1.2: The summary of all quantitative measures for each alternative, including the percent change in annual buoy lines, reduction in co-occurrence, and change in line strength and gear threat due to weak line measures. The risk reduction and co-occurrence estimates with and without the credit for the implementation of the MRA are shown according to risk reduction estimates in Chapter 3 (with the upper and lower bound estimates provided for weak inserts) and the Biological Impact Analysis in Chapter 5, which used only the 2017 baseline without the MRA credit to compare the alternatives.

Alternative:	1 (i.e. baseline)	2 (Preferred)	3 (Non-preferred)
Line Reduction		% Reduction	% Reduction
Risk Reduction		60%	72%
Risk Reduction (with MRA Credit)		69% – 73%	
Line Reduction		7%	7%
Co-Occurrence		% Reduction	% Reduction
Right Whale		54%	60%
Right Whale (with MRA Credit)		65%	
Humpback Whale		12%	19%
Fin Whale		14%	17%
Weak Line			
Mean Line Strength	2162	1976	1753
Change in Line Strength		9%	19%
Change in Gear Threat		17%	29%

The results of the biological impact analysis are summarized in Table 1.2 and evaluate the percent reduction in buoy lines, reduction of co-occurrence of buoy lines, and the change in gear threat from buoy lines under each action alternative relative to the no action alternative (Alternative 1). The percent reduction in line is estimated to be approximately seven percent under both alternatives but differ in the amount of estimated co-occurrence reduction between buoy lines and large whales.

- Alternative 2 (Preferred), which includes broad trawling up requirements and two new seasonal restricted areas closed to lobster and Jonah crab buoy lines, is estimated to yield a reduction in right whale co-occurrence of approximately 54 to 65 percent, depending on whether the MRA is included (i.e. the baseline model chosen).
- Alternative 3 includes a 50 percent line cap allocation in federal waters, trawling up requirements in LMA 3, and additional seasonal restricted areas and is estimated to reduce co-occurrence by approximately 60 percent.

Both alternatives also convert a portion of buoy line from full strength rope to weakened rope that either is manufactured with a maximum breaking strength of 1,700 pounds (771 kilograms)

or includes inserts with the same maximum breaking strength spaced throughout the line. The baseline mean rope strength is estimated at 2,162 pounds (981 kilograms) with a skewed distribution where most estimated breaking strengths are between 1,000 and 4,000 pounds (453 to 1,814 kilograms), with some upwards of 8,000 pounds (3,628 kilograms) or more. For this analysis, inserts placed at least every 40 feet (12.2 meters, i.e. equal to or shorter than the average length of an adult right whale) are considered to be equivalent to full weak rope.

- Alternative 2 (Preferred) proposes weak inserts in all buoy lines, but very few inserts relative to inserts every forty feet. Alternative 2 will reduce line strength by nine percent for an average of 1,976 pounds (896 kilograms) per buoy line. Within this alternative, weak rope is a precautionary measure to reduce serious injury and mortalities if whales are entangled. Weak insertions are required down to 50 percent in the rope in nearshore areas but only down to 33 percent in offshore areas due to fishermen's concern that the rope poses safety risks and increased chances of gear loss when fished with heavier offshore gear.
- Under Alternative 3 reduces line strength by 19 percent to an average 1,753 pounds (795 kilograms) per buoy line. Under this alternative, most areas would require full weak line in the top 75 percent of all buoy lines with the exception of LMA 3.

Weak rope should reduce the severity of entanglements for right whales, fin whales, and to a lesser extent humpback whales, but would not reduce the encounter rates and associated risk of entanglement.

In addition to impacts on large whale species, changes to Plan regulations may affect other aspects of the marine environment, including other protected species and habitat. Analysis of these issues, addressed in Sections 5.4 and 5.5 of this FEIS, suggests no significant differences among Alternatives Two and Three (Preferred and Non-preferred, respectively) with respect to impacts on habitat because the impacts are generally expected to be minor. The alternatives differ, however, with respect to the ancillary benefits that would be afforded to other protected species. These differences stem from the extent to which the alternatives would mandate requirements, such as fewer buoy lines, that would prove to benefit other whales and sea turtles.

1.4.2 *Economic and Social Impacts of Alternatives*

Chapter 6 evaluates the economic and social impacts of Alternatives 2 and 3 relative to the status quo (Alternative 1), including a yearly distribution of the compliance costs for the six years following implementation. For the purpose of summarizing and comparing the economic impact of the alternatives, this discussion will focus on initial incremental implementation costs of the two action alternatives. Additionally, although the risk reduction analysis considered the contribution of fishery management, state and federal risk reduction measures toward achieving the target risk reduction, the economic analysis considers only the costs of the federal rules that would be implemented. The costs of fishery management measures that are being phased in or are reasonably foreseeable through other regulatory actions are not analyzed in the FEIS.

The first year costs of all new federal regulatory measures for Alternative 2 including gear marking, weak rope, restricted areas, and trawling up costs range from \$9.8 million to \$19.2

million. As described in Chapter 6, the range of costs depends on assumptions about catch/landings loss caused by trawling up and about whether fishermen choose to remove lines or relocate due to buoy line restricted areas. Year one compliance costs for Alternative 3 range from \$32.8 million to \$44.6 million. Thus, the costs associated with Alternative 2 are well under one third the total costs associated with Alternative 3.

Alternative 2 achieves less reduction in co-occurrence between buoy lines and large whales than Alternative 3. The co-occurrence model suggests right whale co-occurrence would be reduced by approximately 65 percent with the MRA credit (54 percent without). The costs associated with the co-occurrence reduction (trawling up and buoy line restricted area) under Alternative 2 range from \$2.9 million to \$10.8 million (Table 1.3), depending on implementation assumptions (buoy lines relocated vs. buoy lines removed). For every unit of co-occurrence reduction, the costs of Alternative 2 is estimated at \$54,000 to \$199,000.

Alternative 3 performed better at reducing large whale co-occurrence than Alternative 2, achieving a co-occurrence reduction of 60 percent. This alternative would increase the likelihood of achieving the higher target that takes into account estimated right whale mortalities. However, the first year costs associated with co-occurrence reduction in Alternatives 3 (trawling up, buoy line restricted area, federal water line caps) are substantially higher, ranging from \$7.8 million to \$19.5 million dollars; or \$130,000 to \$325,000 for each unit of co-occurrence reduction. That is, each risk reduction unit of Alternative 3 would cost more than two or three times the cost per risk reduction unit in Alternative 2.

Analysis of the weak rope modification measures are similar, with Alternative 3 performing better but at a high cost. Final modifications in Alternative 2 would weaken the rope in buoy lines by approximately 9 percent, with an estimated cost of \$2.2 million dollars, about \$250,000 for each percent of rope strength reduction (Table 1.4). Alternative 3 would weaken rope in buoy lines by 19 percent, with an estimated cost of \$10.6 million or about \$557,000 for each percent of rope strength reduction.

Table 1.3: A summary of initial compliance costs associated with trawling up, buoy line closures, and a line cap (2020 dollars) compared to co-occurrence reduction for each alternative without the MRA credit.

	Alternative 2	Alternative 3
Trawling Up Lower	\$1.6 million	\$1.0 million
Trawling Up Upper	\$8.8 million	\$2.0 million
New Buoy Line Closure Lower	\$1.3 million	\$3.0 million
New Buoy Line Closure Upper	\$2.0 million	\$4.1 million
Line Cap Lower		\$3.9 million
Line Cap Upper		\$13.4 million
Total Lower	\$2.9 million	\$7.8 million
Total Upper	\$10.8 million	\$19.5 million

	Alternative 2	Alternative 3
Co-occurrence Reduction Score	54%	60%

Chapters 6 and 9 provide a full analysis and comparison of the economic impacts of federally regulated components of the alternatives. While this comparison of the costs of implementation of the risk reduction elements in each action alternative is an oversimplification, it demonstrates that Alternative 2 achieves the purposes laid out in Chapter 2 of this FEIS while minimizing the potential economic impacts of the final modifications to the Plan. That is, while Alternative 3 was estimated to achieve higher co-occurrence reduction and risk reduction than the preferred alternative, both the total costs and per-unit risk reduction costs were much higher than the selected alternative and the implementing measures in the final rule. Therefore, Alternative Two achieves the purpose and need for action, but with less economic impact on all regulated entities.

Table 1.4: A summary of annualized Federal Plan modification compliance costs related to weak line.

	Percent reduction in rope strength	First year cost of converting to weak rope
Alternative 2	9	\$2.2 million
Alternative 3	19	\$10.6 million

According to the estimation in the IEC Vertical Line Model, there are 3,970 vessels in lobster and Jonah crab trap/pot fisheries in the Northeast Region except for Maine exempt waters (which will be regulated by the state of Maine). These represent 3,460 unique entities including 3,458 small entities. Impacts do not appear to be disproportionate across small and large entities. These vessels fish for lobster and Jonah crab. Under Alternatives 2 and 3, gear marking and weak rope requirements would affect every lobster and Jonah crab vessel fishing in the Northeast Region. Line reduction measures (i.e. trawling up) under Alternative 2 would affect 1,206 vessels, slightly fewer than the 1,565 vessels affected by the Alternative 3 line reduction measures (line caps, trawling up in LMA 3). Federally regulated seasonal buoy line closures of Alternative 2 would affect up to 256 vessels, compared to more than 501 vessels affected by the buoy line closures under Alternative 3. Chapter 6 provides further details on the economic impacts of the Alternatives.

Community impacts vary across the region, with more vulnerable communities in mid-coast and Southeast Maine, where the lobster fishery is a major economic driver. The value of 2020 lobster landings in Hancock and Knox Counties each exceeded \$100 million. Southern Maine and New Hampshire have a more diversified economy, making communities more resilient to adverse economic impacts that may stem from Plan modifications. Similarly, Massachusetts and Rhode Island communities may also be resilient due to diversified economies, although revenues from Take Reduction Plan fisheries exceed \$15 million per year in some counties.

1.4.3 Preferred Alternative

NMFS has identified Alternative 2 as the Preferred Alternative in this FEIS. The alternative includes measures largely drawn from proposals from the Team, New England states, input from fishermen, and public comments. Measures were aggregated and evaluated using the DST, which estimated that Alternative 2 would achieve at least a 60 percent risk reduction in the northeast lobster and Jonah crab trap/pot fisheries through a substantial reduction in entanglement risk via co-occurrence and the reduction in threat of severe entanglement through the introduction of weak rope or inserts into buoy lines. Alternative 2 includes concurrent fishery management measures and measures implemented by Maine and Massachusetts for fishermen in exempted or state waters that would reduce entanglement risk to right whales. Alternative 2 achieves the minimum target estimated to meet PBR based on document right whale entanglement incidents. Finally, although the Alternative is not identical to the recommendations that the ALWTRT made to NMFS in April 2019 Team meeting (Table 3.1), they align with the basic principles within those recommendations:

- They were estimated by the DST to achieve at least 60 percent risk reduction in the Northeast Region lobster and crab trap/pot fisheries
- Risk reduction is distributed across jurisdictions
- Measures primarily include line reductions through trawling up and requiring weak rope or weak inserts

Modification of existing restricted areas to allow ropeless fishing without the use of persistent buoy lines was included to support fishermen's participation in the development of ropeless fishing methods that are feasible under commercial fishing conditions. Two new seasonal restricted areas that would allow ropeless fishing are included in the Preferred Alternatives. One is a large South Islands Restricted Area south of Cape Cod and the LMA 1 Restricted Area was included to boost the LMA 1 risk reduction toward the target. Both are areas of predictable right whale aggregations that would provide valuable protection to whales analogous to the protection afforded by the MRA. The Preferred Alternative and Final Rule would also expand the size of the MRA north into Massachusetts State waters to the New Hampshire border.

Analysis of Alternative 2 using the DST estimated a high reduction in right whale co-occurrence (65 percent, 54 without the MRA). Consistent with past analyses of Plan modifications, co-occurrence is considered a proxy for risk, as reducing co-occurrence would reduce the opportunity for encounters between whales and U.S. trap/pot buoy lines. Alternative 2 also includes precautionary weak insert and weak rope requirements across all lobster and crab trap/pot trawls, reducing line strength by nine percent and gear threat by 17 percent. The broad application of these measures to weaken rope across the area is resilient to changes in right whale distribution. Finally, an economic analysis of the measures that would be implemented under Federal rulemaking under Alternative 2 would have a much lower economic impact relative to the federal measures under Alternative 3.

The public welfare benefits associated with increased whale protection are likely to be similar across Alternatives Two and Three. As noted, the analysis measures the change in whale protection offered by a given alternative as a change in the co-occurrence of whales and buoy lines as well as by the reduction in mean line strength and threat of buoy lines to reduce the severity of entanglement injuries. By these measures, Alternative 3, with the largest number of

restricted areas, offers the greatest protection to all large whales unless the MRA credit is taken into account within Alternative 2. This Alternative is estimated to reduce co-occurrence by 60 percent for right whales, 19 percent for humpback whales, and 17 percent for fin whales. The buoy lines in the Northeast would be weakened by 19 percent and the gear threat of those lines would be reduced by an estimated 29 percent. Alternative 2 offers less benefit, with a reduction in co-occurrence without consideration of the MRA of 54, 12, and 14 percent for right, humpback, and fin whales respectively. However, the MRA is critical to right whale conservation, the Team recommended this credit in the final rule, and it was implemented shortly before the 2017 buoy line baseline year. With the MRA credit, co-occurrence is reduced by approximately 65 percent under Alternative 2. Buoy lines would be weakened by nine percent and gear threat of those lines by 17 percent. These biological benefits to whale populations have socioeconomic implications for the general public. Increasing whale populations would have a positive impact on the consumer surplus derived from whale watching (a use benefit) and may increase producer surplus for operators of whale watch vessels. Likewise, whale conservation may enhance intrinsic values that society holds for healthy, flourishing whale populations.

NMFS has considered the benefit and cost information presented above and designated Alternative 2 as its Preferred Alternative. The reduction in co-occurrence achieved under this alternative is considerable, particularly when the MRA credit is included as recommended by the ALWTRT. The broad use of line reduction and weakened line across most vessels that fish in the Northeast Region would be resilient to the potential shifts in right whale distribution and density. The reduction in co-occurrence achieved under Alternative 3 is greater than that achieved under Alternative 2 (Preferred) when compared using the same baseline (i.e. without the MRA restricted area) but at nearly three times the cost, greater uncertainty regarding how allocations would be applied and how fishermen would react, and how implementation and reaction would affect risk seasonally in response to a 50 percent line cap allocation in federal waters. Alternative 3 applies more restricted areas and even greater percent reduction in buoy line strength, compared to Alternative 2. Weaker line across most vessels that fish in the Northeast Region is resilient to the potential continued shifts in right whale distribution and density. The inclusion of additional buoy line closures that are larger in size or time period may also provide greater benefit to whales. However, the implementation costs of Alternative 2 are at least two thirds lower than the costs of implementing Alternative 3, making Alternative 2 the most cost-effective of the alternatives. Additionally, the measures in Alternative 2 were derived primarily from proposals submitted by the states, from the public comment period, and were informed by extensive outreach with fishermen in those states and in the LMA 3 offshore fleet. The measures are therefore more likely to be feasible and result in higher compliance because of fishermen's input on the development of the measures.

NMFS believes that Alternative 2, the Preferred Alternative, addresses the Purpose and Need for Action stated in this FEIS, incorporating measures that will help to conserve large whales by reducing the potential for and severity of interactions with commercial fishing gear that may lead to mortalities and serious injuries. Included are region wide measures that will be resilient to shifting whale distribution, informed by stakeholders and therefore considered feasible, underlaid by seasonal restrictions that protect predictable aggregations of right whales, and supplemented by state conservation measures that will be implemented before or simultaneously by

Massachusetts and Maine. On this basis, NMFS believes that Alternative 2 (Preferred) offers the best option for achieving compliance with MMPA requirements.

1.5 Public Comment

1.5.1 *Public Scoping and Comments Received*

On August 2, 2019, we published a Notice of Intent to Prepare an Environmental Impact Statement and Request for Comments regarding Atlantic Large Whale Take Reduction Plan Modifications (84 FR 37822). As part of the scoping process, we held eight public meetings at locations around New England between August 8 and 21, 2019:

1. Thursday, August 8, 2019—Narragansett, RI, 6 p.m. to 9 p.m. URI Graduate School of Oceanography, Corless Auditorium, 215 South Ferry Road, Narragansett, RI 02882
2. Monday, August 12, 2019—Machias, ME, 6 p.m. to 9 p.m. University of Maine at Machias, Performing Arts Center, 116 O'Brien Avenue, Machias, ME 04654
3. Tuesday, August 13, 2019—Ellsworth, ME, 6 p.m. to 9 p.m. Ellsworth High School Performing Arts Center, 24 Lejok Street, Ellsworth, ME 04605
4. Wednesday, August 14, 2019—Waldoboro, ME, 6 p.m. to 9 p.m. Medomak Valley High School, 320 Manktown Road, Waldoboro, Maine 04572
5. Thursday, August 15, 2019—Portland, ME, 6 p.m. to 9 p.m. South Portland High School, 637 Highland Ave., South Portland ME, 04106
6. Monday, August 19, 2019—Portsmouth, NH, 6 p.m. to 9 p.m. Urban Forestry Center, 45 Elwyn Road, Portsmouth, NH 03801
7. Tuesday, August 20, 2019—Gloucester, MA, 6 p.m. to 9 p.m. NMFS Greater Atlantic Region, 55 Great Republic Drive, Gloucester, MA 01930
8. Wednesday, August 21, 2019—Bourne, MA, 6 p.m. to 9 p.m. Upper Cape Cod Regional Technical School, 220 Sandwich Rd., Bourne, MA 02352

These eight public meetings were attended by more than 800 stakeholders. We received more than 89,200 written comments during this process, of which the majority were campaign postcards organized by various non-governmental groups, including Natural Resources Defense Council (39,559), Conservation Law Foundation (859), Defenders of Wildlife (8,755), as well as various other online campaigns (39,805). We also received letters from each New England state's fishery management organization, from the Marine Mammal Commission, Atlantic States Marine Fisheries Commission, the Maine Congressional delegation, and a Maine State representative. Four fishing industry representatives sent comments by mail or email, and we received more than 50 unique letters from fishermen providing details about their fishing practices by mail, as well as 125 form letters. By email, we received more than 120 unique comments, including 30 emails from fishermen or fishing families. Eleven representatives from environmental organizations sent letters and emails, and we received more than 89,000 emails associated with at least 12 non-governmental organizations' campaigns. For a complete list of comments and how they were addressed, please see Appendix 1.1 and Volume 3.

After receiving and reviewing these comments, we developed the Final Rule to Amend the Atlantic Large Whale Take Reduction Plan to Reduce Risk of Serious Injury and Mortality to

North Atlantic Right Whales Caused by Entanglement in Northeast Crab and Lobster Trap/Pot Fisheries and Draft Environmental Impact Statement.

1.5.2 *Public Comments on DEIS*

We published the Proposed Rule to Amend the Atlantic Large Whale Take Reduction Plan to Reduce Risk of Serious Injury and Mortality to North Atlantic Right Whales Caused by Entanglement in Northeast Crab and Lobster Trap/Pot Fisheries and Draft Environmental Impact Statement on December 31, 2020. A 60-day public comment period began on December 31, 2020, and ended on March 1, 2021 (85 FR 86878, December 31, 2020).

Oral Comments

In January 2021, we held four public information sessions and in February 2021, we held four public hearings, all virtual due to the global pandemic. The sessions were organized by region, though everyone was welcome to attend any session. Although the purpose of the January meetings was to provide information and answer questions, we accepted oral comments on the proposed rule and the Draft Environmental Impact Statement (DEIS) at all eight meetings. See Tables 1.5 and 1.6 for a breakdown of participants that attended the information sessions and public hearings.

Information Sessions

1. Rhode Island, Southern Massachusetts and LMA3, Tuesday, January 12, 2021, 6:30-8:30 pm
2. Massachusetts (Outer Cape and LMA1) and New Hampshire (LMA1), Wednesday, January 13, 2021, 6:30-8:30 pm
3. Southern Maine, Tuesday, January 19, 2021, 6:30-8:30 pm
4. Northern Maine, Wednesday, January 20, 2021, 6:30-8:30 pm

Table 1.5: Nightly attendance for the proposed rule and DEIS information sessions held in January 2021

Session	Participants
Jan. 12, RI, Southern MA, LMA3	79
Jan. 13, Outer Cape MA, LMA1, MA and LMA1 NH	79
Jan. 19, Southern Maine	73
Jan. 20, Northern Maine	85
Total Attendees	316
Total Unique Registrants	230
Attended 1 Session	166
Attended 2 Sessions	48
Attended 3 Sessions	10
Attended all 4 Sessions	6
Attended more than one session	64

Public Hearings

1. Rhode Island, Southern Massachusetts and LMA3, Tuesday, February 16, 2021, 6:30-8:30 pm
2. Massachusetts (Outer Cape and LMA1) and New Hampshire (LMA1), Wednesday, February 17, 2021, 6:30-8:30 pm
3. Southern Maine, Tuesday, February 23, 2021, 6:30-8:30 pm

4. Northern Maine, Wednesday, February 24, 2021, 6:30-8:30 pm

A total of 211 people ask questions or provided comments through these informational sessions and public hearings. Of these, at least 59 identified themselves as fishermen on the calls. About 77 commenters voiced support for this rule or strengthening this rule, while 44 generally opposed the rule or questioned the need for a rule. Many people had questions or wanted clarification on particular parts of the rule, but did not specifically voice either support or opposition.

Table 1.6: Nightly attendance for the proposed rule and DEIS public hearings held in February 2021

Session	Participants
Feb. 16, RI, Southern MA, LMA3	112
Feb. 17, Outer Cape MA, LMA1, MA and LMA1 NH	123
Feb. 23, Southern Maine	234
Feb. 24, Northern Maine	344
Total Attendees	813
Total Unique Registrants	635
Attended 1 Session	517
Attended 2 Sessions	76
Attended 3 Sessions	24
Attended all 4 Sessions	18
Attended more than one session	118

To see summaries of the comments made at public information sessions and hearings, please see Appendix 1.1 and Volume 3. Table 1.7 below summarizes the commenters and the key themes of their statements. Responses to comments are available in Appendix 1.1.

Written Comments

We received 171,213 comments on the Proposed Rule and the Draft Environmental Impact Statement (DEIS) through the comment portal. Of these, six comments from Non-Governmental Organizations were entered as counting for more than one comment:

- Pew Charitable Trusts: 47,699
- Conservation Law Foundation: 1,192
- Humane Society of the U.S: 15,922
- Oceana: 18,440
- Natural Resources Defense Council: 33,045
- Riverkeepers: 4

Five additional comments from Non-Governmental Organization were entered as one comment, but had thousands of signatures attached:

- International Fund for Animal Welfare: 31,912
- Whale and Dolphin Conservation: 3,629
- Environment America: 11,727
- Center for Biological Diversity: 26,594
- Environmental Action: 11,135

All of the above-referenced comments, which represent up to 201,269 people, were in favor of stronger regulations to protect North Atlantic right whales. They strongly favored the following

measures: longer and larger restricted areas, increased gear marking, transition to ropeless gear, and a risk reduction target of more than 60 percent. While many were in favor of weak rope or weak link requirements, many also voiced concerns that 1700 lb breaking strength has not been proven to reduce entanglements and could still severely entangle juveniles and calves. In addition, the vast majority urged NMFS to use the most updated population data in setting risk reduction targets and recommended the use of emergency measures to take action immediately.

After accounting for the bulk submissions, we received 53,585 comments uploaded through the regulations.gov portal, as well as 9 comments emailed directly to our office, 3 of which were added to Regulations.gov, and are included in the 53,585 total above. After running a deduplication analysis, identifying additional campaign emails not detected by the deduplication analysis, and reviewing the entries for double submissions or submissions of supporting documentation separate from the original comment letter, we received approximately 1,076 unique comments that were not clearly part of a coordinated campaign. We received 28 comments from academic/scientific individuals or organizations, 2 federal agencies, 1 federal resource manager, 2 fishery management associations, 10 fishing industry associations, 2 manufacturers, 71 non-governmental organizations, 617 members of the public, 300 fishermen, 2 representatives from other industries, 32 state/federal legislators, 7 state fishery resource managers, and 2 towns.

A total of 122 speakers submitted comments orally at public information sessions or public hearings. Many of the speakers submitted more than one comment, and several submitted comments at more than one session. If an individual commented at more than one session, the individual was counted as a unique speaker on each day. We received 2 comments from academic/scientific individuals or organizations, 3 fishing industry associations, 27 non-governmental organizations, 27 members of the public, 59 fishermen, 2 state fishery resource managers, and 2 state/federal legislators.

As many of the speakers who submitted comments orally also submitted comments through the Regulations.gov portal, we considered each individual's comments, both oral and written, as one submission. This gives us a total of 1,129 unique submissions. Combining both written and oral submissions, and excluding duplicates, we received submissions from 28 academic/scientific individuals or organizations, 2 federal agencies, 1 federal resource manager, 2 fishery management associations, 10 fishing industry associations, 2 manufacturers, 76 non-governmental organizations, 628 members of the public, 336 fishermen, 2 representatives from other industries, 33 state/federal legislators, 7 state fishery resource managers, and 2 towns.

Of the 336 unique commenters who identified themselves as fishermen, either directly or through context, 312 voiced opposition to all or part of the rule, 19 commented on particular provisions, but did not expressly support or oppose, and 5 supported the general idea of the rule, though had specific comments on some measures. Of the ten fishing industry groups, eight opposed all or part of the rule, one gave specific recommendations, but did expressly support or oppose, and one supported the general idea of the rule. The primary concerns raised by fishermen are that right whales are not in the areas that they fish and this rule will not protect right whales, but instead will place a large economic burden on fishermen with no benefit for the whales (>147);

the economic impact of this rule will put them out of business and devastate coastal communities (>126); and that ropeless fishing is not yet and may never be feasible on a large scale (>105).

Of the 628 unique commenters who identified themselves as members of the public, either directly or through context, the vast majority (534) supported this rule, but expressed the opinion that the rule did not go far enough to protect right whales, with 84 suggesting NMFS use emergency authority to implement immediate protections for whales. Only 54 expressed opposition to the rule. A small number suggested that this rule should be withdrawn because it does not provide adequate levels of protection for right whales, and NMFS should start over.

To summarize, overall, nearly 59 percent of unique commenters supported the Proposed Rule in whole or in part, with the majority expressing the opinion that the proposed regulations should be strengthened to provide more protection to right whales. A little over 34 percent of commenters opposed the rule in whole or in part, and about 4 percent suggested that the rule should be scrapped because it does not provide adequate levels of protection for right whales, and NMFS should start over. About 4 percent of commenters did not express support or opposition, but suggested specific measures or strategies that NMFS should employ. In addition, about 14 percent of commenters (who had either supported the rule or suggested starting over) wanted NMFS to take emergency action.

Table 1.7 below summarizes the substantive comments received on the proposed rule and DEIS, and provides information on how we responded to the comments. Our responses to these comments are available in Appendix 1.1. In the Appendix, we categorize the comments according to the topic identified in written statements or oral testimony regarding the proposed action and alternatives. We first summarize the topic category, and then provide specific comments, and responses to each. Responses may refer to portions of the FEIS or Final Rule that have been modified as a result of comments. We also made changes to the FEIS and the Final Rule in response to the comments, where appropriate, including updates to data where the comments affect the impact analysis. Technical or editorial comments on the DEIS merely pointing out a mistake or missing information were addressed directly in the body of the FEIS and Final Rule.

NMFS identified a total of 187 distinct substantive comments that were within the scope of the current rulemaking. The majority of these comments were submitted by multiple people, some of them by thousands of people.

Section 1.4.3 below serves as a guide for reviewing the comments and should not substitute for reading the comments directly. See FEIS Volume III for a more complete description of the comments received.

1.5.3 *Response to Comments*

When preparing a FEIS, an agency must address comments received on the DEIS, either by modifying the alternatives in the DEIS, supplementing the DEIS alternatives, revising the analyses, making factual corrections, or explaining why the comments do not warrant further

agency response (40 CFR 1503.4). In the table below, we identify the major topics and subtopics we received, and where we provided responses.

Table 1.7: A summary of comments received on the Proposed Rule and DEIS as well as where to find the responses to the comment, organized by subtopics.

Topic	Subtopic	Comment	Response
Collaboration with Canada	Apportionment	Split of 50/50 of unknown entanglement cases	Appendix 1.1, Comment 1.1
	Fishery	Canada's regulations insufficient	Appendix 1.1, Comment 1.2
	Research	More collaboration with Canada needed	Appendix 1.1, Comment 1.3
	Bilateral	Maine DMR should be involved in bilateral discussions	Appendix 1.1, Comment 1.4
Economics	Economic Effects	Competition with Canada	Appendix 1.1, Comment 2.1
		Costs of LMA1	Appendix 1.1, Comment 2.2
		Disentanglement costs	Appendix 1.1, Comment 2.3
		Economic analysis of benefits of ropeless fishing	Appendix 1.1, Comment 2.4
		Economic benefits of weak lines	Appendix 1.1, Comment 2.5
		Economic cost of prior rules	Appendix 1.1, Comment 2.5
		Effects on fishermen from other states (CT, NY)	Appendix 1.1, Comment 2.6
		Fleet consolidation	Appendix 1.1, Comment 2.7
		Gear conversion/replacement savings	Appendix 1.1, Comment 2.8
		Gear marking time and labor	Appendix 1.1, Comment 2.9
		Gear loss due to changes required by rule	Appendix 1.1, Comment 2.10
		Include cost of gear marking done in anticipation of rule	Appendix 1.1, Comment 2.11
		NMFS should analyze economic effects to supply chain	Appendix 1.1, Comment 2.12
		Socioeconomic effects/culture/heritage	See FEIS Section 6.7
	Economic Assistance	Buybacks	Appendix 1.1, Comment 2.13
		Compensation for fishermen	Appendix 1.1, Comment 2.14
		Institute a lobster/crab tax to support fishermen	Out of Scope
	Economic Analysis	Costs of AIS/vessel tracking systems	Appendix 1.1, Comment 2.15
		Ecological value of whales	Appendix 1.1, Comment 2.16
		Issue with Casco Bay Ferry Line data	Out of Scope

Topic	Subtopic	Comment	Response
		Meyers and Moore 2020 Paper	Appendix 1.1, Comment 2.17
		Equipment durability	Appendix 1.1, Comment 2.18
		Use of dealer data	Appendix 1.1, Comment 2.19
		Fails to analyze reduced catch	Appendix 1.1, Comment 2.20
Enforcement	Compliance	NMFS should develop comprehensive plan	Appendix 1.1, Comment 3.1
		Monitor/patrol offshore	Appendix 1.1, Comment 3.2
		Enforce regs in different areas	Appendix 1.1, Comment 3.3
		Enforce regulations on offshore dumping	Out of Scope
Gear Marking	Evaluation	3-year evaluation period	Appendix 1.1, Comment 4.1
	Exemptions	Hand-hauling	Appendix 1.1, Comment 4.2
	Manufacturers	NMFS should work with manufacturers	Out of Scope
	More specific gear marks	Individual ID tags	Appendix 1.1, Comment 4.3
		Subdividing areas	Appendix 1.1, Comment 4.4
	Requirements	NMFS should not add any gear-marking requirements	Appendix 1.1, Comment 4.5
		Should apply to all fisheries in migratory path	Appendix 1.1, Comment 4.6
		Should be required every 17 fathoms	Appendix 1.1, Comment 4.7
		Sinking groundlines	Appendix 1.1, Comment 4.8
		Visibility of gear marks	Appendix 1.1, Comment 4.9
		Gear marking every 40 feet	Appendix 1.1, Comment 4.10
	Timing	Implement during the off-season	Appendix 1.1, Comment 4.11
	Visual or acoustic	Could visual or acoustic cues alert whales to lines in the water	Appendix 1.1, Comment 4.12
Legal Issues	APA	APA - Refusal to Evaluate Some Strategies	Appendix 1.1, Comment 5.1
	EO 12898	EO 12898 - Violates	Appendix 1.1, Comment 5.2
	ESA	ESA - Authorization of fisheries violates	Appendix 1.1, Comment 5.3
	MMPA	MMPA - Violates by Allocating Full PBR to Pot/Trap Fishery	Appendix 1.1, Comment 5.4
		MMPA - Violates by Considering Economics in Alternatives	Appendix 1.1, Comment 5.5
		MMPA - Violates by Not Meeting ZMRG Within 5 Years	Appendix 1.1, Comment 5.6

Topic	Subtopic	Comment	Response
		MMPA - Violates by Not Reducing PBR in 6 Months	Appendix 1.1, Comment 5.7
		MMPA - ALWTRP may not prevent decline of right whales	Appendix 1.1, Comment 5.8
		MMPA - State Measures Should Be Included in the Final Rule	Appendix 1.1, Comment 5.9
	NEPA	NEPA - "Purpose and Need" Statement Too Narrow	Appendix 1.1, Comment 5.10
		NEPA - CEQ's Recent Amendments	Appendix 1.1, Comment 5.11
		NEPA - Did Not Consider a "No Commercial Fishing" Alternative	Appendix 1.1, Comment 5.12
		NEPA - Did Not Evaluate a Reasonable Range of Alternatives	Appendix 1.1, Comment 5.13
		NEPA - Rejected Trap Reductions	Appendix 1.1, Comment 5.14
	Multiple	NEPA/APA - DEIS Did Not Analyze All Risks	Appendix 1.1, Comment 5.15
		NEPA/APA - Did Not Consider Dynamic Area Management	Appendix 1.1, Comment 5.16
		MMPA/ESA - Regulations Are Not Effective and Immediate	Appendix 1.1, Comment 5.17
		MMPA/NEPA/APA - Violated Best Scientific Information Available	Appendix 1.1, Comment 5.18
	Unconstitutional	Exceeds authority of unelected officials	Appendix 1.1, Comment 5.19
Line/Effort Reduction	Buyback program	NMFS should establish a buyback program	Appendix 1.1, Comment 2.13
	Latent effort	Properly account for latent effort	Appendix 1.1, Comment 6.1
	Reduce Effort	Cap endlines	Appendix 1.1, Comment 6.2
		Cap and reduce licenses	Appendix 1.1, Comment 6.3
		Remove half the traps from the water	Appendix 1.1, Comment 6.4
Management	Adaptive Management	Should reassess and recalibrate measures on regular basis	Appendix 1.1, Comment 7.1
		Should develop another process	Appendix 1.1, Comment 7.2
	Apportionment	Split of 50/50 of unknown entanglement cases	Appendix 1.1, Comment 1.1
	Areas	Should include southeast states in future rulemakings	Appendix 1.1, Comment 7.3
	Disentanglement Teams	Fishermen should be part of disentanglement teams	Appendix 1.1, Comment 7.4
	Emergency Rulemaking	Close all fisheries or all areas	Appendix 1.1, Comment 7.5
		Shut down high seas transport	Out of Scope
		Implement year-round closure for South Island area	Appendix 1.1, Comment 7.6
		Seasonal closures in Gulf of Maine	Appendix 1.1, Comment 7.7

Topic	Subtopic	Comment	Response
		Remove verticals lines in areas of high co-occurrence	Appendix 1.1, Comment 7.8
	Evaluation	How will regulation be evaluated?	Appendix 1.1, Comment 7.9
		Past regulations should be evaluated before adding new ones	Appendix 1.1, Comment 7.10
	Fisheries	NMFS should ban/reduce commercial fisheries	Appendix 1.1, Comment 7.11
		Harvester reporting	Appendix 1.1, Comment 7.12
		Should be managed like multispecies fishery	Appendix 1.1, Comment 7.13
	MMPA Mandate	Regulations won't bring the right whales back	Appendix 1.1, Comment 7.14
	Other whale species	Effects of regulations on other species	Appendix 1.1, Comment 7.15
	Risk Reduction Target	Cryptic mortality taken into account?	Appendix 1.1, Comment 7.16
		Focus on areas of high occurrence	Appendix 1.1, Comment 7.17
	Risk Reduction Calculations	ASMFC Pending Measures Should Not Be Counted in Analyzing Risk Reduction	Appendix 1.1, Comment 7.18
		Changes to MA regulations	Appendix 1.1, Comment 7.19
		Conservation Equivalences	Appendix 1.1, Comment 7.20
		If Maine funds GPS trackers, should get risk reduction credit	Appendix 1.1, Comment 7.21
		LMA3 - 50% endline reduction v. closed area/gear displacement	Appendix 1.1, Comment 7.22
		State credits	Appendix 1.1, Comment 7.23
		Proposal evaluations	Appendix 1.1, Comment 7.24
		Threat of gear based on water column	Appendix 1.1, Comment 7.25
		Validity of the threat component of the DST	Appendix 1.1, Comment 7.26
		Uncertainty in DST	Appendix 1.1, Comment 7.27
	Timing	Implementation timing	Appendix 1.1, Comment 7.28
	Language Clarification	From previous regulations	Appendix 1.1, Comment 7.29
	Trap tags	Rule applies to all traps with trap tags	Appendix 1.1, Comment 7.30
	Justification	Benefit to whales not sufficient to justify rule	Appendix 1.1, Comment 7.31
	Recreational fisheries	Should be eliminated	Appendix 1.1, Comment 7.32
Research	Entanglements	Effects of entanglements on birth rates	Appendix 1.1, Comment 8.1
		Healthy whales capable of avoiding lines	Appendix 1.1,

Topic	Subtopic	Comment	Response
			Comment 8.2
		Mechanical engineers should study cause of entanglements	Appendix 1.1, Comment 8.3
		Monitor whale entanglements with satellites and observers	Appendix 1.1, Comment 8.4
		No Maine lobster gear involved in entanglements	Appendix 1.1, Comment 8.5
		Gillnet and netting more prevalent	Appendix 1.1, Comment 8.6
	Data Insufficient	Line density model too uncertain	Appendix 1.1, Comment 8.7
		Model overestimates right whale mortalities	Appendix 1.1, Comment 8.8
		Monitor whale travel routes	Out of Scope
		NMFS should use acoustic/prey data, longer/shorter time series	Appendix 1.1, Comment 8.9
		PBR based on outdated population data	Appendix 1.1, Comment 8.10
		Peer-reviewed science required	Appendix 1.1, Comment 8.11
	Distribution	Data on distribution flawed/incomplete	Appendix 1.1, Comment 8.12
		Migratory patterns of whales in Area 2?	Appendix 1.1, Comment 8.13
		NMFS should increase aerial, boat-based, and drone surveys	Appendix 1.1, Comment 8.14
		NMFS should tag and track whales	Appendix 1.1, Comment 8.15
		NMFS should use spotter planes to alert fishermen to whales	Appendix 1.1, Comment 8.16
		Whale distribution has changed due to climate change/copepod distribution	Appendix 1.1, Comment 8.17
		Whales do not occur in inshore Maine waters, no need for rules	Appendix 1.1, Comment 8.18
		Whales not injured by Massachusetts fishing gear	Appendix 1.1, Comment 8.19
		Whales traveling to Iceland and Labrador, not dead, as model says	Appendix 1.1, Comment 8.20
Restricted Areas	Broad Application	Should apply to all fisheries/mobile gear fishermen	Appendix 1.1, Comment 9.1
	Dynamic Closures	NMFS should implement dynamic closures based on presence of whales	Appendix 1.1, Comment 9.2
	Effects	Effort displacement/crowding in other areas	Appendix 1.1, Comment 9.3
		Mobile gear fishermen	Appendix 1.1, Comment 9.4
		Walls of dense gear	Appendix 1.1, Comment 9.5
	Georges Bank	Add Georges Bank Restricted Area	Appendix 1.1, Comment 9.6
	Gulf of Maine	3 seasonal closures recommended by Pew	Appendix 1.1, Comment 9.7

Topic	Subtopic	Comment	Response
	Justification	Changes in whale distribution	Appendix 1.1, Comment 9.8
		Use best available data	Appendix 1.1, Comment 9.9
	Seasonal Closures	LMA 1 trigger	Appendix 1.1, Comment 9.10
		LMA1 "hotspot" designation based on old data	Appendix 1.1, Comment 9.11
		LMA 1 hotspot designation based on improper calculation	Appendix 1.1, Comment 9.12
		LMA1 should be closed in the fall, not spring	Appendix 1.1, Comment 9.13
		LMA1 should be open for ropeless	Appendix 1.1, Comment 9.14
		LMA1 should be reconfigured	Appendix 1.1, Comment 9.15
		LMA 1 not supported by acoustic data	Appendix 1.1, Comment 9.16
		LMA3 closure should be added	Appendix 1.1, Comment 9.17
		Mass Bay closure area should be expanded	Appendix 1.1, Comment 9.18
		Mass Bay closure trigger should include mom/calf pair	Appendix 1.1, Comment 9.19
		Pot/Trap should be entirely managed by seasonal closures	Out of Scope
		Ropeless fishing should be re-evaluated in seasonal closures	Appendix 1.1, Comment 9.20
		South Island RA effects on other species?	Appendix 1.1, Comment 9.21
		South Island RA should be expanded	Appendix 1.1, Comment 9.22
		South Island RA should be year-round	Appendix 1.1, Comment 9.23
		South Island RA should include vessel speed reduction	Appendix 1.1, Comment 11.10
		South Island RA should require one buoy in	Appendix 1.1, Comment 9.24
		Underestimated fishermen in LMA1	Appendix 1.1, Comment 9.25
	Timing	Recommend no summer closures	Appendix 1.1, Comment 9.26
	Vessel speeds	Add speed restrictions to EFPs	Appendix 1.1, Comment 9.27
	Offshore closures	Offshore closures would affect fewer fishermen	Appendix 1.1, Comment 9.28
Ropeless Gear	Access	Should make EFPs accessible to all fishermen	Appendix 1.1, Comment 10.1
	Feasibility	Various feasibility issues	Appendix 1.1, Comment 10.2
	Economics	Buybacks/subsidies for fishermen	Appendix 1.1, Comment 10.3
		Economic effects of lost gear/gear conflicts	Appendix 1.1,

Topic	Subtopic	Comment	Response
		with mobile gear	Comment 10.4
		NMFS needs to invest in gear development	Appendix 1.1, Comment 10.5
	Enforcement	How can ropeless be enforced?	Appendix 1.1, Comment 10.6
	Gear Conflicts	Need to reduce number of traps for ropeless to work	Appendix 1.1, Comment 10.7
		Space-sharing agreements	Appendix 1.1, Comment 10.8
	Planning	Fast-track/simplify permitting process	Appendix 1.1, Comment 10.9
		Need comprehensive long-term plan/roadmap	Appendix 1.1, Comment 10.10
		Need to have a uniform system so everyone can see gear placement	Appendix 1.1, Comment 10.11
		Require transition in 3 years	Appendix 1.1, Comment 10.12
		Should not be allowed in Cape Cod Bay	Appendix 1.1, Comment 10.13
		What about the Gray Zone?	Appendix 1.1, Comment 10.14
		Will increase risk due to lack of tension in lines?	Appendix 1.1, Comment 10.15
	Risk Reduction	Should not be considered neutral risk	Appendix 1.1, Comment 10.16
Stressors	Climate Change	Climate has changed distribution, putting whales in harm's way	Appendix 1.1, Comment 11.1
		Food sources shifted, whales rebounding	Appendix 1.1, Comment 11.2
	Health	Effects of disease and pollution	Appendix 1.1, Comment 11.3
		Inbreeding	Appendix 1.1, Comment 11.4
	Industrial Sonar/Noise	Effects on whales	Appendix 1.1, Comment 11.5
	Oil Spills	Could the BP oil spill have affected right whale calving?	Appendix 1.1, Comment 11.6
	Plastic pollution	Rule increases ocean plastics	Appendix 1.1, Comment 11.7
	Seismic testing	Effects on right whale population	Appendix 1.1, Comment 11.8
	Sharks	Predation on calves	Out of Scope
	Vessels	Vessel strikes a greater, more immediate threat	Appendix 1.1, Comment 11.10
	Wind energy	Offshore wind will displace fishermen	Appendix 1.1, Comment 11.11
Trawls	Economics	50% vertical line reduction will lead to consolidation	Appendix 1.1, Comment 12.1
		Expense will put fishermen out of business	Appendix 1.1, Comment 12.2
		Effects on landings	Appendix 1.1, Comment 12.3

Topic	Subtopic	Comment	Response
	Flexibility	Trawl lengths should be flexible, depending on situation	Appendix 1.1, Comment 12.4
		Exempt gear along 50 fathom line	Appendix 1.1, Comment 12.5
		Maine islands should be regulated as coastal	Appendix 1.1, Comment 12.6
	Gear conflict	One buoy line leads to more gear conflict	Appendix 1.1, Comment 12.7
	Gear loss	Longer trawls lead to more gear conflict	Appendix 1.1, Comment 12.8
	Risk reduction	Agreements among vessels should not be required	Appendix 1.1, Comment 12.9
	Safety of whales	Longer trawls lead to worse entanglements	Appendix 1.1, Comment 12.10
	Safety of fishermen	Concerns re injury, capsizing, unsafe conditions	Appendix 1.1, Comment 12.11
	Trawl requirements	NMFS should require all mobile gear, no traps/pots	Appendix 1.1, Comment 12.12
	Tension	Focus should be on tension in endlines	Appendix 1.1, Comment 12.13
Weak Rope/Links	Configurations	Comments/suggestions on weak rope, links, contrivances	Appendix 1.1, Comment 13.1
	Effects on Fishermen	Comments/suggestions on safety and economic losses	Appendix 1.1, Comment 13.2
	Effects on Whales	Comments on effects of weak links/inserts/rope on right whales	Appendix 1.1, Comment 13.3
	Surface systems	Surface system buoy links	Appendix 1.1, Comment 13.4
	Unproven	Weak links/inserts/rope unproven	Appendix 1.1, Comment 13.5

1.6 Changes from the DEIS to the FEIS

The measures included in this FEIS were modified from the analyses in the DEIS based on comments received during the comment period on the DEIS but are all within the range of alternatives analyzed in the DEIS (as summarized in Table 1.8). NMFS received numerous comments from diverse interested parties during the public scoping and public comment periods on the DEIS. The comments included both formal written comments as well as oral comments offered at public hearings. Those comments are summarized in Appendices 1.1 and 3.4. These comments were taken into consideration with a new round of analyses described and justified in Chapter 3, Section 3.3. The results of these analyses and the public comment period informed the final alternatives included in this FEIS. Responsive to comments, the modifications to the DEIS for the FEIS prioritized use of an updated right whale density model to estimate risk reduction for right whales, the updated right whale population information including information on unobserved mortalities, feasibility of implementation and safety concerns (particularly for small entities) that could be ameliorated by conservation equivalencies, and consideration of indirect effects of measures that may adversely increase co-occurrence between buoy lines and whales.

Gear marking alternatives analyzed for the FEIS are discussed in Section 3.2.2. Marking gear does not reduce risk but if marked gear is retrieved from entangled whales it can provide information about where entanglement incidents occur. Alternative 2 (preferred) and the Final Rule would increase the number of marks required in federal water compared to the Proposed Rule but have lesser impacts within the scope of impacts considered for the buoy line replacement analyzed in Alternative 3 in the DEIS and retained as Alternative 3 in this FEIS.

Modifications to the risk reduction measures in Alternative 2 in this FEIS relative to Alternative 2 in the DEIS include:

- The seasonal restricted area south of Cape Cod in this Alternative is larger than the restricted area analyzed within the Preferred Alternative in the DEIS, coming instead from DEIS Alternative 3.
- The removal of the requirement for a weak link at the buoy, which was analyzed as part of Alternative 3 in the DEIS.
- Adoption of conservation equivalency recommendations submitted by Rhode Island and as public comments on the DEIS and Proposed Rule for LMA 2 exchanging new trawl length requirements with more expansive weak insert requirements throughout the LMA
- Adoption of conservation equivalency recommendations submitted as public comments on the DEIS and Proposed Rule for LMA 3 that would require more traps per trawl than in the DEIS within the Georges Basin area that was analyzed as a restricted area in Alternative 3 of the DEIS. This increase in number of traps per trawl was offset by a lower number of traps required within the Northeast Region south of the 50 fathom depth contour on the south end of Georges Bank.
- Adoption of conservation equivalency recommendations submitted as public comments on the DEIS and Proposed Rule for Maine waters in LMA 1, including modification of regulations implementing the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) at 50 CFR 697.21(b)2) requiring two buoy lines on trawls with more than three pots to accommodate Maine conservation equivalency options. This would allow the use of half the minimum number of traps required with two buoy lines if only one buoy line is used. Other differences in the FEIS Alternative 2 compared to the DEIS are trade-offs in the number of traps on a trawl based on Maine fishery zones and distance from shore between the Maine exemption line and the 12 nm line (see the discussion of conservation equivalencies in Section 3.3.2).

Changes in Alternative 3 risk reduction elements analyzed in this FEIS relative to the DEIS Alternative 3 include:

- Retaining the weak link at the buoy or allowing it to be lowered to the base of the surface system and retaining only one South Island Restricted Area closure
- Only analyzes the seasonal weak line option in LMA 3 because the other option is analyzed in the Preferred Alternative
- No longer offers two options for the South Island Restricted Area, maintaining the medium sized L-shaped area
- Includes the special expansion of the MRA into state waters as implemented by state Regulations (see Table 3.5)

The only gear marking alternative that changed between the DEIS and FEIS is Alternative 2. The DEIS only required one 6 inch (15.2 centimeter) long green mark to be included in state waters within the top two fathoms of the buoy. In the FEIS, gear in federal waters would be required to include at least four 1 foot long (30.5 centimeter) green marks within 6 inches (15.2 centimeter) of each state specific mark. The number of marks in federal waters has increased from the DEIS (four 1 foot/30.5 centimeter marks instead of one 6 inch/15.2 centimeter mark). This change is responsive to concerns about distinguishing state and federal buoy lines, identified during public hearings. Additionally, recently, retrieved gear from a right whale included gear marks of six and 9 inches (22.9) long, inconsistent with current U.S. gear marking requirements but consistent with past Canadian gear marks. Use of a minimum of a 12 inch (30.5 centimeter) mark in U.S. commercial fisheries could help distinguish U.S. marks from Canadian gear. This change is within the scope of impacts analyzed within the DEIS, and would increase gear specialists' ability to distinguish state from federal waters than Alternative 2 in the DEIS. For more information on the details of the alternatives, changes from the DEIS, and on the comments received from the public see Chapter 3 and Appendix 1.1.

Table 1.8: Changes to Alternative 2 (Preferred, top) and Alternative 3 (Non-preferred, bottom) in this FEIS compared to the DEIS.

DEIS	Alternative 2
Trawl Length (reduced line) and Co Occurrence reduction	
MA State Measures: no singles on vessels >29',	No longer being implemented by the state
LMA 2: Increase in trawl lengths over 3 nm	No Trawling up, only weak inserts
LMA 3: 45 traps/trawl	50 traps per trawl in Georges Basin Core area, 35 traps per trawl deeper than 50 fa south of Georges Bank, 45 traps/trawl otherwise.
ME LMA1: Trawling up to three traps per trawl in state waters outside of exempt area	Trawling up most places by distance from shore and by zone outside exemption line. One string option with half the traps through most of three to 12 nm.
ME LMA1: Trawling up everywhere between three to 12 nm by distance from shore (eight to 15 traps per trawl with two buoy lines)	Trawling up most places by distance from shore and by zone between three to 12 nautical miles. Some areas stay at status quo, others go farther than the DEIS for an equivalent risk reduction overall (five to 20 traps per trawl with two buoy lines). One string option with half the traps through most of three to 12 nm.
Restricted Areas	
No expansion of MRA included	Expanded closure in MA state waters north of MRA to border, keep the area closed along with all other state waters from Outer Cape Cod through to NH border until May 15th, with soft opening option. Final Rule will include closure until April.
South Island area proposed by Massachusetts; closed Feb-Apr	Move DEIS closure to considered but rejected, include large South Island Restricted Area from Alternative 3A in DEIS in Alternative 2, for same season of Feb-Apr
Weak Link	
Retain current weak link requirement at surface system but allow it to be at base of surface system or, as currently required, at buoy	For all buoy lines incorporating weak line or weak insertions, remove weak link requirement at surface system
Weakened Rope	

DEIS	Alternative 2
MA State waters: one weak insertion at 50% (didn't include non-exempt)	Weak inserts or full weak line every 60 ft (18.3 m) to 75%
ME State Waters: two inserts in state waters outside of exempt area	One insert, consistent with exempt state waters
ME LMA 1, 3 to 12 nm: two weak insertions 25% and 50%	Maintain 2 weak lines except those increasing trawl lengths to 20 traps per trawl (one at 33% in these areas)
LMA 2, 3 to 12 nm: Two weak insertions 25% and 50%	Weak insertions every 60 ft (18.3 m) or full weak line to 75%
LMA 2: Over 12 nm: one weak insertion in topper at 33%	Weak insertions every 60 ft (18.3 m) or full weak line to 75%
Gear Marking	
State Colors in lower buoy line: 2 in. buoy line below surface system in state waters, 3 in. Federal waters (top, middle and bottom)	At least 2 in. below surface system in state waters and at least three in federal waters (top, middle and bottom)
Federal waters: 6 in. green mark within 1 ft of large surface system mark	Federal waters: Four 1 ft green marks adjacent to ALL state color mark
DEIS	Alternative 3
Restricted Areas	
No expansion of MRA included	Expanded closure in MA state waters north of MRA to border, keep the area closed along with all other state waters from OCC through to NH border until May 15th, with soft opening option. Final Rule will include closure until April.
Two South Island Options (Feb - May): A) Large closure B) L-shaped closure	Move large area from Alternative 3A in DEIS to Alternative 2 for Feb-Apr, keep only L-Shaped area from Feb - May in Alternative 3
Weak Link	
For all buoy lines incorporating weak line or weak insertions, remove weak link requirement at surface system	Retain current weak link/line requirement at surface system but allow it to be at base of surface system or, as currently required, at buoy
Weakened Rope	
LMA 3: two options for weak rope 1) fully weak line in the top 75% of one line, 2) May - August: one weak line to 75% and 20% on other end. Sep - Apr: two weak "toppers" to 20%	Keep seasonal option: May - August: one weak line to 75% and 20% on other end. Sep - Apr: two weak "toppers" to 20%

1.7 Areas of Controversy

Numerous interest groups have participated in the formulation and refinement of the Plan. In addition to Team meetings, NMFS supported this rulemaking by conducting a series of public meetings held at various locations on the east coast during the summer of 2019. Additional scoping meetings were held by Maine, New Hampshire, Massachusetts and Rhode Island throughout the summer and fall of 2019 and into January and February of 2020. The public comment period on the Proposed Rule and DEIS, including public information sessions in January 2021, and public hearings in February of 2021 provided additional public input (see Section 1.5). Through public outreach, NMFS has attempted to gather and accommodate many viewpoints, pursuing whale conservation objectives while remaining sensitive to the many regulatory pressures on the fishing industry. The Maine Congressional delegation has provided regular attention and input. There is also ongoing litigation largely related to non-governmental

organizations' and whale conservationists' allegations that NMFS has not authorized the incidental take of right whales under the ESA or MMPA. The non-governmental organizations suggest that rapid changes to current fishing practices are needed to prevent continued mortality and serious injury of right whales in U.S. fisheries and reverse the decline of the right whale population. The dialogue that has occurred highlights a number of key areas of controversy that NMFS attempted to address in the regulatory alternatives examined:

- Whale conservationists emphasize that whale entanglements have continued despite the existing Plan requirements. Continued mortality and serious injury of right, humpback, and fin whales due to entanglement is the primary motivating factor behind refinement of the Plan. Conservationists support larger seasonal buoy line closure areas, similar to the larger area included in Alternative 2, and accelerated support for ropeless fishing alternatives. The alternatives under consideration seek to reduce large whale entanglement by decreasing the number of buoy lines in the water or modifying the gear so that the resulting entanglement does not result in a serious injury or mortality. Restricted areas that allow ropeless fishing are proposed to accelerate the development of operationally feasible ropeless technology. Chapter 3 further explains the revisions under consideration to the existing Plan.
- The ALWTRT did not broadly support the modification of existing closure areas to closures to buoy lines rather than closures to fishing. Additionally, although Massachusetts proposed a closure south of Nantucket and Cape Cod, they did not propose it as a closure to buoy lines nor did they propose the same area included in the Preferred Alternative in this FEIS. Fishing industry participants disagree that ropeless technology is ready for use in commercial fisheries or affordable and therefore do not consider it an available alternative to current fishing practices in most areas. In addition to operational concerns on a vessel at sea, fishermen express concerns about the time it takes to haul and re-deploy ropeless gear, gear conflict by fishermen unaware of sets on the bottom, an increase in gear loss, and cost effectiveness. The Atlantic States Marine Fisheries Commission's Law Enforcement Committee expressed similar concerns as related to their ability to retrieve and re-deploy gear set with ropeless technology. By proposing modification of existing seasonal closures and establishing new seasonal closures as closures to buoy lines rather than closures to harvesting lobster and crab, allowing the use of ropeless technology gives fishermen access to those areas (with authorization for exemptions from surface system requirements under other laws), but it is not a requirement. NMFS believes that encouraging industry use of ropeless fishing is necessary to accelerate the development of operationally effective ropeless fishing systems that would allow trap/pot fisheries to occur without mortality and serious injury to right whales.
- For the majority of seriously injured and killed right whales demonstrating signs of entanglement, no gear remains on the whales, no gear is retrieved, or retrieved gear is unidentified. Undocumented mortalities estimated in right whale population models (unobserved mortality) result in further uncertainty about the extent of the threat of U.S. fisheries, including trap/pot fisheries, to right whales. As a result, fishermen, particularly lobster fishermen, fundamentally disagree that U.S. trap/pot fishing gear entanglements

are causing right whale mortalities and serious injuries above the PBR. The fishing industry feels singled out unfairly within the overall context of factors that contribute to Atlantic large whale population decline. The cumulative effects analysis in this FEIS considers other stresses on whales (for example, ship strikes, climate change, and water pollution) and identifies parallel measures underway to address these stresses through other initiatives.

- A DST was used to develop and evaluate the risk reduction measures in Alternatives Two and Three. The model applies the best available information about whale distribution, buoy line numbers, and configurations of trap/pot gear. There is uncertainty in each data set. Because whales exhibit regular behavioral patterns (e.g., migration, feeding), NMFS seeks to use distribution data to reduce impacts on the fishing industry but maximize the effectiveness of the Plan by designating requirements tailored by region and season. This FEIS examines regulatory alternatives that introduce new gear modification requirements and other provisions that incorporate information about whale movements and behavior. Development of these spatial and temporal requirements involves the consideration of the inherent uncertainties and the integration of complex technical input from NMFS researchers and other experts. The models underwent Center of Independent Expert peer review in 2019 that acknowledged uncertainty and suggested modifications that were made when possible. Although much of the data is subject to uncertainty, the information employed in developing the spatial and temporal elements of the alternatives under consideration is the best information currently available.
- The data used to assess the restricted area options south of Cape Cod were of particular concern given that right whale sightings data suggest they are currently present in this area more than is reflected in long-term monitoring data within the databases that support distribution models. To address this, we used the most recent right whale habitat density model that used data from 2010 through 2018 to compare a few options for a restricted area in this region and compared these areas to updated survey data through April 2021. Any seasonal buoy line closures implemented will be reviewed by NMFS and the Take Reduction Team every three years considering new whale sightings data to ensure that, given shifting right whale distribution, regulations are adequately protecting areas of seasonal aggregations.
- A common concern expressed has been the lack of data about the lobster and crab trap/pot fisheries and associated challenges evaluating compliance and implementation of enforcement, particularly in waters beyond 12 nm (22 km) from shore. The effectiveness of proposed regulations is dependent upon compliance, including the ability of enforcement to ensure compliance. Parallel actions to increase vessel trip reporting will improve data regarding the fishery, and vessel monitoring systems are being piloted for use in the lobster fishery in federal waters. Monitoring and enforcement efforts will be developed in collaboration with the Take Reduction Team and enforcement partners.
- Delineation of exempt waters has been a recurring area of disagreement. Conservation advocates stress that extending regulations to all waters offers the greatest protection against entanglement, while other groups argue for exemptions in nearshore waters where

recorded whale activity is minimal and where small vessel sizes and solo fishing practices present safety concerns. NMFS sightings data suggest that large whales rarely venture into certain nearshore areas. However, the alternatives considered in this FEIS include both gear marking and precautionary weak insertion modifications in exempted areas. Planned Maine regulations identified in the Maine DMR proposal, and the measures considered in both Alternatives Two and Three include precautionary measures that would reduce the likelihood of a severe entanglement should a whale enter these areas and become entangled.

- The fishing industry is concerned that interactions between large whales and Canadian fishing gear and vessel strikes are not being adequately addressed and that mortalities in Canada must also be reduced to less than one per year to allow the right whale population to recover. They cite twenty years of effort to adapt fishing practices to protect large whales. Fishermen express their belief that the U.S. fishing industry is bearing a disproportionate regulatory burden and in particular, they disagree with NMFS approach dividing unassigned entanglement related mortalities and serious injuries and unobserved mortalities evenly between the U.S. and Canadian fisheries. NMFS recognizes that large whales face mortality risks throughout their range and that the shifting distribution of right whales has increased mortality incidents to unprecedented levels in Canadian waters, particularly the Gulf of St. Lawrence. NMFS continues to work with representatives from the Canadian Department of Fisheries and Oceans (DFO) to advise on protective measures for right whales in Canadian waters. Since 2017, DFO has implemented and modified regulations to address the recent increase in right whale mortality in Canadian waters. In addition, NMFS is working with Canadian whale biologists and support teams to improve and expand disentanglement efforts in Canadian waters. The emergence of new mortality sources in Canada does not exempt NMFS from implementing the Marine Mammal Protection Act. Although in recent years mortalities and serious injuries in U.S. fisheries may have caused fewer incidents than the anthropogenic mortalities in Canadian waters, they remain above PBR and, given other stressors, are not sustainable while the population is in decline. Further modifications to the Plan to reduce risk from U.S. fisheries by at least 60 percent are necessary to achieve PBR.
- Some segments of the commercial fishing industry have expressed concern about gear configuration modifications, particularly the trawling up and weak rope requirements, stressing safety concerns. Most commercial fishermen have optimized their fishing operations based on what their vessels and skills can safely fish. However most of the measures in the Alternative 2 (preferred) come from New England states and after frequent meetings and close collaboration with trap/pot fishermen. The alternatives also consider where and how weak line or weak insertions can be implemented and reflect data available on forces generated on the line during trawling. Buoy line weak insertion measures as well as trawl lengths were also informed by industry tolerances. The alternatives considered in this DEIS offer options for areas with smaller vessels and crews that operate in inshore waters.

- Maine has published rules, effective September 1, 2020 to require purple gear marking on all lobster/trap buoy lines fished by Maine permitted vessels throughout LMA 1, hoping to demonstrate that Maine buoy lines are not involved in right whale entanglement incidents (DMR Chapter 75.02). For the same reason, the South Atlantic Fishery Management Council implemented measures seasonally requiring a 1 foot (30.5 centimeter) long purple mark to be added adjacent to other colored marks required in the black sea bass trap/pot fishery from North Carolina, south. The sea bass marks would then be 2 foot (61 centimeter) long marks of two or three colors, including a 1 foot (30.5 centimeter) long purple band. Although concerns that having more than one purple marking may confound the ability to distinguish between Maine lobster/crab and black sea bass trap/pot gear, the NMFS gear team indicated that the multiple colors in the black sea bass marking regime would be sufficient to distinguish the two fisheries.
- Several commenters disputed the need for and presence of right whales near the LMA 1 Restricted Area, particularly as drawn with only a closure within LMA 1. This FEIS uses a new right whale density model with data only from 2010 through 2018, after the change in right whale distribution was detected, which still predicts this area as a relative hotspot in this region where there is also a high density of buoy lines. Additionally, restricting buoy lines in this area will prevent additional movement of fishing vessels offshore into habitat more frequented by right whales (see discussion in Chapter 5, Section 5.3). Without this area, the Preferred Alternative would likely not meet the minimum risk reduction target needed to reduce mortality and serious injury of right whales below PBR.

1.8 Report Structure

The remainder of this FEIS is organized as follows:

- **Chapter 2** reviews entanglement data and current Plan requirements.
- **Chapter 3** describes the proposed alternatives considered within this FEIS for modifying the ALWTRP.
- **Chapter 4** examines the affected environment, focusing on the status of Atlantic large whales, other protected species, habitat, and the basic features of the regulated fisheries and fishing communities.
- **Chapter 5** analyzes the biological impacts of the alternatives.
- **Chapter 6** analyzes the economic and social impacts of the alternatives.
- **Chapter 7** reviews and summarizes the findings of the biological, economic, and social impact analyses.
- **Chapter 8** examines the cumulative impacts of the alternatives and past, present, and reasonably foreseeable future actions.

- **Chapter 9** provides the Regulatory Impact Review (RIR) as required by Executive Order 12866 and the Initial Regulatory Flexibility Analysis (IRFA) in accordance with the requirements of the Regulatory Flexibility Act (RFA) of 1980. The purpose of the RFA is to evaluate the impacts that the regulatory alternatives under consideration would have on small entities and to examine opportunities to minimize these impacts.
- **Chapter 10** briefly summarizes the statutes and executive orders that have guided development of this FEIS and explains how the document meets the requirements of all applicable laws.

The document also includes a list of preparers and contributors (Chapter 11), a list of persons or agencies receiving the FEIS for review (Chapter 12), and a glossary, list of acronyms, and index (Chapter 13).

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CHAPTER 2 PURPOSE AND NEED FOR ACTION

The National Marine Fisheries Service (NMFS) is revising the Atlantic Large Whale Take Reduction Plan (ALWTRP or Plan) to conserve and provide additional protection to Atlantic large whales, including North Atlantic right whales (*Eubalaena glacialis*, hereafter right whales), Gulf of Maine humpback whales (*Megaptera novaeangliae*), and Western North Atlantic fin whales (*Balaenoptera physalus*). Canadian Eastern Coastal minke whales (*Balaenoptera acutorostrata acutorostrata*) have also previously been monitored for mortality and serious injury in commercial fisheries and considered in the Plan because of persistent entanglement impacts. The revisions would fulfill NMFS' obligations under the Marine Mammal Protection Act (MMPA). Revisions to the Plan would reduce the risk to the right whale and other large whale species due to mortality and serious injury caused by entanglement in commercial fishing gear. For additional background information on the Atlantic Large Whale Take Reduction Team (ALWTRT or Team), and implementation of the Plan, see the 2014 Final Environmental Impact Statement for Amending the Plan (NMFS 2014).

This Chapter will discuss large whale entanglement patterns since 2010, describe the current need for rulemaking (i.e. right whale population decline), and identify an estimate of the amount of risk reduction that is needed to reduce mortality and serious injury below the potential biological removal (PBR) level. The PBR level is defined by the MMPA as the maximum number of animals, not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. The PBR level is the product of the minimum population estimate of the stock, one-half the maximum theoretical or estimated net productivity rate of the stock at a small population size, and a recovery factor of between 0.1 and 1.0, where 0.1 is used for species listed as endangered; 0.5 for stocks of depleted, threatened or unknown status; and up to 1 for stable stocks with no recent issues with incidental fishery takes.

The data included here are primarily sourced from the large whale incident data that are maintained by the NMFS' Northeast Fisheries Science Center (NEFSC) and used to create annually published reports, including the *Serious Injury and Mortality Determinations for Baleen Whale Stocks along the Gulf of Mexico, United States East Coast, and Atlantic Canadian Provinces*, and the *Atlantic and Gulf of Mexico Marine Mammal Stock Assessments* for humpback, North Atlantic right, fin, and minke whales. The period between 2010 through 2019 is analyzed here because it represents the best available peer-reviewed data for the period after the right whale population decline began in 2010 (Pace et al. 2017), when a shift in distribution was documented (Davies et al. 2019, Record et al. 2019) and high mortalities in Canadian waters were detected. Preliminary population data since 2019 are also provided where available and appropriate for context, largely from the publicly available data on monitored right whale incidents that caused NMFS to declare an Unusual Mortality Event, as well as annual calf counts. Given the level of mortality and serious injury of right whales documented and estimated since 2010 combined with low reproductive rates, it has become more urgent to ensure that mortality and serious injury caused by incidental entanglements in U.S. commercial fisheries be reduced below PBR.

This chapter describes in detail the purpose and need for revisions to the existing Plan and is organized as follows:

- Section 2.1 provides background information including the current statutory and regulatory context of the ALWTRP recommendations being considered, summarizes the existing Plan regulations, and recent trends in large whale mortality and serious injury.
- Section 2.2 demonstrates the purposes and needs for additional action under the ALWTRP.

2.1 Background

2.1.1 *Statutory and Regulatory Context*

The Plan consists of regulatory restrictions on where and how U.S. commercial fishing gear in fixed gear fisheries can be set and informs research into whale populations, whale behavior, and fishing gear. The Plan also includes monitoring requirements, outreach to inform fishermen of the entanglement problems and to help them comply with Plan requirements, and a program to disentangle whales that do get caught in fishing gear.

The Plan was first created in 1997 to fulfill the MMPA mandate requiring NMFS to reduce human-caused mortality of right whales as well as humpback and fin whales along the U.S. Atlantic coast. The immediate goal of any take reduction plan is to reduce, within six months of its implementation, the mortality and serious injury of strategic stocks incidentally taken in the course of U.S. commercial fishing operations to below the PBR levels established for such stocks. A stock is considered strategic if it is listed as threatened or endangered under the Endangered Species Act (ESA), is listed as depleted under the MMPA, or is undergoing anthropogenic mortality at rates higher than PBR. The long-term goal of a take reduction plan is to reduce, within five years of its implementation, the incidental mortality and serious injury of marine mammals taken in the course of commercial fishing operations to insignificant levels approaching a zero mortality and serious injury rate, taking into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans.

To comply with the MMPA mandates, NMFS annually estimates the level of human-caused mortality and serious injury for strategic stocks. Baleen whale interactions are rarely detected by marine mammal observers on fishing vessels or through other traditional monitoring methods, therefore most fishery interactions are determined through careful review of stranding and sighting incident reports collected opportunistically (from dedicated aerial and shipboard surveys, marine mammal disentanglement and stranding networks, U.S. Coast Guard, whale watch vessels, mariners, etc.). Following established national policy (*Policy for Distinguishing Serious from Non-Serious Injury of Marine Mammals Pursuant to the Marine Mammal Protection Act*), NMFS reviews incident reports to determine whether an injury is “serious” and likely to lead to death. For reported deaths of baleen whales in the Atlantic, NMFS applies regionally developed criteria to determine whether ship strikes or entanglements caused these documented mortalities (NMFS 2012). NMFS publishes the results of these analyses annually, and they are incorporated into annual stock assessment reports, which identify whether mortality

and serious injury during the most recent five-year period exceed the PBR established under the MMPA (Henry et al. 2014, Henry et al. 2021). Take reduction teams including representative stakeholders are convened to help NMFS reduce mortality and serious injury in commercial fisheries when the rate exceeds PBR.

Throughout the history of the Atlantic Large Whale Take Reduction program, the primary species driving Plan modifications has been the right whale. PBR for the endangered right whale stock has never been greater than one serious injury or mortality per year, and the most recent Stock Assessment Report (Hayes et al. 2020) identified PBR as 0.8 right whale mortality or serious injury a year. Coast-wide, human-caused mortality and serious injury of right whales have been well above PBR for many years, and since 2000 entanglement has been the primary cause of death identified when a cause has been determined (Kraus et al. 2005, Sharp et al. 2019).

Although right whales have always been the primary species of concern, when the Plan was created, humpback¹ and fin whales were also considered strategic stocks because they were listed as endangered. Primary causes of anthropogenic mortality for all three species were fishery interactions and vessel strikes. Humpback whales along the U.S. East Coast are primarily from the West Indies humpback distinct population segment (DPS), which were delisted in 2016 when the listing status of distinct population segments was reexamined individually. However, West Indies humpbacks are still protected under the MMPA throughout its range and continue to be monitored for human interactions when they approach PBR.

2.1.2 Current Gear Modification Requirements and Restrictions

The Plan specifies both widespread gear modification requirements and restrictions that apply to all trap/pot fisheries and anchored gillnets, as well as area- and season-specific gear modification requirements and restrictions. The general gear requirements for gillnet and trap/pot fisheries are delineated in 50 CFR 229.32 and include:

- No floating buoy line at the surface.
- No wet storage of gear (all gear must be hauled out of the water at least once every 30 days. In Federal waters in the Southeast U.S., trap/pots must be returned to shore at the end of every trip).
- In most waters, surface buoys and buoy lines need to be marked to identify the vessel or fishery.
- Knots – Fishermen are encouraged, but not required, to maintain knot-free buoy lines. Splices are not considered to increase entanglement threat and are thus preferable to knots.
- In most waters, groundline must be made of sinking line.
- All buoys, flotation devices, and/or weights must be attached to the buoy line with a weak link. Specific breaking strengths vary by area. This measure was designed so that if a large whale does become entangled, it should be able to exert enough force to break the

¹ NMFS determined that the Gulf of Maine stock of humpback whales was not strategic for the [2019 Stock Assessment Report](#), but was strategic for the 2020 draft Stock Assessment Report because human-caused mortality exceeds PBR; the 2020 Report is still under review.

weak link and break free of the buoy (trap/pot) or net panels (gillnet), increasing the chance of releasing the gear and reducing the risk of injury or mortality.

- All buoy lines need to be marked three times (top, middle, bottom) with three marks along a 12-inch (30.48cm) area. This measure is intended to help managers learn more about where, when, and how entanglements occur.
- Minimum trap per trawl requirements based on area fished and miles from shore (See Appendix 2.1).
- In the Southeast calving grounds, there are restrictions on breaking line strength as well as a limitation that only allows single pots to be fished. Singles are favored in this area to protect calves that would be more likely to survive an entanglement with a single pot compared to a heavier string/trawl of multiple traps.

There are also two seasonal trap/pot closures: the Massachusetts Restricted Area (MRA; 50 CFR 229.32(c)3) and the Great South Channel Trap/Pot Closure (50 CFR 229.32(c)4). The Massachusetts Restricted Area prohibits fishing with, setting, or possessing trap/pot gear in this area unless stowed in accordance with regulations found at 50 CFR [§ 229.2](#), from February 1 to April 30. Great South Channel Trap/Pot Closure prohibits fishing with, setting, or possessing trap/pot and gillnet gear in this area unless stowed in accordance with the regulations, from April 1 through June 30. Cape Cod Bay, part of the MRA, is also closed to gillnet fishing from January 1 to May 15. These time periods coincide with the presence of right whales in these areas. Additional details on current regulations are available in Appendix 2.1.

2.1.3 *Atlantic Large Whale Mortalities and Injuries, 2010 to 2019*

Large whales in the Atlantic are impacted by a variety of threats, both natural and human-caused (Table 2.1). It is important to note that the methods followed to make annual mortality and serious injury determinations of observed large whale incidents may under report entanglements and vessel strike (see Henry et al. 2020). Determinations are only made when they can be decided with absolute certainty and therefore likely do not represent the total number of incidents caused by entanglement or vessel strikes. The number of documented incidents summarized in Table 2.1 also represent only those that were sighted and reported, and does not include unobserved mortalities. For right whales, it is estimated that only an average 36 percent of all mortalities between 1990 and 2017 were detected (Pace et al. 2021). Therefore, mortality and serious injury determinations discussed in this section are underestimates. Additionally, incidents involving different species may not be reported at the same rate due to habitat usage as well as prioritization based on a species' status, and the amount of perceived threat. For example, entangled right whales are more likely to be reported compared to other large whale species due to extensive survey effort dedicated to this species throughout their range.

As delineated in Table 2.1, entanglement is identified as the cause of the highest proportion of all documented large whale incidents, including non-serious injury, reported for humpback, North Atlantic right, fin, and minke whales, with humpbacks and right whales experiencing higher numbers of entanglements compared to other causes. For all large whale species except right whales, the majority of documented mortalities and serious injuries did not have a cause definitively determined. For right whales, human sources were the leading causes of mortality and serious injury; 57 percent of all detected right whale mortalities and serious injuries between

2010 and 2019 occurred as a result of entanglement², 15 percent were caused by vessel strikes, and 3 percent were entrapments. The remaining 25 percent could not be attributed to a source. There were no confirmed natural mortality or serious injury incidents reported for right whales during this time period. Entanglement was also the highest cause of mortality and serious injury for humpback, fin, and minke whales in those instances when cause of death could be determined. Vessel strikes represent the next highest contributor to human-caused large whale mortality and serious injury for all but minke whales, followed by non-human causes and entrapments, incidents where an individual is confined or otherwise restricted in movement but not entangled in gear and can reach the surface for air.

Table 2.1: Atlantic coast-wide causes of large whale human interaction incidents between 2010 and 2019 with all health outcomes by species, including non-serious injuries and those that resulted in serious injury or mortality. The purpose of this table is to identify the risk of human interactions. Therefore these data include 84 incidents where serious injury or mortality due to incidental entanglement were averted due to successful disentangling (52 humpback, 21 fin, and 11 right whales). Also included are 93 individuals where injuries were “prorated” as highly likely to have a serious outcome (6 fin, 51 humpback, 24 minke, 12 right whales).

Cause	Fin N	Fin %	Humpback N	Humpback %	Minke N	Minke %	Right N	Right %	Total N	Total %
All Incidents										
Unknown	43	51.2%	146	31.2%	189	52.9%	28	15.1%	406	37.1%
Entanglement	22	26.2%	231	49.4%	109	30.5%	114	61.6%	476	43.5%
Vessel Strike	15	17.8%	66	14.1%	11	3.1%	38	20.6%	130	11.9%
Non-human Induced	3	3.6%	16	3.4%	42	11.8%	2	1.1%	63	5.8%
Entrapment	1	1.2%	9	1.9%	6	1.7%	3	1.6%	19	1.7%
TOTAL	84		468		357		185		1094	
Mortality & Serious Injury										
Unknown	43	57.3%	146	41.5%	188	54%	26	24.3%	403	45.7%
Entanglement	17	22.7%	139	39.5%	104	29.9%	61	57%	321	36.4%
Vessel Strike	12	16%	44	12.5%	11	3.2%	17	15.9%	84	9.5%
Non-human Induced	3	4%	16	4.5%	40	11.5%	-	-	59	6.7%
Entrapment	-		7	2%	5	1.4%	3	2.8%	15	1.7%
Total	75		352		348		107		882	

Large whale entanglements and vessel strikes occur in both the U.S. and Canadian waters. While vessel strikes are often first observed near the strike location, only in rare instances is the exact location of an entanglement incident determined. In some incidents, injured whales are first documented in U.S. waters but are entangled in gear that was set in Canadian waters, and vice versa. Gear was only retrieved from 21 percent (n = 479) of all large whale entanglements

² This estimate includes 11 disentangled whales where serious injury was avoided in order to better estimate the frequency at which mortality and serious injury would occur if not observed. Including these cases provides a better estimate of the threat of fisheries and associated reduction in entanglements needed and recognizes that relying on disentangling to reduce mortality and serious injury rates puts peoples’ safety at risk and may not always be an available conservation measure

between 2010 and 2019, and only 73 percent of the gear retrieved could be identified to fishery or gear type (i.e. 15 percent of observed entanglement incidents were identified). Of the 79 percent of cases where gear is not retrieved, only 16 percent were identified to a fishery or gear type and 24 percent had no gear present. It is impossible to confirm the country of origin for every incident, particularly for cases where gear was not retrieved or analyzed. And although in recent years Canada has provided some data on large whale entanglements documented in U.S. waters, only right whales are prioritized and fully represented in the Canadian data. Even for right whale incidents that come under more intense scrutiny, location of entanglement incidents can rarely be determined. Of 1462 entanglement incidents evaluated by the New England Aquarium between 1980 and 2016, only 110 had attached gear present and fewer could be traced to a country (Amy Knowlton pers. comm. August 13, 2019) with only 13 identified to the site of entanglement.

When coast-wide mortalities and serious injuries are aggregated based on the country where the incident occurred or, in the absence of a confirmed initial location, where the individual was first sighted, entanglement incidents occur in higher numbers than vessel strikes each year for all species except fin whales (Figure 2.1). Entanglement is the primary source of mortality and serious injury regardless of the location of first sighting or origin of the incident. Vessel strikes have been reported more frequently in U.S. waters than Canadian waters for all four large whale species with the exception of right whales from 2017 through 2019.

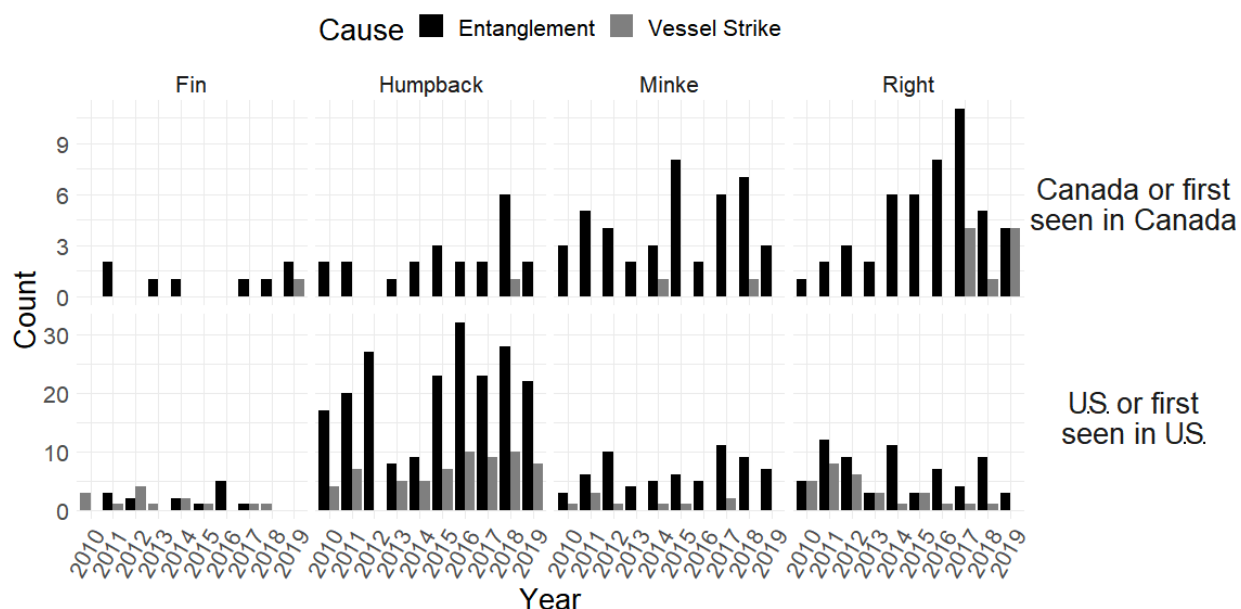


Figure 2.1: mortality and serious injury cases (including prorated injuries and those averted by disentangling response) caused by entanglements and vessel strikes according to the country where the incident occurred or, in the absence of that information, where the individual was first sighted.

Given reporting biases between species, trends in entanglements are difficult to examine, but there is some evidence that country-specific trends have shifted over the years, possibly in concert with regulatory and ecosystem changes that have shifted human activities and species' distribution (Hayes et al. 2018, Davies et al. 2019, Record et al. 2019). For example, Figure 2.1 shows a potential recent uptick in humpback vessel strikes in U.S. waters and a sharp increase in

new reports of right whale vessel strikes and entanglements in Canada. Coast-wide, annual right whale mortality and serious injury caused by entanglement far exceed the PBR level for the population (Figure 2.2). This remains true even when removing incidents first seen in Canada or known to be in Canadian gear. Coast-wide humpback and minke whale entanglements have remained high and observed mortality and serious injury has approached but not surpassed PBR in some years, but this represents the minimum number of takes by U.S. fisheries as not all incidents are seen and not all observed incidents of humpback and minke whales are as well documented as right whales. Using only documented incidents, the five-year rates of mortality and serious injury have remained below PBR for these stocks as well as for fin whales. Impacts on other large whales will be analyzed and discussed, however the primary focus of this document will be reduction in entanglement risk on the right whale stock because of the urgent need to reduce mortality and serious injury from entanglement interactions below PBR for this species.

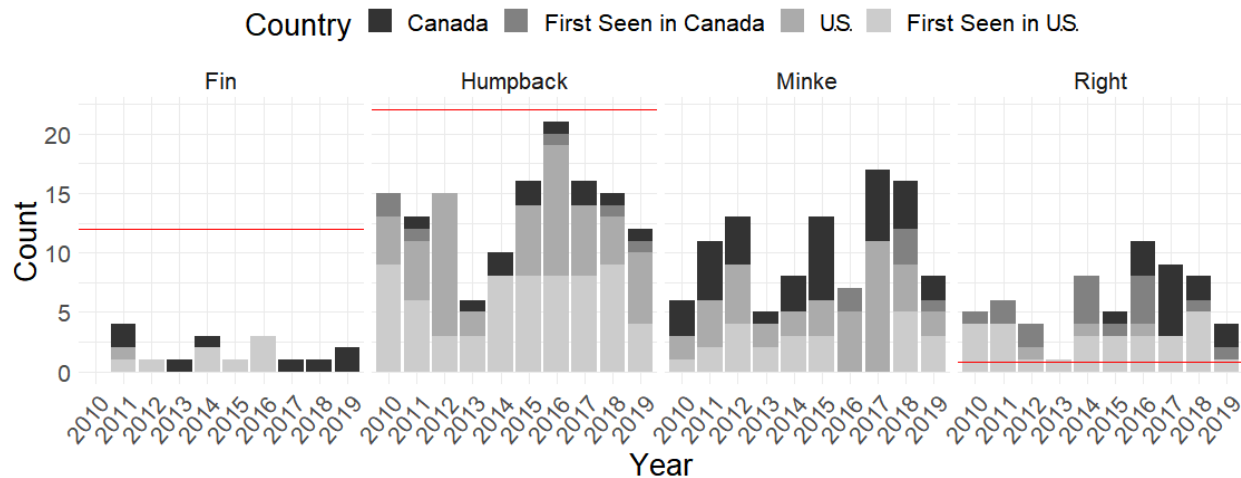


Figure 2.2: Entanglements that resulted in serious injury or mortality, according to the country of origin or country where the incident was first sighted. Incidents with prorated injuries and where serious injury was averted by disentanglement response are included as serious injuries. The red line represents the current PBR for the stock (PBR for minke whales is 189 and not pictured due to scale).

As described in Table 2.2, large whales are entangled in a variety of both fishing and non-fishing gear (e.g. boat moorings or debris). However, fishing gear represents the vast majority of documented sources of entanglements with only three documented non-fishing gear entanglements out of 476 incidents documented between 2010 and 2019 (Table 2.2). The type of fishing gear involved in an entanglement is not identifiable for a large portion of entanglements, including 85 percent of right whale events. Those incidents for which gear was identified are primarily from fisheries that use trap/pot gear, gillnet or other types of netting, or monofilament line. A few incidents have been attributed to fisheries using trawls, seines, or a weir. Trap/pot gear is the highest known documented source of entanglement for all whale species, with a high number of humpback and minke whale entanglements in confirmed U.S. lobster gear. Gillnet and netting gear have been found on all species except fin whales but are most frequently found on humpbacks in the U.S. Monofilament line is also primarily a concern in the U.S. for humpback whales and not commonly found on the other species.

Figure 2.3 shows the primary gear types detected on Atlantic large whales and the outcome of the incident. These data suggest that mortality and serious injury is more likely with trap/pot gear than netting, but they also demonstrate the large knowledge gap in identifying gear types that are contributing to mortality and serious injury. Humpbacks generally experience a higher number of entanglements than other species in a wide variety of gear types (48.5 percent of all entanglements), though many (40 percent) of them did not result in serious injuries. Minke whale entanglements result in serious injury or mortality more often (Table 2.1) and involve trap/pot, netting, and other gear types (Table 2.2). This is consistent with the likely scenario suggested by Knowlton et al. (2016) where a species' or age class' relative strength is linked to the likelihood of mortality and discovery. For those reported right whale entanglements for which gear was recovered and identified, trap/pot gear was more likely to result in mortality and serious injury. However, for most entanglements, no gear, only rope, or rope with buoys is retrieved, making it difficult to assign a specific fishery or fishery type in these cases. Buoy lines associated with fixed gear fisheries are very prevalent in the marine environment and the type of gear most frequently identified on entangled large whales in the Northwest Atlantic (81 percent, Johnson et al. 2005), making fixed gear fisheries a particular concern for the endangered right whale.

Table 2.2: The types of gear that have been identified on all documented entanglement incidents between 2010 and 2019 (including those not causing serious injury), identified to country and fishery, if possible. Confirmed U.S. trap/pot gear is highlighted in grey. This table does not include incidents where the type of gear or the presence of gear was undetermined. Gear determinations could change as additional information is acquired.

Fishery	Fin	Humpback	Minke	Right	Total
Trap/Pot Gear					
CAN trap/pot	0	1	0	0	1
CAN lobster	0	7	3	0	10
CAN snow crab	0	1	0	14	15
CAN crab	0	1	0	0	1
U.S. trap/pot	1	8	0	2	11
U.S. lobster	1	29	19	1	50
U.S. whelk trap/pot	0	1	0	0	1
U.S. recreational lobster	0	1	0	0	1
Unknown trap/pot	0	2	0	1	3
Subtotal Trap/Pot	2	51	22	18	93
Gillnet & Other Netting					
CAN netting	0	1	0	0	1
U.S. gillnet	0	3	0	1	4
U.S. gillnet - dogfish	0	4	1	0	5
U.S. gillnet - striped bass	0	1	0	0	1
U.S. gillnet - winter skate	0	1	0	0	1
U.S. gillnet - ground fish	0	1	0	0	1
U.S. gillnet - spot fish	0	1	0	0	1
U.S. gillnet - blue fish	0	1	0	0	1
U.S. gillnet - croaker	0	1	0	0	1
U.S. midwater trawl - herring	0	0	1	0	1
U.S. bait net	0	1	0	0	1
Unknown netting	0	6	2	1	9
Unknown gillnet	0	6	1	6	13
Unknown gillnet - non-groundfish	0	1	0	0	1
Subtotal Netting	0	28	5	8	41
Monofilament Gear					
U.S. monofilament	0	28	0	0	28

Fishery	Fin	Humpback	Minke	Right	Total
U.S. recreational	0	1	0	0	1
Unknown monofilament	1	31	2	0	34
Subtotal Monofilament	1	60	2	0	63
Multiple Gear Types					
Unknown gillnet & U.S. lobster	0	2	0	0	2
Unknown & U.S. lobster	0	1	0	0	1
Unknown ghost trap & U.S. lobster	0	0	1	0	1
U.S. lobster & unknown	0	2	1	0	3
Subtotal Multiple Gear Types	0	5	2	0	7
Other					
U.S. anchor	0	3	0	0	3
Debris	0	0	1	0	1
Subtotal Other	0	3	1	0	4
Unknown Gear					
CAN unknown	0	2	1	4	7
U.S. unknown	0	3	4	3	10
Unknown	10	65	23	29	127
No gear present	5	13	21	48	87
Subtotal Unknown	15	83	49	84	231
Totals	18	230	81	110	439

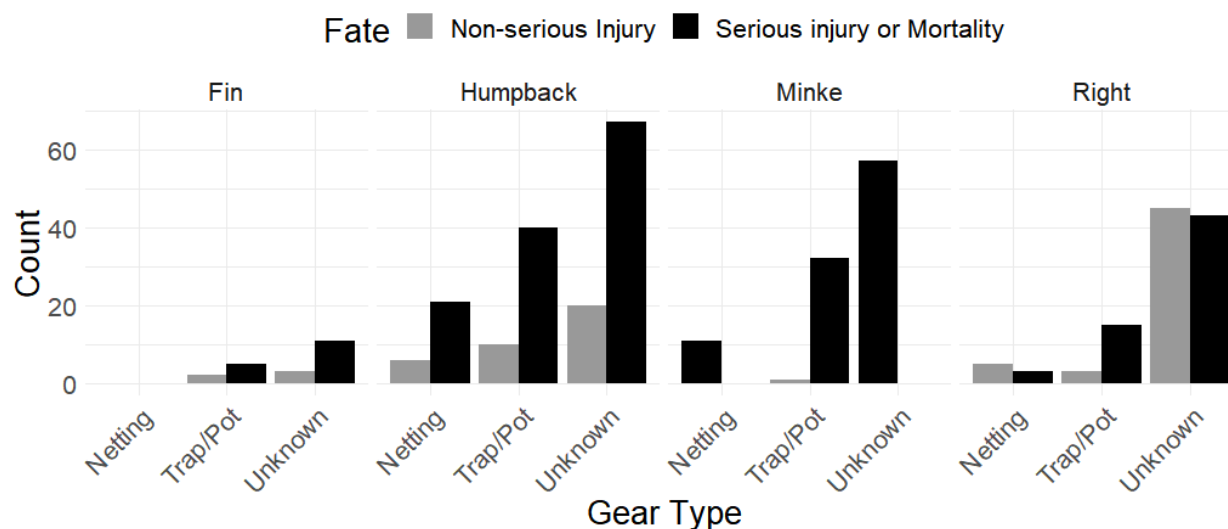


Figure 2.3: Entanglement cases by species and gear type, where available, relative to the fate of the incidents for documented incidents between 2010 and 2019.

A 2017 buoy line estimate derived through a model created by a federally contracted firm, Industrial Economics, Inc. (IEC), to support the Team efforts indicate that outside of exempted waters, over 93 percent of fixed gear buoy lines within right whale habitats along the U.S. Atlantic coast are fished in Northeast Region Trap/Pot Management Area (Northeast Region) by the U.S. lobster fishery. Table 2.3 delineates the relative abundance of various fixed gear buoy lines in the U.S. Northeast, mid-Atlantic, and Southeast commercial fisheries for comparison.

Table 2.3: The average buoy line estimates across months in non-exempt waters

Fishery	Northeast	Mid-Atlantic	Southeast	Total
Lobster Trap/Pot	93.7%	1.5%	0%	95.2%
Gillnet	1.5%	0.4%	0%	1.9%
Other Trap/Pot	0.1%	1.3%	0.9%	2.3%
Blue Crab Trap/Pot	0%	0%	0.6%	0.6%
Total	95.3%	3.2%	1.5%	100%

Note: IEc Line Model, 2017 buoy line estimates per 11/9/2019 model run. See Model Documentation in Appendix 5.1

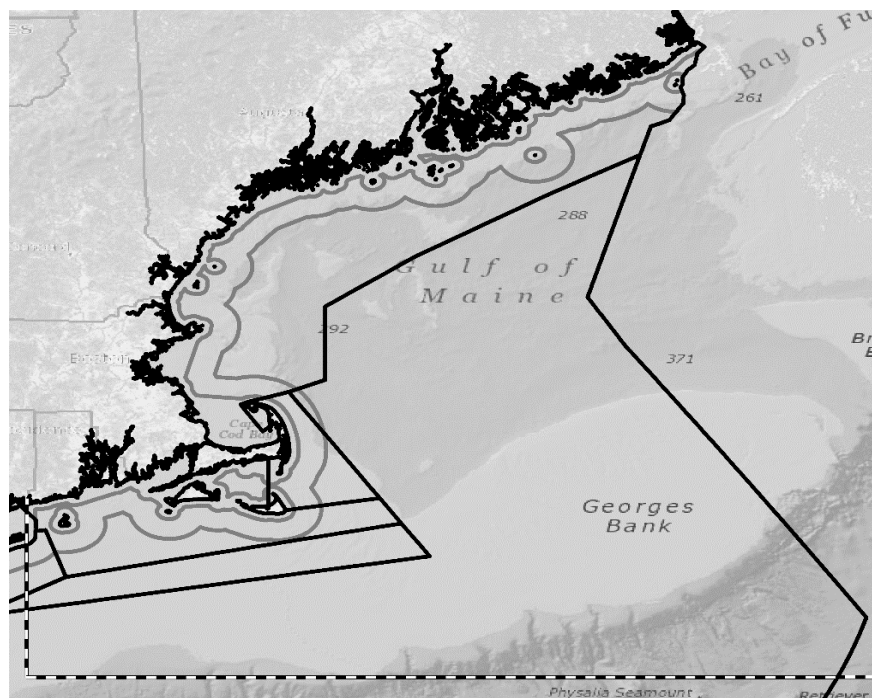


Figure 2.4: The Northeast Region that will be regulated by this EIS are those north and east of the dashed line that lie within U.S. waters. The black line represents the Lobster Management Areas that will be analyzed. Three and 12 nautical mile lines are represented in gray.

Coast-wide rulemaking to modify diverse, relatively data-poor, fisheries can take three to four years. The source of mortality and serious injury to right whales cannot be determined in the majority of documented entanglements but, in the cases where gear can be identified, entanglements to right whales are frequently the result of trap/pot line (Table 2.2). Because of the urgency of responding to the rapid decline in the right whale population, described below, NMFS is focusing the scope of initial modifications to the ALWTRP on Northeast lobster and Jonah crab trap/pot fisheries (Figure 2.4), representing the highest number of buoy lines in the U.S. Atlantic. The red crab fishery is not included, with only an estimated 24 buoy lines set in the area within the scope of this FEIS (IEc Line Model, 2019). The Take Reduction Team will focus on other coast-wide trap/pot fisheries and gillnet fisheries in developing further Plan modifications.

2.1.4 Right Whale Population Decline

Despite efforts by the Team over the last two decades to reduce human-caused mortality of large whales in the Atlantic, right whales have continued to experience unsustainable levels of mortality and serious injury from entanglement, as discussed above. The right whale population is critically endangered and a 2017 study found that the population has been in decline since 2010 (Figure 2.5, 2.6; Pace et al. 2017). The best estimate of the right whale population in 2019 is 368 whales (± 11) with a strong male bias (approximately 60 percent male) (Pace et al. 2017, Pace 2021). New research confirms a significant reduction in survival since 2010 and that an estimated 64 percent of all mortalities are not observed and accounted for in the right whale incident data (Pace 2021, Pace et al. 2021). This population corresponds with, but not demonstrated to be caused by, the shift in distribution. Carcass counts did not parallel the estimated reduction in survival, although Pace notes that his estimates validate the declaration of an Unusual Mortality Event (UME). Declared in 2017, the UME remains open and as of April 2021 includes 34 detected mortalities (17 in 2017, 3 in 2018, 10 in 2019, 2 in 2020, and 2 in 2021). In 2020, 15 serious injuries were included in the UME tally (2 in 2017, 5 in 2018, 1 in 2019, 4 in 2020, and 3 in 2021; see: <https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2021-north-atlantic-right-whale-unusual-mortality-event>). In addition, NARWs have also been determined to be in poor body condition in comparison to southern right whales (*Eubalaena australis*; Christiansen et al. 2020). In particular, a poor female body condition may be contributing to reduction in calf survival or delayed first-calving age and an increase in calving intervals, which is an additional concern for NARW viability and recovery (Christiansen et al. 2020).

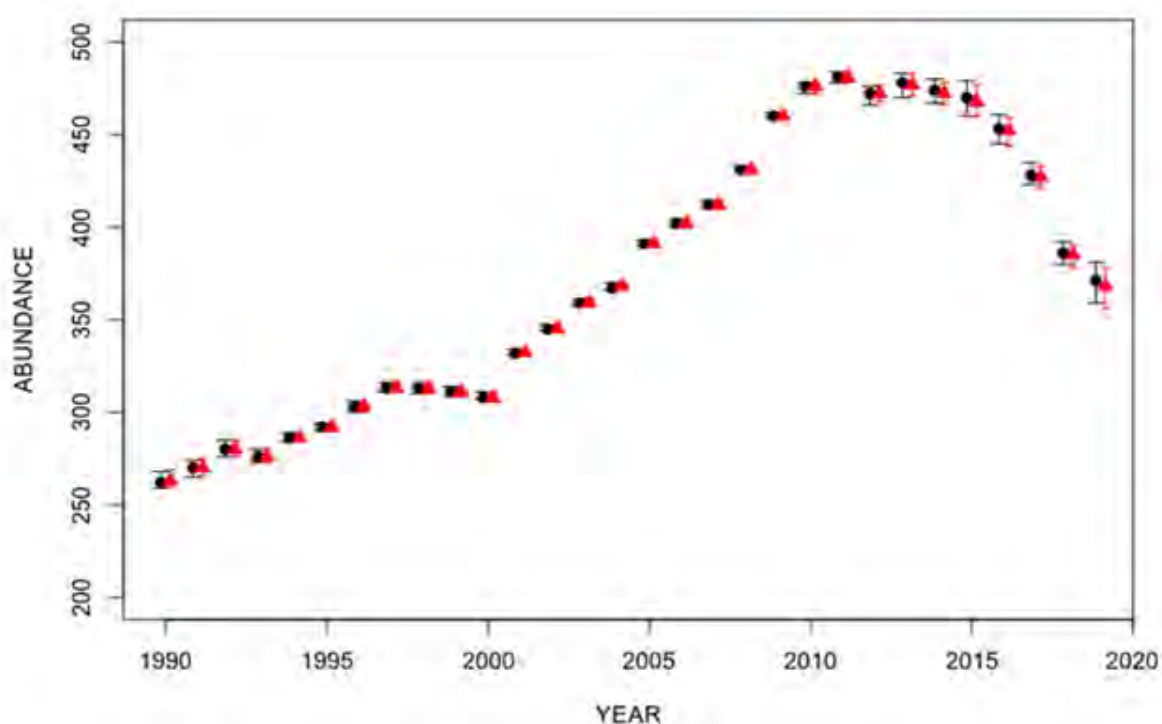


Figure 2.5: The estimated abundance of right whales and 95 percent credible intervals from Pace 2021.

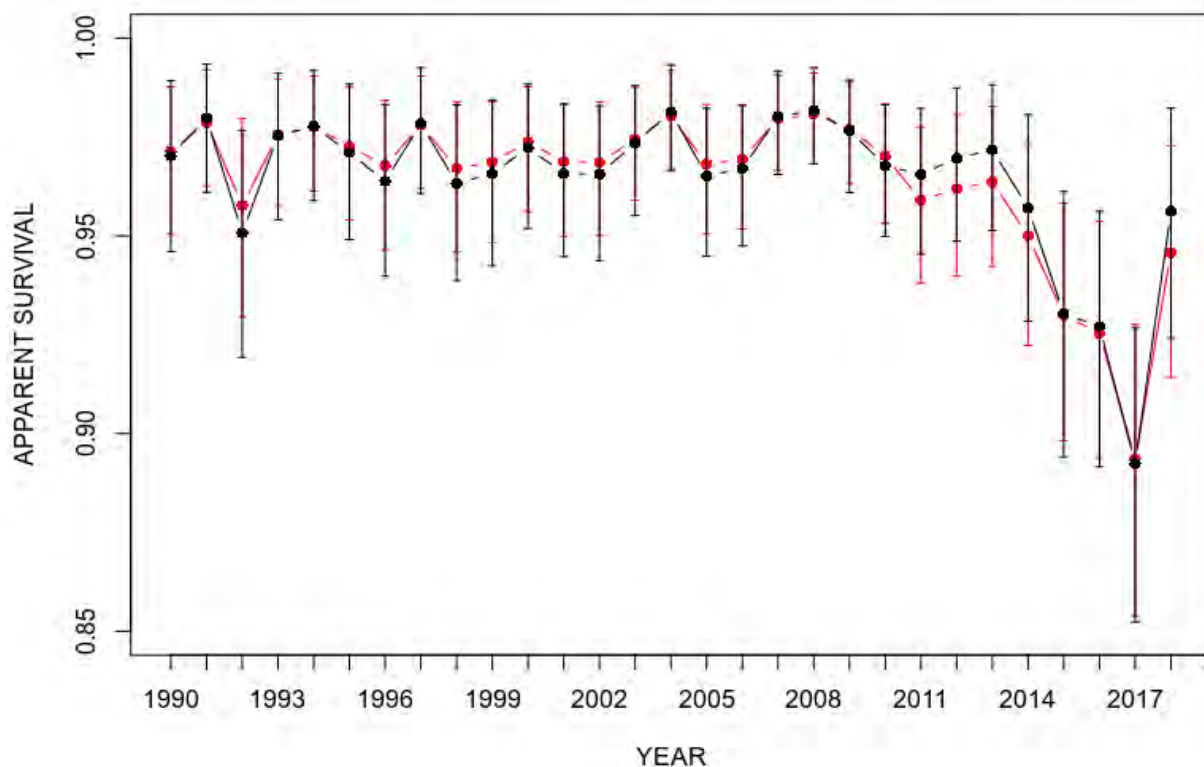


Figure 2.6: Survival rates estimated for the right whale with medians (black) and 95 percent credible intervals (red) derived in Pace 2021

Recent low birth rates are an increasing concern for right whale recovery, with the detection of only 5 births in 2017 (Pettis et al. 2018b), no births in 2018 (Pettis et al. 2018a), only 7 births in 2019 (Pettis et al. 2020), and 10 births in 2020 (Pettis et al. 2021). This is well below the average: 12.8 calves per year over the last decade, or 22 per year in the first decade of this century, with an average 14 or more births per year for the entire monitoring period, which began in 1990. More recently, there were 17 live calves documented in 2021, as of March 29 (<https://www.fisheries.noaa.gov/national/endangered-species-conservation/north-atlantic-right-whale-calving-season-2021>) including some first time mothers who were born during the high birthing years that occurred before 2011. While the number of births in the 2020/2021 calving year is encouraging, it is lower than would have been forecasted from the large number of calves born over a decade ago and follows persistent low birth years that are insufficient to counteract current population mortality rates (Figure 2.5; Pace 2021), increasing concern regarding current levels of entanglement mortality.

Documented, minimum counts of anthropogenic mortality and serious injury of right whales from fishing gear have exceeded the allowable PBR in all but one year (Figure 2.2). The 2019 right whale stock assessment establishes a PBR level of 0.8 right whales a year based on the 2017 population estimates (Hayes et al. 2020). For the five year period from 2014 to 2018 the report documents a minimum average annual mortality and serious injury caused by entanglement is 6.85, including 0.2 attributed to U.S. fisheries, 1.55 attributed to the Canadian snow crab fishery, and 5.1 that could not be identified to a particular fishery (Henry et al. 2021). Since 2018, an additional eight right whale entanglement mortalities and serious injuries have

been documented including three identified as consistent with Canadian snow crab and five that could not be identified to a country or fishery (<https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2021-north-atlantic-right-whale-unusual-mortality-event> reviewed May 1, 2021).

Entanglement rates are higher than the mortality and serious injury rates reflected in the Stock Assessment Report, in part because whales apparently often free themselves of gear following an entanglement event. In an analysis of the scarification of right whales, 519 of 626 (82.9 percent) whales examined from 1980 to 2009 were scarred at least once by fishing gear (Knowlton et al. 2012). Further research using the North Atlantic Right Whale Catalog has indicated that between 8.6 percent and 33.6 percent of right whales acquire new scars annually (Knowlton et al. 2012). Evidence collected following right whale mortalities document that entanglement remains the biggest threat, range wide, to right whales (Sharp et al. 2019). Finally, entanglements are certainly a cause of death of some portion of the 64 percent of estimated mortalities that are unobserved (Pace et al. 2021) but there is no agreement on how to assign the cause of mortality to unobserved but estimated mortality. Pace (2021) and Sharp et al. (2019) caution against using observed mortality ratios to apportion the cause of death due to potential carcass detection biases. Pace (2021) observed more serious injuries are entanglement related rather than from vessel strikes, consistent with the observed incident data. Moore et al. (2020) reported how carcass detection of whales that succumb to entanglement may be very low, due to limited buoyancy from poor body condition associated with months to years of chronic entanglement. Additionally, differences in mission priority and geography create significant detection biases between the U.S. and Canadian waters. Specifically, the geographically closed Gulf of St. Lawrence provides more opportunity for carcasses to strand on land and is surveyed regularly since 2017 by five aircrafts for dynamic management. Surveys in other Canadian waters support a broader science mission, and in the U.S. aerial survey missions are directed towards population assessment which requires far less effort, but reduces the potential for carcass detection.

Despite these uncertainties, there is sufficient evidence to determine that the rate of human-caused mortality and serious injury to right whales exceeds the PBR during a sustained period of population decline, requiring additional modifications to the Plan to reduce entanglement mortality and serious injury risk.

2.1.5 Needed Reduction in Entanglement Mortality and Serious Injury

As presented to the Team in an October 2018 meeting, there is only one year since 2010 (when the decline in the right whale population began) in which right whale entanglement mortality and serious injury first seen in U.S. waters or known to be caused by U.S. gear (Figure 2.2 & 2.6) was below PBR. NMFS, through the take reduction planning process, must reduce the impacts of U.S. commercial fisheries to below a stock's PBR level.

The uncertainty regarding the type of gear that entangles whales and the location and country of origin where the entanglement occurred creates challenges for the Team in determining the magnitude of reduction in mortality and serious injury that is needed. As delineated in Table 2.2 and described previously, many entanglements are never seen by humans, even when seen there is often no gear present on whales showing scars, wounds and injuries clearly caused by

entanglement, gear cannot always be recovered from those whales that are seen entangled, and even when gear is recovered, it can rarely be identified to a source fishery, and even more rarely to a precise fishing location.

In developing mortality and serious injury estimates for use in Stock Assessment Reports and by the Team, NMFS attributes definitive sources of mortality and serious injury only when gear is present and identified to a fishery source or, rarely, when an individual is anchored by the gear. The Canadian snow crab fishery has clearly identifiable ropes and splices that assist in identification when gear is present on a whale. Gillnet gear is also readily identifiable when present. However, in most cases gear is not present or cannot be identified to a specific fishery therefore most entanglement related mortality and serious injury are unassigned in the Stock Assessment Reports.

To estimate the impact of U.S. fisheries on entanglements, the challenge is to determine what percentage of the unknown sources are U.S. vs. Canadian fisheries. In attempting to create a risk reduction target to achieve PBR, NMFS considered how to assign a country of origin to unknown entanglement cases. As illustrated in Figure 2.7, assigning those seen first in U.S. waters to U.S. gear would suggest that a two- or three-fold reduction is necessary to achieve PBR. An alternative approach provided very similar results, discussed below.

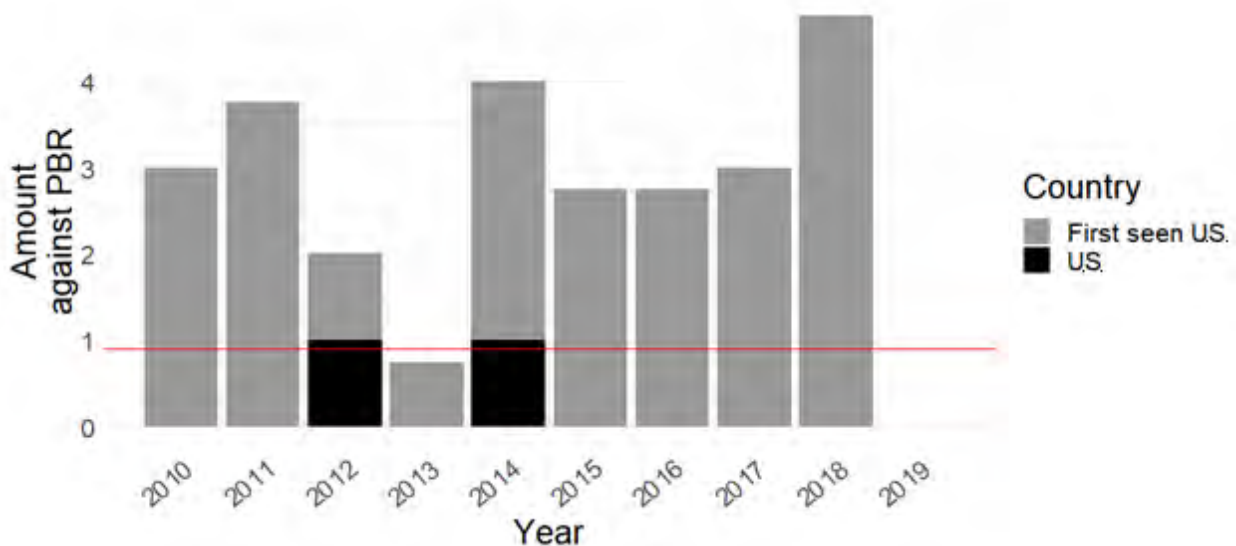


Figure 2.7: Documented entanglement incidents that caused mortality and serious injury of right whales, counted against PBR for right whales from 2010 to 2019. For this purpose, mortalities or confirmed serious injuries are counted as one animal and injuries with a 0.75 probability of becoming serious are adjusted accordingly (e.g. only one prorated injury was detected in 2013). The red line represents the PBR for each year.

Although since 2010 right whale aggregation distribution has continued to shift, much of the right whale population may spend more time exposed to fisheries in U.S. waters than in Canadian waters. Mortality and serious injury from unknown sources could be allocated by percentage of time spent in each country's waters, which would apportion more of these unknown mortalities and serious injuries to U.S. commercial fisheries. However, for the

following reasons, this FEIS assumes that 50 percent of right whale mortalities and serious injuries occur in each country:

- Knowlton et al. (2016) demonstrated the positive relationship of large diameter line to breaking strength and association with serious injuries to large whales. Snow crab gear recovered from dead and seriously injured right whales and identified by the NMFS and Canadian Department of Fisheries and Oceans gear specialists, include heavy traps on knot free and fairly uniform large diameter ropes, stronger than the rope used in most U.S. trap/pot gear. Offshore U.S. gear may be equivalent in risk of injury and mortality given the large diameter of rope fished and the long and heavy trawls. However, other than three one-foot black buoy line marks there is little to distinguish this gear from other rope, and offshore U.S. lobster gear has not been definitively identified from gear retrieved from large whale entanglements (Morin, pers. comm. 2020).
- U.S. take reduction measures over the past two decades have been implemented coast-wide rather than in finite areas like those implemented in July 2017 by Canada. Although the ALWTRP measures are not achieving PBR and the effectiveness of the regulations cannot be evaluated, all the existing sinking ground line, closures, weak links, and other risk reduction Plan measures are affording more protections to right whales than if there were no ALWTRP measures implemented.

At the annual meeting of the Atlantic Scientific Review Group (ASRG) in February 2021, the ASRG commended the use of unobserved mortality estimates (Pace 2021) with the NARW stock assessment report and recommended that the 1:1 apportionment of mortality between the U.S. and Canada be reconsidered based on recent documented mortalities and serious injuries, which occurred at higher frequency in Canadian waters. They also considered Pace (2021), Sharp et al. (2019) and Moore et al. (2020) and suggested that more unobserved mortality could be due to entanglement than to vessel strikes, recommending that NMFS review mortality analysis further to inform future apportionment of estimated mortality to mortality sources.

Table 2.4 uses mortality and serious injury determinations for 2012 through 2020 to determine how the target might change using more recent information and varying apportionment assumptions. Note that the incident data is only peer reviewed through 2019 and published through 2018 so anything after 2018 is not considered final (Hayes et al. 2019, 2020). The table below considers the risk reduction targets needed by assigning unattributed and/or unobserved mortalities to a particular country across multiple rolling five-year averages as well as a combined average. This risk reduction range differs from those presented in the Draft Environmental Impact Statement and those presented to the Team in 2019 due to the incorporation of new data. Sixty percent is still the minimum target risk reduction considered in this FEIS but as new data are finalized the minimum target may change in the future.

Table 2.4: Average mortality and serious injury by country of origin or country where the individual was first sighted for different date ranges. The amount of reduction in mortality and serious injury needed to meet PBR based on where the unattributed individuals were first sighted and with 50 percent of unattributed individuals assigned to each country. For incidents with no cause of death determination or estimated unobserved mortality, we assumed seventy-seven percent resulted from an entanglement according to the large whale incident data. PBR was calculated according to the five year period reported in line with the stock assessment reports. The current PBR published at the time of this FEIS was used for the nine year period summary. The reduction needed was calculated by dividing PBR from all cases assigned to the U.S. fisheries and subtracted from one.

Date range	PBR	Total	Country First Sighted		50% of First		Country Sighted		All Observed & Unobserved U.S. Estimated Entanglement	
			U.S.	Canada	U.S.	Canada	Estimated U.S.	Reduction Needed	Estimated U.S. Entanglement	Reduction Needed
2012-2016	0.9	5.15	0.4	0.6	2.05	2.1	2.08	64%	8.19	89%
2013-2017	0.8	5.55	0.2	1.2	2.45	1.7	2.08	65%	9.80	92%
2014-2018	0.8	6.85	0.2	1.55	3.25	1.85	2.55	71%	10.16	92%
2015-2019*	0.7*	5.65	0	1.95	2.65	1.05	1.85	62%	**	**
2016-2020*	0.7*	5.7	0	1.95	2.85	0.9	1.88	63%	**	**
2010-2018	0.8	5.39	0.22	0.78	2.75	1.56	2.15	66%	7.96	90%

*Uses preliminary data

**Data on unobserved mortalities are not available for 2019 or 2020 and thus that risk reduction is unable to be calculated at this time.

As delineated in Table 2.4, these findings are slightly lower than results attained by attributing unknown mortality and serious injury sources to the country of first sighting. For this calculation, the incidents where location was unattributed to a specific country were split in half, assuming 50 percent occurred in each country. The necessary reduction ranges from 63 to 77 percent risk reduction and is higher than the fifty percent split due to the number of entanglements detected in U.S. waters. Since right whales spend more time in U.S. waters and can travel far from the original entanglement location, it is possible detection bias could be a factor with an estimate using the country where the individual was first seen.

However, as discussed above, calculations that include only documented mortality and serious injury also are subject to a detection bias and are likely underestimating mortality and serious injury due to entanglement. Actual mortality and serious injury of right whales in U.S. fisheries are likely higher than the observed 2.56 per year between 2010 and 2019 (Pace et al. 2021). Population models provide an estimate of mortality that suggests 40 to 64 percent of right whale mortalities and serious injuries are unobserved (applying the methods from Pace et al. 2017 and new method in Pace 2021). Additionally, there are mortalities where no cause of death was determined, despite some evidence of human causes, and it is likely a proportion of these cases also resulted from an entanglement.

In order to take into account unobserved mortality as well as mortality where the cause of death was not confirmed, additional unobserved mortality was estimated and added to the observed mortality estimates in Table 2.4. To estimate unobserved mortality from entanglements, the observed mortality and serious injury was first subtracted from the total estimated mortality between 2012 and 2018 (the most recent data available) from a population model published by Pace et al. (2021). The remaining unobserved right whale mortality was added to those with unknown cause of death, 50 percent of which were attributed to the U.S. We then estimated that 77 percent of unknown or unobserved right whale incidents apportioned to the U.S. were likely caused by entanglement according to long term right whale incident data.

For example, according to data from the model from Pace et al. (2021) and NMFS right whale incident data, there was an annual average of 2.2 incidents with an undetermined cause of death and an estimated 12.3 unobserved mortalities from 2010 through 2018, for a total of 14.5 incidents that were not accounted for in the calculations for minimum risk reduction target. If we assume half of these incidents occurred in the U.S. as described above, then 7.25 additional incidents likely occurred in the U.S. According to incident data, 77 percent of all incidents (from 2010-2019) are a result of entanglement mortality and serious injury so we then assume 77 percent of 7.25 unknown or unobserved incidents were the result of an entanglement, or 5.6 per year. Adding this to the known entanglement data yields an annual average of 7.96 entanglements causing serious injury or mortality in U.S. waters every year between 2010 and 2018. This number would require a 90 percent reduction in mortality and serious injury (equation: $1 - (0.8/7.96)$). Under those assumptions, mortality and serious injury of right whales in U.S. fishing gear would need to be reduced by at least 60 percent according to documented mortality but may require up to 92 percent, depending on the year range and cause assumptions used, to reduce actual estimated mortality and serious injury below PBR. As Table 2.5 illustrates, across various assumptions and recent time frames, an upper target reduction in mortality and

serious injury from 77 to 92 percent would be needed to achieve PBR under recent mortality conditions.

Table 2.5: Examples of risk reduction target effects of varying assumptions regarding country of origin and cause of the incident for unattributed documented and estimated unobserved entanglement mortality and serious injury. Three country apportionments were tested for cases where country of origin is unknown: a 50:50, 40:60, and 30:70 (US:Canada). For incidents with no cause of death determination and estimated unobserved mortality, we tested four approaches to estimate the proportion resulting from entanglement: the proportion of entanglements observed between 2010 and 2019 (77 percent), the proportion in Pace et al. 2021 (67 percent), the proportion from Sharp et al. 2019 (58 percent), and a 50 percent split. PBR was calculated according to the five year period reported in line with the stock assessment reports. The current PBR published at the time of this FEIS was used for the nine year period summary. EN = Entanglement.

Country Split	Date range	PBR	Observed M/SI	Estimated entanglements that were unobserved or observed with no known cause			
				77% EN	67% EN	58% EN	50% EN
50 U.S. / 50 CAN	2012-2016	0.9	64%	89%	88%	87%	85%
	2013-2017	0.8	65%	92%	91%	90%	89%
	2014-2018	0.8	71%	92%	91%	90%	89%
	2010-2018	0.8	66%	90%	89%	88%	87%
40 U.S. / 60 CAN	2012-2016	0.9	56%	86%	85%	84%	82%
	2013-2017	0.8	57%	90%	89%	87%	86%
	2014-2018	0.8	64%	90%	89%	88%	87%
	2010-2018	0.8	59%	88%	86%	85%	83%
30 U.S. / 70 CAN	2012-2016	0.9	45%	82%	81%	79%	77%
	2013-2017	0.8	45%	87%	85%	83%	82%
	2014-2018	0.8	54%	87%	86%	84%	83%
	2010-2018	0.8	47%	84%	82%	80%	78%

*See Column 10 in Table 2.4.

Further consideration of these alternative assumptions are anticipated to inform future Stock Assessment Reports and in assessing appropriate risk reduction targets. Additionally, the population estimate for 2019 is estimated to be 368 (± 11 , Pace 2021) based on modifications to the population model, described in Pace et al. (2021) which recognized that mortality of right whales since the regime shift in 2010 and during the Unusual Mortality Event that began in 2017 was higher than originally anticipated. PBR will likely be lowered to 0.7 in the next Stock Assessment Report. This new PBR would require a target risk reduction range of 71 to 91 percent using data from 2010 through 2018 (Pace 2021, Hayes et al. 2020).

Because of the urgency of responding to the rapid decline in the right whale population and because the fishery source of mortality and serious injury to right whales cannot be determined in 77 percent of the documented cases since 2010, for this action NMFS is focusing its scope on the area and fishery that fishes the greatest number of buoy lines in the U.S. Atlantic: lobster and Jonah crab trap/pot fisheries in the Northeast Region (Figure 2.5). As shown in Table 2.3, the 2017 buoy line estimates derived through a model created to support the Team efforts indicate that over 93 percent of fixed gear buoy line within right whale habitats along the Atlantic coast are fished by the U.S. lobster and Jonah crab trap/pot fisheries in the Northeast Region. Further risk reduction for other trap/pot fisheries and gillnet fisheries along the U.S. East Coast will be addressed through the Take Reduction Team process with discussions that started in the spring of 2021.

The regulatory options for reducing the risk of entanglement mortality and serious injury fall into two categories: reduction in overall entanglement risk and reduction in the severity if an entanglement occurs. Reducing the likelihood of entanglement is primarily accomplished by reducing the amount of line in the water column through line reductions and through seasonal restricted areas with predictable aggregations of right whales. Further reducing the severity of entanglements through gear modifications that allow lines to break prior to causing a serious injury could minimize mortality and serious injury of entangled whales and mitigate potential sublethal impacts. Most whales in the right whale stock are entangled at least once throughout their lifetime, and researchers have suggested that continuous sublethal stress of entanglement could be impacting population health and contributing to increased reproductive intervals (Rolland et al. 2016, Pettis et al. 2017, van der Hoop et al. 2017, Christiansen et al. 2020, Moore et al. 2021). There is new evidence that lower strength rope (i.e. 1,700 pounds/771 kilograms) may be less likely to remain on entangled adult whales (Knowlton et al. 2016, DeCew et al. 2017), thereby allowing modifications in rope strength to be used to minimize the lethality of fishing gear.

In addition to reducing risk of mortality and serious injury, there is an additional need to acquire more data to inform future management actions. Additional gear marking regulations will be considered that improve the quantity and quality of data available for future rulemaking and investigating some of the uncertainties discussed above regarding gear type and the country where the entanglement occurred.

Finally, because right whale distribution, particularly the location of aggregations of feeding right whales, continues to shift, monitoring the population continues to be a Plan priority. Monitoring the effectiveness of the Plan modifications on reducing mortality and serious injury of right whales in U.S. waters and the impacts on fishermen and fishing communities is also required.

2.2 Purpose and Need for Action

This EIS is being prepared using the 1978 CEQ NEPA Regulations. NEPA reviews initiated prior to the effective date of the 2020 CEQ regulations may be conducted using the 1978 version of the regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14,

2020. This review began on August 2, 2019 (Notice of Intent published on this date) and the agency has decided to proceed under the 1978 regulations.

Need	Purposes
To reduce right whale mortality and serious injury in Northeast trap/pot commercial fisheries to below PBR, by at least 60 to 80 percent of the level observed in 2017.	• Reduce risk of entanglement • Reduce the severity of entanglements
To inform future management actions	• Improve ability to identify entanglement gear source • Improve available data used to estimate entanglement risk
To monitor the impacts of management actions	• Monitor Compliance with regulatory actions • Monitor impacts of Plan measures for mortality and serious injury to right whales • Monitor social and economic impacts to fisheries
To reduce fin and humpback whale mortality and serious injury in Northeast Trap/Pot commercial fisheries.	• Reduce risk of entanglement • Reduce the severity of entanglements

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CHAPTER 3 REGULATORY ALTERNATIVES

The Atlantic Large Whale Take Reduction Plan (ALWTRP), last amended in 2015, includes a combination of fishing gear modifications and seasonal area closures aimed at reducing the risk that large whales will be killed or seriously injured as a result of entanglement in U.S. commercial fishing gear. Gear marking to improve our understanding of where entanglement incidents occur is also required. The nature and extent of the gear modification and seasonal closure requirements varies by jurisdiction (i.e. state waters, geographic regions, and within federal waters) such that risk reduction is distributed along the U.S. East Coast. NMFS recognizes that entanglement risks occur throughout the distribution of North Atlantic large whales, requiring continued collaboration with the Government of Canada toward the development of similar protective measures for large whales beyond the northern bounds of U.S. waters.

The scope of modifications analyzed with this Final Environmental Impact Statement (FEIS) are confined to the Northeast Region Trap/Pot Management Area (hereinafter referred to as the Northeast Region) where large whales, and particularly North Atlantic right whales (hereafter referred to as right whale), occur nearly year round and where the vast majority of buoy lines are fished (see Chapter 2). This chapter is organized as follows:

- Section 3.1 describes the process that was followed in developing the alternatives analyzed in the DEIS and modified due to public comments and new information for analysis in this FEIS.
- Section 3.2 provides a description of the regulatory alternatives under consideration.
- Section 3.3 details justification for the alternatives selected for analysis in this FEIS.
- Section 3.4 contains an overview of the alternatives that NMFS considered but rejected.

3.1 Development of Alternatives

NMFS is considering two types of actions: 1) modifications to the existing Take Reduction Plan requirements to reduce frequency or severity of entanglements and 2) small modifications to the federal regulations for American Lobster related to increasing maximum length of trawls between buoys and increasing the number of traps on a trawl using only one buoy. The alternatives being considered would reduce risk to all large whales but especially target ongoing right whale entanglements that result in serious injury or mortality. Additionally, NMFS is considering gear marking requirements that may improve our understanding of where entanglements occur and the type of gear involved.

The alternatives analyzed use the best available information about right whale distribution and co-occurrence with buoy lines as well as the relative threat of gear configurations across the Northeast Region. While development of alternatives began with consideration of recommendations of conceptual buoy line and weak rope measures spread across jurisdictions within the Northeast Region, scoping results and implementation challenges resulted in substantial modifications that included the addition of seasonal restricted areas. The alternatives attempt to scale gear modifications to relative risk, while recognizing that continuing ecosystem shifts require broad scale precautionary measures to protect the shifting distribution of right

whales. In areas of low risk to right whales, such as where right whales have not predictably aggregated and where buoy lines are of lower strength, precautionary measures such as weak insertions in buoy lines are considered. Where risk is higher because lines are stronger and/or whales occur in higher abundance or aggregate seasonally, measures to reduce the number of buoy lines, close areas to buoy lines, or require buoy lines to be reconfigured to include a portion that breaks at 1,700 pounds (771 kilograms) are analyzed. The measures under consideration aim to reduce entanglement risk posed by Northeast Region trap/pot fisheries gear by at least 60 percent or greater to help achieve the potential biological removal level (PBR) of less than one right whale per year (see section 2.1.5 for further explanation of these calculations).

To evaluate and compare risk reduction alternatives to estimate the extent to which regulatory changes would achieve the risk reduction target, a Decision Support Tool (DST) was developed by the Northeast Fisheries Science Center. The DST attempts to quantify entanglement risk for right whales in lobster and Jonah crab trap/pot fisheries in the Northeast Region. The following sections describe the data and associated tools that were considered and how these were incorporated into the DST, as well as how the tool was used in the development of a near-consensus suite of alternatives recommended by the Take Reduction Team, and further, how the DST was used, often in consultation with New England state managers and offshore lobster fishery Team members and in response to public input, to create the alternatives considered in this FEIS.

3.1.1 *Relevant Meetings*

3.1.1.1 **Take Reduction Team Input**

Since the inception of the Atlantic Large Whale Take Reduction Plan, risk reduction measures recommended by the Team and implemented through regulations have been directed at:

- reducing line in the water column,
- reconfiguring buoy lines and gillnet panels, including weak links, to allow large whales to break free of the lines, and
- protecting predictable aggregations of whales through restricted areas.

The 1997 regulations implementing the Plan included: the use of negatively buoyant buoy lines to fixed gear fisheries to reduce line floating at the surface; configuration options to reduce strength of connections between surface systems with buoy lines in lobster or gillnet gear and between panels of sink gillnet gear seasonally; and closures of predictable aggregation areas in Cape Cod Bay and the Great South Channel, (62 FR 39157, July 22, 1997). Information on these early Team meetings, through the present, as well as Plan regulatory actions can be found on the NMFS website at <https://archive.fisheries.noaa.gov/garfo/protected/whaletrp/trt/>.

After the initial rulemaking, the Team focused on considering how to further reduce the amount of line in the water column. The Plan was modified to reduce the profile of the groundline that runs between traps along a multi trap trawl; replacing floating line with sinking groundline in U.S trap/pot fisheries and on sink gillnets, with some seasonal and area exemptions, along the Atlantic Coast, effective April 5, 2009 (73 FR 51228, September 2, 2008). The Team then turned

efforts toward reducing the risk of entanglement in buoy lines, culminating with 2014 and 2015 measures that expanded the Cape Cod Bay restricted area for trap/pot fisheries into Massachusetts Restricted Area (MRA; 50 CFR 229.32(c)(3)). These 2014 and 2015 amendments reduced the number of buoy lines substantially through both the expanded closure area largely resulting in the removal of gear to shore storage, and by establishing “trawling up” areas that increased the number of traps between buoy lines.

Confirmation that the right whale population had been in decline since 2010 was published in 2017 (Pace et al. 2017), identifying a decrease in calving and increased mortality. Also in 2017, unprecedented right whale mortalities were documented, including 12 mortalities seen in Canada and five in U.S. waters, prompting NMFS to declare an Unusual Mortality Event, which continues through 2021. In 2017, due to decomposition or lack of access, the cause of mortality was only determined for six of the twelve dead right whales discovered in Canada, including two that were attributed to entanglement and four to blunt force trauma associated with vessel strikes. Cause was determined for three of the five mortalities first seen in U.S. waters: two showed signs of entanglement trauma, and one young right whale killed by a vessel strike. In addition, zero births were observed in the subsequent 2017/2018 calving season. As a result of evidence of a declining population exacerbated by 2017’s high mortalities, in February 2018, NMFS established two subgroups of the Atlantic Large Whale Take Reduction Team to consider the operational feasibility of potential risk reduction measures. One subgroup was charged with investigating the feasibility of using weak rope (1,700 pounds/771 kilograms maximum breaking strength) and gear marking, and the other was tasked with investigating the feasibility of fishing without buoy lines (ropeless fishing). As discussed in Section 2.1.3, over 95 percent of buoy lines fished along the U.S. East Coast in waters not exempt from Plan requirements are fished by the lobster trap/pot and Jonah crab fishery; 93 percent within the Northeast Region. For this reason NMFS focused the scope of the Team’s discussions on developing recommendations for the Northeast Region lobster and Jonah crab trap/pot fisheries.

In recent years, no gear has been retrieved from 79 percent of large whales (80 percent of all right whales) where entanglement-related serious injuries and mortalities are identified. Therefore while the subgroups concurred that expanded gear marking requirements were feasible, expensive approaches such as micro-chips or transponders were identified as possibly too expensive given the relatively low benefits of the gear marking. Weak rope was considered by the subgroup to be feasible nearshore but concerns were expressed about use in deeper water fisheries as well as about the economic impacts of a wholesale change-over in buoy lines. The subgroup considering ropeless fishing alternatives suggested that it was impractical for rapid deployment and therefore should not be considered for imminent plan modification recommendations. The subgroups’ findings were shared with the Team in support of a full in-person meeting in October 2018.

Additionally, in preparation of Also prior to the October 2018 in-person meeting, team members were invited to submit risk reduction proposals. Eight proposals were submitted to NMFS prior to the meeting and an additional proposal was crafted during the meeting and shared with all Team members at the meeting. The goal was to develop Team recommendations regarding acceptable risk reduction elements for further evaluation. The lack of agreement on whether or how much risk reduction was necessary, or any mechanism to compare the wide range of

proposal elements, challenged the Team's ability to develop consensus recommendations. As a result, the Team created work plans for NMFS identifying data needs for decision making to have at the April 2019 meeting. Priority was given to common themes including development of a risk reduction target, a tool to allow comparison of alternatives, and a focus on elements with the greatest potential to reduce mortality and serious injury quickly.

Following up on the work plans provided to NMFS at the October 2018 meeting, NMFS conducted two "work group" teleconferences for the Team: one to discuss gear marking alternatives and the other to discuss methods for developing and evaluating closed areas. Additionally, NMFS hosted a third teleconference with the Team in order for the New England Aquarium to share the results of a rope workshop they held. Aquarium staff and participating Team members could recount the discussion of operational challenges and weak rope relative to use in Northeast Region trap/pot fisheries. Maine Department of Marine Resources (DMR) rope research was also reviewed during this teleconference.

Also included on the October 2018 agenda was discussion of the NMFS Advance Notice of Proposed Rulemaking (ANPR) to modify existing seasonal closures to instead be closures to the use of buoy lines. Under a revised closure definition, trap/pot fishermen could fish with trap/pot gear using "ropeless" methods that did not use buoy lines, although exempted fishing permits would be required to exempt fishermen from the surface marking requirements under fishery management regulations. The gear would not be truly ropeless, but would still require rope in the groundline between pots in the trawls on the ocean floor. Most designs also include rope buoy lines that are stored on the bottom until retrieved by a vessel operator when on site to haul the lobster trawl. Team members disagreed about further consideration of "ropeless fishing" for multiple reasons, including: costs of the technology, concerns about gear conflicts, lack of testing under commercial fishing conditions, questions about impacts on trawlers and other mobile gear fishermen, ability of enforcement agents to retrieve, inspect, and reset the gear, and the belief that it could not be rapidly adapted for commercial use. Some Team members recognized that ropeless fishing could provide an alternative to seasonal closures and many strongly supported the need for commercial fishermen to be involved in the further development and design of ropeless gear. Because it was clear that the Team would not provide a consensus recommendation on the ANPR, NMFS did not move the action further in 2018.

Between the October 2018 and April 2019 in-person meetings, NMFS identified the need for a 60 percent to 80 percent risk reduction in U.S. entanglement-related mortality and serious injury in order to achieve a PBR of, at the time, 0.9 right whales (PBR is currently 0.8; see Section 2.1.5). Additionally, the Northeast Fisheries Science Center created a preliminary DST (see Section 3.1.4 and Appendix 3.1), for use during the in-person April 2019 meeting to model and analyze the contribution of various proposal elements (whale density, gear density, etc.) towards the target risk reduction. The draft version of the preliminary DST was presented to the Team a week before the April 2019 meeting.

Many Team members did not agree with the risk reduction target established by NMFS. Fishermen in particular believed that too many entanglements of unknown origin were assigned as serious injuries and mortalities due to U.S. commercial fisheries. There were particular concerns expressed about the uncertainties related to the upper bound of the target, which

considered estimated mortalities generated by a new population model (Hayes et al. 2019). Because all observed mortalities that can be attributed to a source are caused by either entanglements or vessel strikes (except for some natural neonate mortalities), estimated unobserved mortalities are likely to be caused by the same human interactions. However, there is no way to definitively apportion unobserved mortality across causes (fishery interactions vs. vessel strike) or country of origin (U.S. vs. Canada). For the purposes of developing a conservative target, NMFS assumed that half of the unobserved incidents occurred in U.S. waters and were caused primarily by incidental entanglements. However, given the many sources of uncertainty in the 80 percent target, as well as the challenges achieving such a target without large economic impacts to the fishery, the Team focused on recommendations to achieve the 60 percent, lower bound, target.

Team members were also uncomfortable with the preliminary nature of the DST, particularly the threat index component that models risk associated with line strength and gear configurations. However, all present Team members worked within and across caucuses to run various alternatives through the DST. Both the target risk reduction and the DST generated an understanding of the scope of measures NMFS was proposing to achieve the necessary PBR for right whales. After some discussion there was general agreement that risk reduction should be shared across jurisdictions so no one state or fishing area would have to bear the bulk of reductions, and so that different jurisdictions could choose an approach that best fit their fishery, rather than a “one size fits all” approach. This also allowed consideration of area-wide measures that would be resilient to changes in whale distribution. By the final morning of the meeting, all but one Team member agreed that NMFS should move forward on the recommendations listed on Table 3.1 toward a 60 percent risk reduction. The dissenter believed that the measures did not go far enough to prevent the extinction of the right whale.

New England states were given the lead in scoping with stakeholders in their states and developing measures and implementation details related to the Team’s near-consensus recommendation. Maine, New Hampshire, Massachusetts, and Rhode Island conducted scoping before and after drafting measures. Lacking a state jurisdictional counterpart, NMFS also worked closely with the Atlantic Offshore Lobstermen’s Association on measures for the offshore federal Lobster Management Area (LMA) 3. NMFS conducted scoping in August and September of 2019, receiving over 89,000 written comments and including eight public meetings attended by over 800 stakeholders.

Table 3.1: TEAM NEAR-CONSENSUS RECOMMENDATIONS, April 2019*(Vote on support to move forward with these measures: 44 out of 45 Team members)*General Recommendations

- Given the high variability around gear severity rankings included in the tool, re-do the poll using expert elicitation methods to converge on improved severity/risk reduction estimates
- Develop a monitoring plan, including whale and gear surveys, to monitor efficacy over time, as well as track implementation approaches and innovations.
- Revisit the need for weak links if weak lines are required.
- Put in place safety exemptions for young fishermen, nearshore fisheries, shallow waters, etc.
- Update the right whale model used for rulemaking to account for regime shift

Specific Recommendations by Area

- For Maine, LMA 1
 - 50 percent buoy line reduction
 - The top $\frac{3}{4}$ length of buoy lines made of weakened rope (toppers) on all gear outside of 3 miles (5.6 kilometers); expected to generate an 11.6 percent risk reduction
 - Assessment and monitoring should include assessment of unintended consequences; develop best practices to avoid issues such as increasing rope diameter/strength
- For Massachusetts, LMA 1
 - 30 percent buoy line reduction (excluding the approximately 100 fishermen already closed out of the Massachusetts Restricted Area); results in annual net risk reduction of roughly 25 percent.
 - Sleeves or their equivalent everywhere; expected to generate an 11 percent risk reduction
 - 24 percent credit for the previously implemented Massachusetts Restricted Area
 - Note: Some source data for this calculation needs confirming
- For Rhode Island, LMA 2
 - Buoy lines expected to be reduced by 18 percent in the next three years
 - Willing to use 1,700 pounds (771 kilograms) sleeves or equivalent everywhere; expected to generate a 43 percent risk reduction or equivalent
 - Additionally, Rhode Island to trawl up from 20 to 30 pots in 2/3 overlap as a component of its 30 percent buoy line reduction
- For New Hampshire, LMA 1 (aggregate risk reduction of 58.5 percent)
 - 30 percent buoy line reduction
 - 1,700 pounds (771 kilograms) or sleeves or equivalent throughout fishery; expected to generate a 28-29 percent risk reduction
- For Offshore, LMA 3
 - Fishermen in principle agree to reducing risk through a combination of buoy line reductions (already underway) and other measures; LMA 3 responsible (like other LMAs) for meeting the 60 percent risk reduction goal
 - Ongoing LMA 3 risk reduction of 18 percent anticipated due to already planned buoy line reductions from 2018-2020
 - Through 50 fathoms (91.4 m) depth, fishermen agree to use 1,700 pounds (771 kilograms) breaking strength or equivalent
 - Five-year rapid research commitment to address lower rope weight breaking strength and other risk reduction measures
 - Work with industry to identify the specifics of risk reduction; present approaches to Team

Note: The risk reduction estimates provided here represent old calculations based on the original version of the tool. The tool has since been updated and the current version is discussed below. One notable difference here is where the Team noted a discrepancy in risk reduction anticipated by using sleeves versus 1,700 pounds (771 kilograms) rope. Although the Team believes these conservation measures are equivalent, according to the tool, the sleeves were projected to provide a 43 percent reduction. This has since been altered in the most current iteration of the tool to consider these two configurations as equivalent.

Proposals submitted to NMFS by the states can be found in Appendix 3.3. As described in the list of measures for Alternative 2 (Preferred), nearly all of the measures in the Preferred

Alternative were originally proposed by the states and modified in this FEIS based on state and public feedback during the public comment period. One measure, an area seasonally closed to buoy lines along the edge of LMA 1 about 30 miles (48.3 km) off shore of Maine, was included by NMFS though not in Maine's proposal to ensure LMA 1 achieved sufficient risk reduction. Another measure, proposed by Rhode Island, to require one weak buoy line for LMA 2 vessels, was not included in the Preferred Alternative. Instead, a closure south of Nantucket proposed by Massachusetts is included in the risk reduction measures of Alternative 2. Measures discussed with LMA 3 participants, including the Atlantic Offshore Lobstermen's Association, are analyzed in both Alternatives 2 and 3. In sum, the alternatives analyzed in this FEIS were adapted from state proposals for risk reduction alternatives, where possible.

The Marine Mammal Protection Act directs NMFS to adopt as regulations take reduction team recommended plan modifications, or to identify and explain why measures different from what the team recommended were implemented. The alternatives proposed by the states, the alternatives analyzed in the Draft Environmental Impact Statement (DEIS), and the final regulatory alternatives detailed in Table 3.2 in this FEIS are not the same as the recommendations provided by the Team. The framework provided by the April 2019 meeting shaped the overarching goals and the scoping conducted by NMFS and the states to develop region specific approaches to risk reduction. However as a framework, the Team's recommendations were not directly translatable into implementing regulations. Additionally, these measures were refined based on stakeholder feedback, feasibility, improvement of risk reduction estimate modeling, public scoping, and extensive public comments on the DEIS. Additionally, improvements in the analytical tools being used to develop the alternatives, new weak insert data, and other details that were not yet in place at the time of the ALWTRT meeting, as well as safety or capacity-related concerns over longer trawls by smaller entities were considered in creating the final measures. However, Alternatives 2 and 3 align with the basic principles within the Team's framework recommendations: they were estimated by the DST to achieve at least 60 percent risk reduction in the northeast lobster and Jonah crab trap/pot fisheries in the Northeast Region, distributed as possible across jurisdictions, primarily using line reductions through trawling up and reduction of line strength through the use of weak rope or weak inserts. One large change is that Alternatives 2 and 3 include seasonal restricted areas, closed to lobster and Jonah crab buoy lines in areas where right whales are known to aggregate based on the best available data, which were added to ensure the sufficiency of other measures in meeting the risk reduction goal, as well as in response to public input related to areas of high whale use. Finally, Alternative 2 (Preferred) in the FEIS differs from the DEIS in the extent of the area being closed and weak inserts being required due to updates to the DST, especially a modification of the whale data, and associated new data analysis, as well as consideration of new measures being implemented by the state of Massachusetts. These changes in the FEIS led to a stronger Preferred Alternative with greater risk reduction to right whales than those in the DEIS.

3.1.1.2 Atlantic States Marine Fisheries Commission Consideration of Take Reduction Team Target

The large majority of buoy lines along the Atlantic coast occur in the American lobster trap/pot fishery. The Atlantic States Marine Fishery Commission (ASMFC) is the management authority for the American Lobster Fishery Management Plan, coordinating interstate management of the American lobster (*Homarus americanus*) fishery in state waters (coastline to 3 miles/coastline to

5.6 km offshore). NMFS has management authority for the fishery in federal waters (3 to 200 miles/5.6-370.4 kilometers) in close coordination with ASMFC.

At the ASMFC's October 2018 American Lobster Board Meeting, the Board was briefed on proposals considered by the Atlantic Large Whale Take Reduction Team, including what are traditionally considered fishery management measures such as establishment of trap caps toward reducing buoy line numbers. The Lobster Board recognized that many of the right whale conservation proposals considered could impact the economic and cultural future of the lobster fishing industry. They created a Lobster/Whale Work Group to evaluate measures under consideration by the Team and to create recommendations for the Board. After discussing measures including consideration of up to a 50 percent line reduction requirement, the Work Group recommendations, presented at the February 2019 Lobster Board meeting, included initiation of an Addendum to ASMFC's American Lobster Fishery Management Plan to consider reducing traps and/or buoy lines, vessel tracking requirement for federal permit holders, and reporting requirements. The Board initiated the drafting of an Addendum to the American Lobster Fishery Management Plan (Addendum XXVIII) to reduce the number of buoy lines in the lobster fishery by 20 to 40 percent in each LMA (except LMA 6) taking into consideration ongoing effort reduction measures - and to the extent possible maintaining the viability and culture of the lobster fishery.

A Plan Development Team (PDT) was created and met regularly beginning in March 2019. Like the Take Reduction Team, the PDT struggled with the difficulty in assessing the effectiveness of buoy line reduction in different areas towards reducing risk to right whales. The draft Decision Support Tool was presented in April 2019 using baseline line data informed by the states participating in the PDT, but the DST was not sufficiently finalized at that time to inform an Addendum. The PDT also shared concerns about the challenge determining buoy line numbers given the variety of data collection requirements and standards used by each state. For states that do not have 100 percent vessel trip reporting that includes buoy line data, the Team agreed to use the NMFS Co-occurrence model developed by Industrial Economics, Inc. (IEC) to provide the 2017 monthly buoy line estimates as the baseline against which line reduction would be considered. Consideration for 2015 and 2016 effort reduction actions was also promoted. Finally, the PDT was concerned about the ability to provide states with flexibility to develop measures suited to their lobster management areas with the need for consistency in federal waters, as well as concerns about the ability to evaluate the effectiveness of line reduction measures with inconsistent reporting requirements.

No draft addendum was put forward by the PDT at the August 2019 Annual meeting, citing challenges in the buoy line count data, analysis, and evaluation challenges. However, the Lobster Board did establish a fishery control date of April 30, 2019. Control dates alert fishery permit holders that their eligibility to participate in a commercial fishery in the future might be affected by their past participation as that is documented through landings data, vessel trip reports and gear configuration from records prior to the control date. However discussions by the ASMFC's Lobster/Whale Work Group and PDT informed the development of measures included in the alternatives analyzed within this FEIS, particularly including consideration of development of a line cap under the Non-preferred Alternative.

3.1.2 *Decision Support Tool Analyses*

The DST, a model designed to assess and compare the risk reduction that may be achieved by various management measures, was developed by the Northeast Fisheries Science Center to aid in the comparison of spatial management measures toward the development of alternatives that meet the 60 to 80 percent risk reduction target provided to the team in 2019. This model calculates right whale entanglement risk based on three components: the density of lines in the water, the distribution of whales (as indicated by a habitat density model predicting right whale distribution from 2010 through 2018), and a gear threat model to determine the relative threat of gear based on gear strength. Both line density and whale distributions are resolved monthly. Together, these components roughly estimate the approximate risk of an entanglement that will result in serious injury or mortality, where a higher density of lines or predicted whales, and/or high line strength increase risk. This enables a semi-quantitative comparison of how different management scenarios and gear modifications are predicted to change the risk of entanglements that result in serious injury or mortality.

An early DST model was used by the Team in April 2019. That model was modified in response to a peer review conducted in late 2019, so DST version two was used to assess risk for the DEIS. Subsequent modifications include a change in the Duke right whale habitat density model (right whale density model) to version 11 (Roberts et al. 2020), which consider right whale distribution after ecosystem shifts since 2010. DST version three was used in this FEIS to help select risk reduction scenarios for the Preferred and Non-preferred Alternatives that are predicted to sufficiently reduce right whale mortality and serious injury risk due to entanglement and to distribute risk across the proposed area as equitably as practicable, with extra protection in areas where higher density aggregations are most likely. Entanglement threat and risk reduction calculations are unchanged between DST versions two and three as used in this analysis. This section includes a brief summary of the model and how it was used in this FEIS. More thorough documentation of the model and its components are available in Appendix 3.1.

The line density component of the DST for all areas except LMA 3 is based on the peer-reviewed NMFS Vertical Line Model and Co-occurrence model developed by IEC. It estimates the number of buoy lines associated with trap/pot configurations within a given spatial area. The main model uses buoy line estimates from 2017, the latest data available and considered representative of current fishery management measures and associated effort. A separate line component for LMA 3 was developed by the NEFSC that was assessed to perform comparable to the IEC model in aggregate but to have finer spatial resolution. The DST evaluates all changes against the 2017 baseline, chosen because it was the year the NMFS determined that the population was in decline, an Unusual Mortality Event was ongoing, and represented the most recent data available when the ALWTRT process was reinitiated. An additional model was included that uses older fishing effort data prior to the implementation of the MRA to determine the value of that closure since the ALWTRT recommended considering the value of MRA toward achieving the risk reduction target. The MRA in its current form was implemented in 2015 only a year and a half before the baseline year of 2017. Using the older line data that predated the MRA, DST analyses estimated how much risk reduction the closure likely accomplished that could be put towards a risk reduction credit.

A second layer in the model assesses the risk associated with different gear configurations, accounting for the use of lines with different breaking strengths. Gear with higher breaking strength is more risky to whales because it is harder to break out of and therefore more likely to result in serious injury or mortality. An empirical gear threat model was built using information on the strength of ropes involved in serious whale entanglements and how the strength of the ropes observed in entanglements compares to the strength of ropes that whales would be expected to encounter. The model estimates uncertainty within the gear threat model and provides an upper and lower bound within the model output, if the option is selected. This uncertainty is calculated by bootstrapping the observed line strength data to generate a ratio of observed to expected line strengths and fitting the data to a binomial generalized linear model. See Appendix 3.1 for more detail about the development of the gear threat model and associated uncertainty.

The final layer is a right whale density model. The DST employs a right whale density model built by researchers at Duke University that predicts the spatiotemporal distribution and density of right whales throughout the proposed area (Roberts et al. 2016; Roberts et al. 2020). The right whale density model used oceanographic and habitat variables to create a map of likely whale presence using whale data from 2003 through 2018. There are three options for whale layers: one spans from 2003 through 2018, one from 2003 through 2009, and one from 2010 through 2018. The alternatives in this FEIS were all developed using the model for the most recent right whale data. The DST also includes a humpback density model and a fin whale density model for the period of 1999 through 2017 (Roberts et al. 2017). The fin whale density model currently does not support the use of a gear threat model and can only be used to examine co-occurrence.

Each model run allows selection of a variety of spatially explicit management measures on a monthly basis with a focus on measures that reduce the number or strength of lines in the water column, such as changes in the number of traps per trawl, the proportion of traps fished, line strength, line number, restricted areas with lines out and/or lines moved to adjacent fishing areas, and number of lines per trawl. The output provides the mean reduction in risk throughout an entire fishing year as well as reduction in co-occurrence of whales and fishing lines. Suites of measures can be run in tandem to best estimate overall changes in risk while taking into account how different management measures may interact with one another to alter the risk landscape. For example, risk reduced first by reducing line number reduces the risk landscape against which a weak line requirement would be measured; they are not directly additive. Uncertainty is estimated for the gear threat model but additional measures of model uncertainty are unavailable for each layer of the model at this time.

3.1.2.1 Center for Independent Experts Peer Review

The Center for Independent Experts managed a review of the DST by three independent experts through a public panel process conducted in November, 2019. The experts' summary and individual reports can be found online: <https://www.st.nmfs.noaa.gov/science-quality-assurance/cie-peer-reviews/cie-review-2019> and <https://www.fisheries.noaa.gov/feature-story/decision-support-tool-helpful-those-finding-ways-reduce-whale-entanglement-fishing>. To summarize briefly, the reviewers concluded that the decision support tool provides a useful and open way for industry and managers to compare relative changes in entanglement risk for right

whales under various risk management scenarios. The reviewers advised caution in interpreting decision tool results and advised on modification to improve the tool but, given the urgent need to reduce entanglement mortalities as soon as possible, indicated that decision-making should proceed while the tool is further refined. The interim version of the DST used for the DEIS (version two) and the version of the DST (version 3) used to estimate risk reduction in the Alternatives included a number of changes informed by the reviewer input. Documentation of the DST version used to assemble Alternatives estimated to achieve a 60 percent or greater risk reduction can be found in Appendix 3.1.

3.1.2.2 Selecting the Risk Reduction Alternatives

Generally, the alternatives were selected based on the combination of risk reduction measures that, when combined, met the target of a minimum of 60 percent risk reduction from Northeast Region Lobster and Jonah crab trap/pot fisheries within each alternative package (Table 3.2). The target of 60 to 80 percent was presented to the Team, as described in section 3.1.1.1, to reduce all U.S. fishery mortalities and serious injuries to below the PBR. To expedite rulemaking, NMFS asked the Team to first focus on the northeast lobster and Jonah crab fisheries because they fish 93 percent of the buoy lines used in areas of the U.S. Atlantic where right whales occur. Regulating multiple fisheries coast wide is a more complex and lengthy process. Given the fact that unobserved mortality estimated in the population model was new, and the many sources of uncertainty in the 80 percent target related to both documented and unobserved mortalities and serious injuries, as well as the challenges of achieving such a target without large economic impacts to the fishery, the Take Reduction Team focused on recommendations to achieve the lower 60 percent target for lobster and Jonah crab fisheries in the Northeast Region. The ALWTRT near-consensus agreement presented a framework aimed at achieving a 60 percent risk reduction target in those fisheries. The dissenting opinion that prevented consensus did so because they thought the proposed measures were not sufficient for population recovery.

In addition to 60 percent or greater risk reduction target, the guiding principles applied in assembling the alternatives in this FEIS include:

- As recommended by the Team, spread risk reduction across jurisdictions and include broad application of reduced line and weak rope.
- For jurisdictional approach: incorporate the proposals submitted by the New England states and collaborate with the Atlantic Offshore Lobstermen's Association for LMA 3.
- Direct the most protection to areas of predictable high seasonal aggregations of right whales, including substantial risk reduction across areas of likely occurrence and precautionary measures in other areas to be resilient to ecosystem changes and associated changing whale distribution
- Consider conservation equivalencies proposed by the states or the Atlantic Offshore Lobstermen's Association
- Comments received during the public comment period for the Draft Environmental Impact Statement

- Development of lower bound estimates of the alternatives above the 60 percent risk reduction target to account for some uncertainty in risk reduction calculations.

Table 3.1: The total risk reduction estimated for the Preferred Alternative (Alternative 2) and Non-preferred Alternative (Alternative 3). Given the uncertainty in risk reduction for the insert intervals proposed by the states, upper and lower bounds were also provided, as described in section 3.1.2.2, as was the uncertainty provided by the gear threat model within the DST. Elements that do not result in significant risk reduction (e.g. weak link and gear marking modifications) are not included.

Combination of Measures	Alternative 2 (Preferred)	Alternative 3*
Risk Reduction: Restricted Areas	53.3%	33.6%
Risk Reduction: Restricted Areas + Trawl Length	59.2%	34.4%
Risk Reduction: Restricted Areas + Trawl Length + Other Line Reduction**	61.8%	59.4%
Total Risk Reduction - lower: Restricted Areas + Trawl Length + Other Line Reduction + Weak Line: lower bound estimate for inserts (DST Gear Threat Uncertainty)	68.8% (65.9% - 70.2%)	72.5%*** (61.8% - 77.9%)
Total Risk Reduction - upper: Restricted Areas + Trawl Length + Other Line Reduction + Weak Line - upper bound estimate for inserts (DST Gear Threat Uncertainty)	72.7% (66.5% – 75.8%)	

*Alternative 3 uses a different baseline line model than the Preferred Alternative because it does not include the Massachusetts Restricted Area Credit.

** Other line reduction for Alternative 2 represents line reduction via trap reductions in LMA 2 and 3. Other line reduction for Alternative 3 represents the risk reduction from the line cap.

*** No bounds calculated because only full weak line was included and analyzed

3.1.2.3 Decision Support Tool Analyses

Each suite of measures were run through the DST (version three) to identify the estimated contribution to risk reduction across the Northeast Region. The summary of model runs that best estimate the risk reduction of the alternatives in this FEIS, taking into account the interactive effects of different measure types, are located in Table 3.1. Additional output of individual model runs is included in Appendix 3.2.

The model has several options to customize each run according to the assumptions being made. The following delineates how scenarios were run based on the different underlying assumptions of the different model options available.

- Alternatives were assessed using one buoy line and right whale density model to avoid combining non-additive model runs, as was necessary for the DEIS when we relied on version two of the DST. The use of a single model allows all analyses to be run on one model with a consistent baseline for all measures within the alternative.
- To get an idea of relative contribution of each measure type (e.g. trawl length, restricted area, or maximum line strength), measures of a particular type were added to progressive model runs until all measures for an alternative were combined in one final model run (see Table 3.1).
- All final estimates were run in high resolution with DST model version 3.1.0.
- The most updated lobster trap map was used for each region, line model version 3.0.0.

- All risk reduction estimates used the same gear threat model and assumed line strength would not increase for the trawl up scenarios selected based on feedback from the Maine DMR and offshore fishermen.
- All models were assessed with version 11 of the right whale density model provided to NMFS by Duke University in early 2021 (Roberts et al. 2020). All alternatives used the right whale density model timeframe that estimated density from 2010 to 2018 data to incorporate the most recent data available and ecosystem shifts, most evident in the area south of Cape Cod.
- The two alternatives in this FEIS were assessed using two line models with baseline buoy line data from 2017, both produced by IEC, according to the data needed to assess the impacts of each suite of measures within complete model runs.
 - Alternative 2 (Preferred) considered “credit” for the Massachusetts Restricted Area (MRA) agreed upon by the Team in April 2019 and so used a line model that estimated the line density and trap configurations within the MRA from February through April prior to the implementation of the MRA in 2015. All other line data in this model represented the 2017 baseline year.
 - Alternative 3 (Non-preferred) used the same 2017 line model as Alternative 2 but did not include the line data that pre-dated implementation of the MRA during the closure months. This is because the baseline year selected for this alternative was wholly 2017 and so this alternative did not consider the MRA credit.
- Weak insertion analyses: weak insertions in longer intervals than what is considered fully weak (i.e., more than 40 feet between insertions, where 40 feet is the interval assumed to be equivalent to full weak rope) were not built into the decision support tool (see Section 3.3.4 for a discussion the criteria used to evaluate weak inserts). To determine the risk reduction achieved from these scenarios, we calculated an upper and lower bound for the proportion of full weak line risk reduction offered by a weak insert configuration:
 - The lower bound represented the proportion of insertions in a weak line scenario to the number of insertions needed to be set at 40 foot (12.2 meter) intervals considering water depths and anticipated buoy line length. This measure was the best approximation based on the data available. The number of insertions needed for full weak rope equivalent was estimated using average depth in the area weighted by the number of lines in each sub-region, and adjusted for estimated scope ratio of the buoy lines in the area based on consultation with state managers or fishermen (McCarron & Tetreault 2012).
 - The upper bound estimate was equivalent to the proportion of the buoy line above the lowest weak insertion point since the lower the insertion, the more likely a whale will encounter and breakaway from above the insertion. Below the lowest insertion, no risk reduction value is given (see Knowlton et al. 2020).
 - The proportional risk reduction assigned to the lower and upper bound estimates were then included in the DST model runs to approximate risk reduction where full weak line was not included.

- The lower bound weak line estimate was used to estimate whether an alternative met the required minimum risk reduction target of 60 percent to account for uncertainty given the lack of better quantitative data for these estimates.
 - The range presented is responsive to those comments on the DEIS that suggested either we should consider all the rope down to the lowest link to be the equivalent of weak rope (the upper bound) or that we should not consider rope weak unless it is engineered to break at 1,700 pounds (771 kilograms) or less or has the full suite of weak inserts (the lower bound)
- For any alternatives that impacted vessels fishing within the overlap between LMA 2 and Three, we assumed half of the vessels in this area were impacted by LMA 2 measures and the remainder were assumed to fish according to LMA 3 measures. Under fishery management measures, dual permitted fishermen would have to fish under the more conservative permit requirements therefore LMA 3 fishermen fishing in the overlap area would have to fish under LMA 3 trawling up and weak rope requirements.
 - Because of variability in the number of lines fished in particular months and by area, the 50 percent line cap analysis was estimated to achieve an average 45 percent reduction in line across the entire year, which varied by region from 37 to 49 percent. This was estimated by calculating half of the average number of lines fished across the year by area and how this might impact fishing effort by month in areas where the number of lines fished during some months in 2017 was less than the monthly average (i.e. the line cap). The most conservative estimate of average percent line reduction for each LMA was used to estimate risk reduction in the DST (see Section 3.5.5.5 for further details).

3.1.2.4 Identifying Areas for Seasonal Restrictions to Buoy Lines

Broad scale reduction in buoy lines across the proposed area is resilient to changes in whale distribution. However, NMFS identified areas and seasons where persistent aggregations of right whales appear to be seasonally predictable and to afford opportunity for additional risk reduction through seasonal closures to persistent buoy lines. To be effective, areas should not cause predictable relocation of lines to areas of high co-occurrence with right whales, inadvertently displacing risk. In considering areas, the primary goal was to find areas and seasons where there was an increased likelihood of right whale presence while minimizing undesirable consequences. For optimal conservation, the area needs to be sufficiently large to provide protection for whales despite annual variation in whale presence, but not designed such that large numbers of lines would relocate to other areas of high risk or to create a fencing effect along the borders of the restricted area. Hotspots of high buoy line and right whale co-occurrence were identified and tested with the DST to look for overall risk reduction. The approach for selecting hotspot areas is discussed below.

3.1.2.5 South of Martha's Vineyard and Nantucket

Several proposals from Team members and during the scoping process included the need for a restricted area south of Cape Cod and several areas of varying sizes and configurations were considered in this analysis (Figure 3.1). This area was also predicted as viable right whale habitat based on oceanographic models showing suitable habitat and prey availability (Pendleton et al.

2012). The Preferred Alternative analyzed for final rulemaking would implement a larger area closure than was identified in the Preferred Alternative in the DEIS but that was analyzed within the Non-preferred Alternative. Right, humpback, fin, minke, and sei whales were all sighted throughout the restricted areas from spring of 2011 through spring of 2015, extending from the area south of Nantucket to the west past Martha's Vineyard (Stone et al. 2017). During this period, all demographic classes of right whales were seen, within the 196 individuals identified. Thirty-five of the whales identified between 2011 and 2015 were not seen in other right whale habitats during this period. Right whale sightings occurred primarily from December through April, but were highest in February and March (Leiter et al. 2017). Though right whale occurrence peaks in winter and spring, there does appear to be some year round presence in this region (Oleson et al. 2020). The newest right whale density model from Duke University (version 11) captures the distribution shift in recent years (2010 to 2018) when compared to the previous nine year period (Roberts et al. 2020). Although the identification of this area as an important foraging area could partly be due to increased survey effort in this area due to wind energy development, it was predicted by models of copepod distribution (Pendleton et al. 2012).

When considering a restricted area in this region, we compared a number of options to consider the relative protection offered by different sizes and shapes towards achieving 60 percent risk reduction for LMA 2. Ultimately, three different shapes were selected for analysis in the DEIS based on the most recent five year NARWC sightings data (data downloaded in 2019). NMFS revisited these areas in selecting a Preferred Alternatives for the FEIS and for rulemaking based on public comment, an updated right whale density model within the DST that takes into account the most recent data from 2010 through 2018, and new sightings data that are not in the right whale density model but demonstrates high use of a broader area than was preferred in the DEIS. This area south of Cape Cod, Martha's Vineyard, and Nantucket represents an area where right whale aggregations have increased in recent years and therefore the most recent data is essential for delineating an area that is likely to have an impact on right whale entanglement risk.

The restricted area that was included in the Preferred Alternative in the DEIS was proposed by Massachusetts because it encompassed most of the sightings in the most recent two years when whale use of the area appeared to have shifted to the East. The restricted area bolstered the risk reduction that they were proposing for southern New England's LMA 2. However, updated aerial data collected between 2017 through 2021 demonstrate annual variation in habitat use in southern New England and that right whale aggregations are likely to shift to areas outside of the original preferred restricted area (Figure 3.1). The DST further estimated higher, more predictable risk reduction occurring within the larger restricted areas, therefore the area proposed by Massachusetts and in the Preferred Alternative in the DEIS was moved into the considered but rejected measures within this FEIS.

For the FEIS, we revisited the restricted areas included in the Non-preferred Alternative of the DEIS. One restricted area option in the DEIS Non-preferred Alternative is an L-shaped restricted area that encompasses the area with the most sightings over the most recent three years of data available for the FEIS (2017 through March 3, 2020). This shape was highly tailored to the areas where right whales have been frequently spotted from February through April, the proposed implementation months, between 2010 and 2020 but new 2021 data demonstrates that an overly surgical approach may not be robust to annual changes in aggregations in this area.

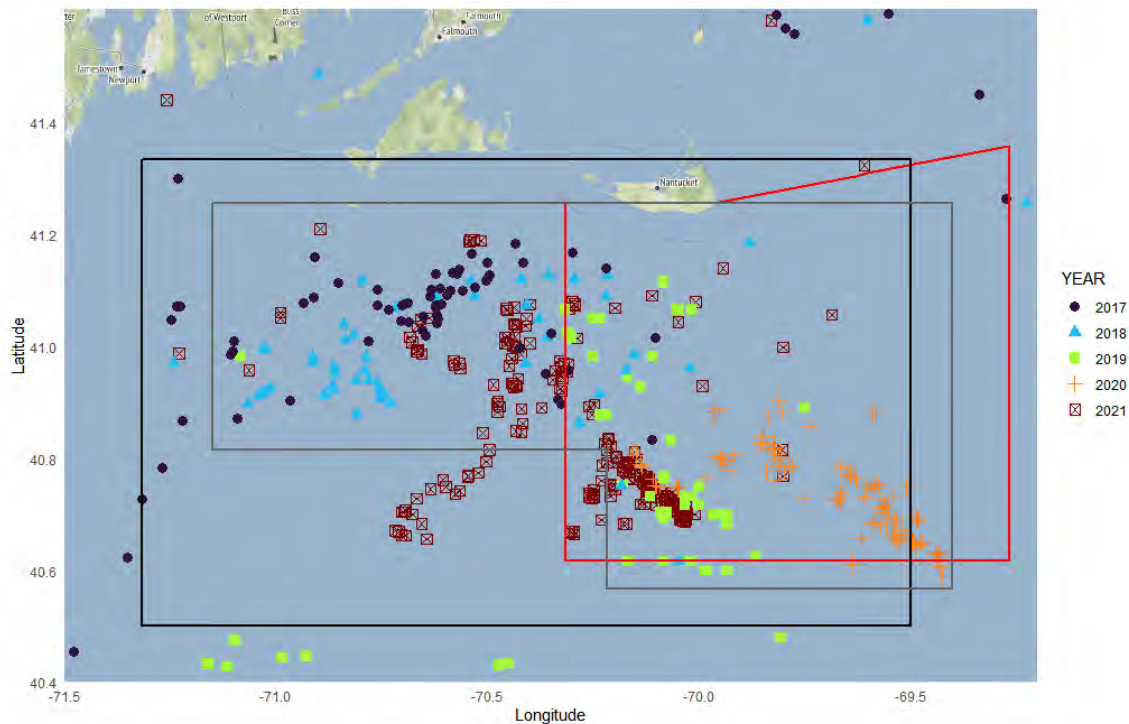


Figure 3.1: Right whale sightings data during February through April from 2017 through 2021 with the restricted areas analyzed in the DEIS. The area in the Preferred Alternative in the DEIS is in red, the area now in the FEIS Preferred Alternative is in black, and the grey area is in the Non-preferred alternatives in both the DEIS and FEIS. Aerial and shipboard survey data collected by NMFS, the New England Aquarium, and The Center for Coastal Studies and also includes opportunistic sightings data.

The largest area analyzed in the DEIS encompasses most of the recent right whales sightings since at least 2014. This area was included in the DEIS because it encompassed most of the smaller hotspot areas in the DST runs for the DEIS that were tested using various data sources and proposals. This area captures the majority of sightings in the most recent five year period during peak right whale presence according to aerial and shipboard survey data collected by NMFS, the New England Aquarium, and The Center for Coastal Studies and through opportunistic sightings data (February through April, Figure 3.1). This area provided over two times the risk reduction of the more tailored L-shaped area and, notably, encompasses dense right whale aggregations observed in spring of 2021 that would have been missed by the L-shaped area. This area better captures variability in habitat use, will be more resilient to environmental variability in the future, and prevents relocation of lines into areas of entanglement risk in adjacent areas. For these reasons, the larger closure analyzed in the DEIS was incorporated into Alternative 2 (Preferred) for this FEIS, and the L-shaped area was retained as an element of the Non-preferred Alternative 3.

3.1.2.5.1 Offshore Hotspot Analyses

A co-occurrence hotspot analysis was conducted in the offshore fishing habitats in LMA 1 and LMA 3 to see if there were any regions where whales and buoy lines co-occurred more frequently and where measures might be targeted to achieve the target risk reduction. The

offshore fishery uses stronger and longer buoy lines to retrieve trawls with more trap/pots in deeper waters. As described by Knowlton et al. (2017), stronger gear is likely more lethal. As a caveat, surveys are more rare in offshore areas compared to the coast but are occasionally conducted in response to reports of sightings. In order to identify offshore areas that could benefit from a restricted area during development of the DEIS, we used the right whale density model, version eight, within the DST to identify the individual pixels that represent forty to 50 percent of the cumulative risk in LMA 1 (assuming MRA is closed through May, see below identified as a “hotspot”) and in LMA 3 within the Northeast Region. Two areas were identified as having higher than average risk: one beyond 12 miles (22.2km) offshore of Maine during fall and winter months (Figure 3.2), which has been proposed for a seasonal buoy line closure in Alternatives 2 and 3, and one in Georges Basin within the Northeast Channel out to the Exclusive Economic Zone (EEZ) boundary beginning in late spring through late summer (Figure 3.3), proposed as a lobster trap/pot management area in Alternative 2 and a seasonal buoy line restricted area in Alternative 3. The final borders around these areas were drawn through an iterative process, testing the risk reduction offered in each version with the Decision Support Tool and selecting an area that is robust to annual shifts in predicted whale distribution without being larger than is necessary. For the LMA 1 restricted area, we also considered Maine’s fishing zone boundaries, and truncated the borders to align with the edges of the outermost two zones. Independent observations, as well as the physical and biological features of these “hotspots” identified by the DST confirm their relative importance. The inclusion of a new right whale density model into version three of the DST (right whale density model, version 11), still showed substantial risk reduction occurring in these hotspots suggesting these areas remain relatively important between 2010 and 2018.

LMA 1: The initial hotspot analyses were conducted with an older version (version eight) of the right whale density model that spanned from 1998 through 2017. The most updated version of the right whale density model (version 11) allows comparison of whale distribution before and after 2010 and suggests the Gulf of Maine, including this area, is slightly less important for right whales in recent years than previously but remains a potential hotspot for right whales during late fall and early winter months (Roberts et al. 2020). Though some research suggests the presence of the preferred prey species are shifting within the Gulf of Maine, acoustic data have still detected right whales in this area in recent years. Data from recent gliders operating in offshore Maine waters during December and January in 2018 and 2019 detected the presence of right whales, with positive detections within an area in the season and within the boundaries selected with the DST. Humpback, fin, and sei whales were also detected (data available at dcs.whoi.edu, Baumgartner et al. 2019, Baumgartner 2020). Restricting buoy lines during this time period in this region will reduce existing entanglement risk as well as prevent movement of the prolific nearshore fishery further offshore into this hotspot. Although aerial surveys in recent years have been sparse for this area, Baumgartner’s recent detections coincide with the area that had been identified as a potential winter breeding ground from 2002 to 2008 (Cole et al. 2013). Sound traps placed along the Maine Coast this year may provide further information regarding the value of a seasonal closure to buoy lines in this area. But at the time of writing of this FEIS, acoustic recordings for this season had not been uploaded or analyzed.

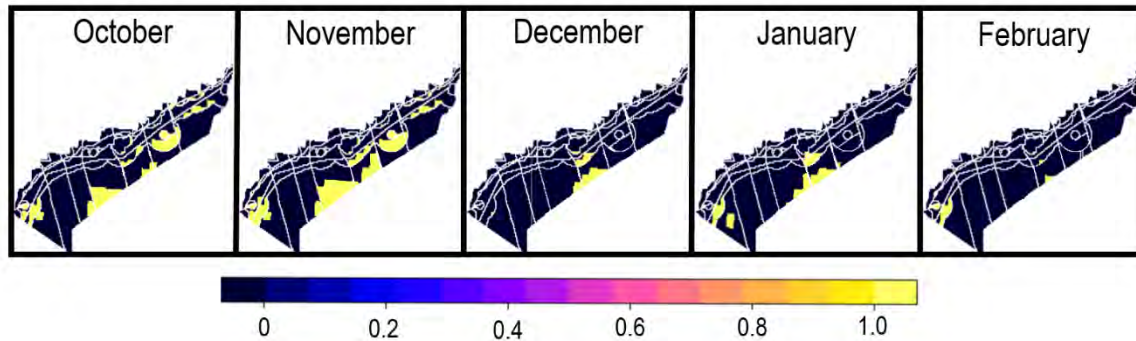


Figure 3.2: A hotspot analysis of the first 50 percent of risk characterized in the right whale density model version eight for LMA 1

LMA 3, Georges Basin: There is some evidence that this area could serve as a right whale foraging area. Historical data from Gulf of Maine show high densities of *C. finmarchicus*, in this area in May and June, particularly in areas sampled on the edge of Georges Bank in Georges Basin (Grieve et al. 2017). The area north of Georges Bank in the Gulf of Maine typically have higher percentages of stage five *C. finmarchicus*, one of the more lipid-rich stages that make up a part of the right whale diet (Mayo et al. 2001), starting in May and extending through summer (Harvey Walsh, NEFSC, Pers. Comm.). High *C. finmarchicus* densities are known to be present in summer months through fall just across the EEZ from the area in question, which could be connected to densities in the proposed restricted area (Plourde et al. 2019). Right whales also begin appearing in Canada in April and May (DFO 2019), potentially transiting through Georges' Basin area in search of food on their way north. However, co-occurrence model results included in the DEIS suggested that relocation of gear out of this area into adjacent productive fishing grounds would increase risk for several large whale species just outside of the boundaries of the area, possibly due to movement patterns through the entire region. In comments on the DEIS, the Atlantic Offshore Lobstermen's Association instead proposed a higher number of traps per trawl for this area as a conservation equivalency that would allow shorter trawl lengths than the 45 traps per trawl specified in the DEIS along the southern boundary of Georges Bank. Because of the importance of this Georges Basin hotspot to right whales, this FEIS adopted this as a Preferred Alternative. The measure offers a slightly higher line reduction measure for vessels fishing for lobster or Jonah crab in the Georges Basin area than the rest of LMA 3 in the Northeast without shifting co-occurrence into other potential hotspots.

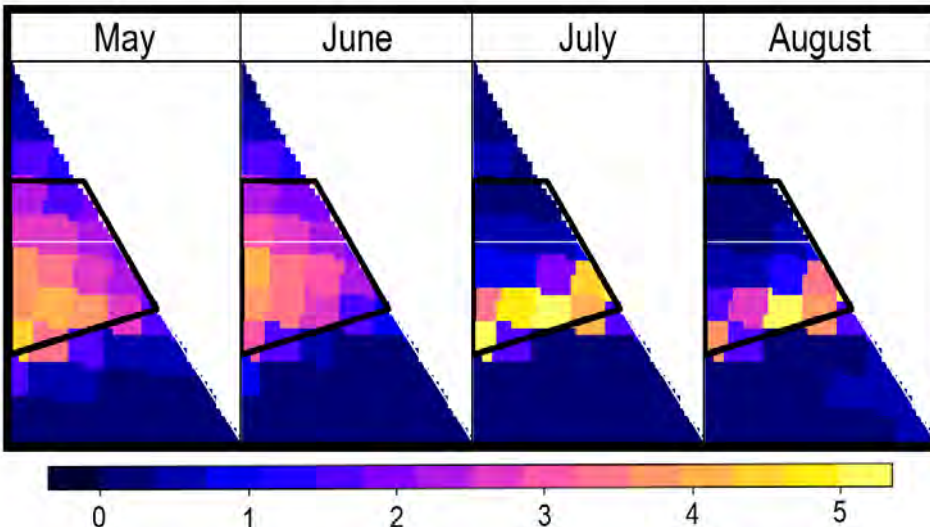


Figure 3.3: A hotspot analysis of the first 40 percent of risk characterized in the right whale density model version eight for LMA 3

3.1.2.5.2 Massachusetts Restricted Area Extensions

Though the time period selected for the original MRA from February through April was based on the months where whales were known to consistently aggregate, optimal habitat conditions in Cape Cod Bay, Massachusetts Bay, and surrounding areas often extend well into May (Morano et al. 2012, Pendleton et al. 2012, Roberts et al. 2020). Thus, several options were analyzed that recognize the state's flexibility in reopening dates in certain areas at the end of the restricted period in case large aggregations are still present.

3.2 Alternatives Considered

The alternatives examined in this FEIS emphasize options that are designed to reduce the potential for entanglements or to minimize the severity of adverse impacts to right whales and other large whales if entanglements occur, with a goal of at least 60 percent risk reduction (Section 3.2.1). Regulatory options were combined based on a variety of factors including the spatial risk landscape, regional fishery characteristics, safety concerns, known areas of increased whale presence, and public input. Most of the regulatory elements within the Preferred Alternative in the FEIS and final rule combine risk reduction measures that achieve the principles identified by the Take Reduction Team of applying broad and resilient weak line and line reduction measures, but the Team's recommended relative weak rope and line reduction measures were modified as a result of further risk reduction assessment, modifications proposed by the New England states or the Atlantic Offshore Lobstermen's Association, and conservation equivalencies proposed during public comments on the DEIS and proposed rule.

In addition to Alternative 1 (baseline) NMFS analyzed two suites of regulatory alternatives for consideration and identified a Preferred Alternative in this FEIS for final rulemaking. This section delineates new risk reduction and gear marking alternatives for lobster and Jonah crab trap/pot fisheries already managed under the Plan within New England waters. The measures included in this FEIS were modified from the analyses in the DEIS based on comments received

during the comment period on the DEIS but are all within the range of alternatives analyzed in the DEIS. Risk reduction estimates include the updated measures implemented by Massachusetts in recent months. Alternative 2 (Preferred) also adopts some of the conservation equivalency measures for vessels in Maine, LMA 2, and LMA 3 that offer alternative measures of equivalent or near-equivalent risk reduction that still achieve at least the minimum 60 percent target. Described in detail below, NMFS also proposed precautionary requirements, like additional gear marking and modifications to whale monitoring, that would apply across all the alternatives, with the exception of the No Action Alternative (Alternative 1, see section 3.2.2 for gear marking alternatives). The requirements under these alternatives supplement existing Plan requirements, unless otherwise noted (see Appendix 2.1 for description of current regulations).

Consistent with the recommendations of the Team, as delineated in Table 3.1, the suites of measures developed for Alternative 2 and Alternative 3 include the risk reduction contribution of regulatory measures that will not be written into the Final Rule, including:

- American lobster and Jonah crab fishery management measures that are being phased-in or are imminent, including ongoing changes to trap allocations phased in through 2021, and in-development regulations to further modify the trap allocation and trap transfer program to address the poor condition of southern New England lobster stock per Addenda 21, 22 and 26 to Amendment Three of the Interstate Fishery Management Plan for American Lobster
- Measures in Alternative 2 that will be implemented by states, including gear marking and weak insertions in lobster buoy lines in Maine exempt waters, extension of state waters of the Massachusetts Restricted Area season (until May 15 with the option of opening if whales leave the area or extending if whales remain in the area), and weak insert requirements in Massachusetts State waters.
- “Credit” for the Massachusetts Restricted Area.
- Measures in both alternatives include Massachusetts Department of Marine Fisheries (DMF) extension of the Massachusetts Restricted Area north in Massachusetts State waters to the New Hampshire border, which would be included in the final rule modifying the Plan. Evaluation of the extension of the state water closure into May is also analyzed but would not be included in the federal regulations.
- Modifications of regulations implementing the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) at 50 CFR 697.21(b)2 requiring two buoy lines on trawls with more than three pots to accommodate Maine conservation equivalencies
- Though not related to risk reduction, the minimum trawl lengths proposed for both alternatives in LMA 3 will also require associated modifications to the regulations at 50 CFR 697.21 (b)(3) implementing the Atlantic Coastal Fisheries Cooperative Management Act, increasing the allowable length of the trawl and groundline between the buoy lines from 1.5 nautical miles (2.78 kilometers) to 1.75 nautical miles (3.24 kilometers) in length.

Table 3.3: A summary of the risk reduction regulatory elements of the alternatives analyzed within the two action alternatives in this FEIS, arranged by LMA and geographic region (where appropriate). Dark gray shaded rows represent risk reduction elements that already exist or are reasonably foreseeable under state regulations or federal fishery management regulations and that contribute to the risk reduction goal but would not be implemented by Federal rulemaking to amend the Take Reduction Plan. Accommodations required in the ACFCMA and gear marking modifications are not listed. OC = Outer Cape

Component	Area	Alternative 2	Alternative 3
Restricted Areas	All existing and new closures become closed to buoy lines	Allow trap/pot fishing without buoy lines. Will require exemption from fishery management regulations requiring buoys and other devices to mark the ends of the bottom fishing gear. Exemption authorizations will include conditions to protect right whales such as area restrictions, vessel speed, monitoring, and reporting requirements. All restricted areas listed here would require an exemption. Federal waters in the Outer Cape LMA would remain closed to all lobster fishing consistent with the ASMFC lobster FMP.	Allow trap/pot fishing without buoy lines. Will require exemption from fishery management regulations requiring buoys and other devices to mark the ends of the bottom fishing gear. Exemption authorizations will include conditions to protect right whales such as area restrictions, vessel speed, monitoring, and reporting requirements. All restricted areas listed here would require an exemption. Federal waters in the Outer Cape LMA would remain closed to all lobster fishing consistent with the ASMFC lobster FMP.
	LMA 1 Restricted Area, Offshore ME LMA 1/3 border, zones C/D/E	Oct – Jan	Oct – Feb
	South Island Restricted Area	Feb – April: Area from Non-preferred A in DEIS.	Feb – May: L-shaped area closed to buoy lines.
	Massachusetts Restricted Area	Credit for Feb-Apr, state water in MRA have a soft opening until May 15th, until no more than three whales remain as confirmed by surveys	Federal extensions of restricted area throughout MRA and LMA 1/OC state waters unless surveys confirm that right whales have left the area.
	Massachusetts Restricted Area North	Feb-Apr: Expand MRA north in MA state waters to NH border	Feb-Apr: Expand MRA north in MA state waters to NH border
	Georges Basin Restricted Area	-	Closed to buoy lines May through August.
Line Reduction	ME exemption line – 3 nm (5.6 km), Zones A, B, F, G	3 traps/rawl	-
	ME exempt area – 3 nm (5.6 km), Zones C, D, E	Status quo (2 traps/rawl)	-
	ME 3 (5.6 km) – 6 nm*, Zone A West**	8 traps/rawl per two buoy lines or 4 traps/rawl per one buoy line	Line allocations capped at 50 percent of average monthly lines in federal waters
	ME 3 (5.6 km) – 6 nm*, Zone B	5 traps/rawl per one buoy line	
	ME 3 (5.6 km) – 6 nm*, Zones C, D, E, F, G	10 traps/rawl per two buoy lines or 5 traps/rawl per one buoy line	Same as above
	ME 3 (5.6 km) – 12 nm (22.2 km), Zone A East**	20 traps/rawl per two buoy lines or 10 traps/rawl per one buoy line	Same as above
	ME 6* – 12 nm (22.2 km), Zone A West**	15 traps/rawl per two buoy lines or 8 traps/rawl per one buoy line	Same as above

Component	Area	Alternative 2	Alternative 3
Buoy Line Reduction Continued	ME 6* – 12 nm (22.2 km), Zone B, D, E, F	10 traps/trawl per two buoy lines or 5 traps/trawl per one buoy line (status quo in D, E, & F)	Same as above
	ME 6* – 12 nm (22.2 km), Zone C, G	20 traps/trawl per two buoy lines or 10 traps/trawl per one buoy line	Same as above
	MA LMA 1, 6* – 12 nm (22.2 km)	15 traps/trawl	Same as above
	LMA 1 & OC 3 – 12 nm (5.6 – 22.2 km)	15 traps/trawl	Same as above
	LMA 1 over 12 nm (22.2 km)	25 traps/trawl	Same as above
	LMA 3, north of 50 fathom line on the south end of Georges Bank	Year-round: 45 traps/trawl, increase maximum trawl length from 1.5 nm (2.78km) to 1.75 nm (3.24 km)	May - August: 45 trap trawls; Year-round increase of maximum trawl length from 1.5 nm (2.78 km) to 1.75nm (3.24 km)
	LMA 3, south of 50 fathom line on the south end of Georges Bank	Year-round: 35 traps/trawl, increase maximum trawl length from 1.5 nm (2.78km) to 1.75 nm (3.24 km)	Same as above
	LMA 3, Georges Basin Restricted Area	Year-round: 50 traps/trawl, increase maximum trawl length from 1.5 nm (2.78km) to 1.75 nm (3.24 km)	Same as above
Other Line Reduction	LMA 2	Existing 18% reduction in the number of buoy lines	-
	LMA 3	Existing and anticipated 12% reduction in buoy lines	-
Buoy Weak Link	Northeast Region	For all buoy lines incorporating weak line or weak insertions, remove weak link requirement at surface system	Retain current weak link/line requirement at surface system but allow it to be at base of surface system or, as currently required, at buoy
Weak Line	ME Exempt State Waters	1 weak insertion 50% down the line	Full weak rope in the top 75% of both buoy lines
	ME exemption line – 3 nm (5.6 km)	1 weak insertion 50% down the line	Same as above
	MA State Waters	Weak inserts every 60 ft (18.3 m) or full weak line in top 75% of line	Same as above
	NH State Waters	1 weak insertion 50% down the line	Same as above
	RI State Waters	Weak inserts every 60 ft (18.3 m) in top 75% of line or full weak line	Same as above
	ME Zone A West**, B, C, D, E; federal waters 3 – 12 nm (5.6 – 22.2 km)	2 weak insertions, at 25% and 50% down line	Same as above
	ME Zone A East**, F, and G; federal waters 3 – 12 nm (5.6 – 22.2 km)	1 weak insertion 33% down the line	Same as above
	MA and NH LMA 1, OC; federal waters 3 – 12 nm (5.6 – 22.2 km)	2 weak insertions, at 25% and 50% down line	Same as above

Component	Area	Alternative 2	Alternative 3
	LMA 1 & OC over 12 nm (22.2 km)	1 weak insertion 33% down the line	Same as above
	LMA 2	Weak inserts every 60 ft (18.3 m) or full weak line in top 75% of line	Same as above
	LMA 3	One buoy line weak year round to 75%	May - August: one weak line to 75% and 20% on other end. Sep – Apr: two weak “toppers” down to 20%

*Note that the 6 nautical mile line refers to an approximation, described in 50 CFR 229.32 (a)(2)(ii) and a similar approximation of the 50 fathom lines would be included in the final rule implementing the Preferred Alternative at 50 CFR 229.32 (a)(2)(iv).

**Maine Zone A East is the portion of Zone A that is east of 67°18.00' W and Maine Zone A is west of this longitude.

These existing or anticipated state and fishery management regulatory measures would not be included in the final rulemaking associated with this FEIS, with the exception of the inclusion of Massachusetts spatial extension of the MRA from February through April. The analysis still considers the risk reduction contributed by these measures toward achieving the lobster and Jonah crab trap/pot fishery's target of more than 60 percent. The measures not included for rulemaking are listed but shaded in Table 3.3. The economic impact of the measures that are not being implemented under this action are also not included in the estimated economic impacts of Alternatives 2 and 3, with the exception of gear marking measures in Maine exempt waters.

During the scoping process, NMFS received numerous comments from diverse interested parties. The comments included both formal written comments as well as oral comments offered at public hearings. Appendix 3.4 summarizes the comments received during the initial stages of rulemaking at the public scoping meetings. Even more extensive comments were received on the DEIS and proposed rules. Those comments are summarized in Appendix 1.1. These comments were taken into consideration with a new round of analyses described above in Section 3.1.2.3 and in the justification for alternatives in Section 3.3 below. The results of these analyses and the public comment period informed the final alternatives included in this FEIS. Modifications to the DEIS for the FEIS also prioritized estimating risk reduction for right whales and other large whales with the updated right whale density model, the updated right whale population information, feasibility of implementation and safety concerns (particularly for small entities) that were ameliorated by conservation equivalencies, and possible indirect effects of measures that may adversely increase co-occurrence between buoy lines and whales.

Gear marking alternatives analyzed for the FEIS are discussed in Section 3.2.2. Marking gear does not reduce risk but if marked gear is retrieved from entangled whales it can provide information about where entanglement incidents occur. This information can be used by the Team to improve future amendments to the ALWTRP. Alternative 2 (Preferred) and the Final Rule would increase the number of marks required in federal water compared to the Proposed Rule but are still within the scope of what was analyzed in Alternative 3 in the DEIS and retained as Alternative 3 in this FEIS.

A number of alternatives were considered in the development of the DEIS and FEIS, or as we considered information submitted in public comments. A list of considered but rejected alternatives can be found in Section 3.4 and some additional information about measures considered but rejected can be found in the responses to comments found in Appendix 1.1.

3.2.1 *Risk Reduction Alternatives*

This section describes the risk reduction regulatory elements of the analyzed Alternatives. Changes to each alternative from the DEIS to the FEIS are described in each section.

3.2.1.1 Alternative 1: No Action Alternative

Under Alternative 1, NMFS would continue with the status quo, i.e., the baseline set of Plan requirements currently in place. A description of the current requirements can be found in Chapter 2, Appendix 2.1.

3.2.1.2 Alternative 2: Preferred Alternative

Alternative 2 would modify the ALWTRP requirements for lobster and Jonah crab trap/pot fisheries in the Northeast Region in a number of ways varying by lobster management areas or distance from shore. These measures follow general principles agreed upon by the ALWTRT modified by measures proposed by each state or lobster management areas. Further modifications would allow the exempted fishing permits for the harvest of lobster and Jonah crab through fishing methods that do not use persistent buoy lines within most waters of existing and future seasonal restricted areas, and the addition of two new “ropeless” seasonal restricted areas implemented to reduce co-occurrence of whales and ropeless to improve the overall risk reduction of the modifications within the Preferred Alternative and final rule. Modifications to the risk reduction measures in Alternative 2 (Preferred) in this FEIS relative to the Alternative 2 in the DEIS includes:

- The proposed seasonal restricted area south of Cape Cod in this alternative is larger than the restricted area analyzed within the DEIS’ Preferred Alternative, coming instead from a seasonal restricted area analyzed under DEIS Alternative Three.
- The removal of the requirement for a weak link at the buoy was analyzed as part of Alternative 3 in the DEIS.
- Adoption of conservation equivalency recommendations submitted as public comments on the DEIS and Proposed Rule for LMA 2 exchanging new trawl length requirements with more expansive weak insert requirements throughout LMA 2
- Adoption of conservation equivalency recommendations submitted as public comments on the DEIS and Proposed Rule for LMA 3 that would require more traps per trawl than in the DEIS within the Georges Basin area that was analyzed as a restricted area in Alternative 3 of the DEIS. This increase in number of traps per trawl was offset by a lower number of traps required within the Northeast Regions south of a curve representing the 50 fathom depth contour along the southern edge of Georges Bank.
- Adoption of conservation equivalency recommendations submitted as public comments on the DEIS and Proposed Rule for Maine waters in LMA 1, including modification of regulations implementing the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) at 50 CFR 697.21(b)(2) requiring two buoy lines on trawls with more than three pots to accommodate Maine conservation equivalency options. This would allow the use of half the minimum number of traps required with two buoy lines if only one buoy line is used. Other differences in the FEIS Alternative 2 compared to the DEIS are trade-offs in the number of traps per trawl based on Maine fishery zones and distance from shore between the Maine exemption line and the 12 nautical miles line (22.2 kilometer line; see the description of conservation equivalencies). See Section 3.3.2 for a more detailed description of the complex trawl length and weak line requirements proposed and implemented in this FEIS.

Specific changes are summarized in Table 3.4. For more information on the comments received from the public see Appendix 1.1 and Volume 3, and for details on the state proposals see Appendix 3.3.

Table 3.4: A summary of changes to Alternative 2 from the DEIS to this FEIS

DEIS Alternative 2 (Preferred)	FEIS Alternative 2 (Preferred)
Trawl Length	
MA State Measures: no singles on vessels >29’,	No longer being implemented by the state
LMA 2: Increase in trawl lengths over 3 nm	No Trawling up, only (additional) weak inserts (LMA 2 weakened rope conservation equivalency measures below)
LMA 3: 45 traps/trawl	50 traps per trawl in Georges Basin Core area, 35 traps per trawl deeper than 50 fa south of Georges Bank, 45 traps/trawl otherwise.
Maine LMA 1: Trawling up to three traps per trawl in state waters outside of exempt area	Trawling up most places by distance from shore and by zone outside exemption line. One string option with half the traps through most of three to 12 nm.
Maine LMA 1: Trawling up everywhere between three to 12 nm by distance from shore (eight to 15 traps per trawl with two buoy lines)	Trawling up most places by distance from shore and by zone between 3 to 12 nautical miles. Some areas stay at status quo, others go farther than the DEIS for an equivalent risk reduction overall (five to 20 traps per trawl with two buoy lines). One string option with half the traps through most of three to 12 nm.
Restricted Areas	
No expansion of MRA included	Expanded closure in MA state waters north of MRA to border, keep the area closed along with all other state waters from Outer Cape Cod through to NH border until May 15th, with soft opening option. Final Rule will include closure until April.
South Island area proposed by Massachusetts; closed Feb-Apr	Move DEIS closure to considered but rejected, include large South Island Restricted Area from Alternative 3 A in DEIS in Alternative 2, for same season of Feb-Apr
Weak Link	
Retain current weak link requirement at surface system but allow it to be at base of surface system or, as currently required, at buoy	For all buoy lines incorporating weak line or weak insertions, remove weak link requirement at surface system
Weakened Rope	
MA State waters: 1 weak insertion at 50%	Weak inserts or full weak line every 60 ft (18.3 m) to 75%
ME State Waters: 2 inserts in state waters outside of exempt area	One insert, consistent with exempt state waters
ME LMA 1, 3 to 12 nm: 2 weak insertions 25% and 50%	Maintain 2 weak lines except those increasing trawl lengths to 20 traps per trawl (one at 33% in these areas)
LMA 2, 3 to 12 nm: 2 weak insertions 25% and 50%	Weak insertions every 60 ft (18.3 m) or full weak line to 75%
LMA 2, Over 12 nm: 1 weak insertion in topper at 33%	Weak insertions every 60 ft (18.3 m) or full weak line to 75%

Trawling Up Modifications

These measures would increase the number of traps per trawl according to distance from shore. For waters offshore of Maine, these are largely taken from the conservation equivalency measures submitted as comments by Maine DMR and supported by many Maine fishermen and legislators; for LMA 2 these reflect Rhode Island Department of Environmental Management and fishermen comments about conservation equivalency and for LMA 3 these measures reflect comments from the Atlantic Offshore Lobstermen's Association.

Lobster Management Area 1

- Maine exempt area – 3 nautical miles (5.6 kilometers), Zones A, B, F, G: three traps per trawl
- Maine exempt area – 3 nautical miles (5.6 kilometers), Zones C, D, E: two traps per trawl (status quo)
- Maine 3 nautical miles (5.6 kilometers) – 6 nautical mile line, Zone A West**: eight traps per two buoy lines or four traps per one buoy line
- Maine 3 nautical miles (5.6 kilometers) – 6 nautical mile line, Zone B: five traps per one buoy line
- Maine 3 nautical miles (5.6 kilometers) – 6 nautical mile line, Zones C, D, E, F, G: 10 traps per two buoy lines or five traps per one buoy line
- Maine 3 (5.6 kilometer) – 12 nautical miles (22.2 kilometers), Zone A East**: 20 traps per two buoy lines or 10 traps per one buoy line
- Maine 6 nautical mile line – 12 nautical miles (22.2 kilometers), Zone A West**: 15 traps/ per two buoy lines or eight traps per one buoy line
- Maine 6 nautical mile line – 12 nautical miles (22.2 kilometers), Zone B, D, E, F: 10 traps per two buoy lines or five traps per one buoy line (status quo in D, E, and F).
- Maine 6 nautical mile line – 12 nautical miles (22.2 kilometers), Zone C, G: 20 traps per two buoy lines or 10 traps per one buoy line
- Outside of Maine, 3 nautical miles (5.6 kilometers) to the 6 nautical mile line: retain minimum 10 traps per trawl (status quo)
- All LMA 1, the 6 nautical mile line to 12 nautical miles (22.2 kilometers): minimum 15 traps per trawl
- All LMA 1, outside of 12 nautical miles (22.2 kilometers): minimum 25 traps per trawl

Outer Cape Lobster Management Area

- 3 (5.6 kilometer) to 12 nautical miles (22.2 kilometers): minimum 15 traps per trawl

Lobster Management Area 3

- Georges Basin Management Area: minimum 50 traps per trawl
- Area south of a line representing the 50 fathom isobaths on the south edge of Georges Bank: minimum 35 traps per trawl
- Remaining Northeast Region LMA 3: Trawl up to minimum 45 traps per trawl
- Increase allowed maximum length of trawl between buoy lines: To accommodate trawling up modifications, increase allowable length of lobster trawl from 1.5 nautical miles (2.8 kilometers) to 1.8 miles (3.24 kilometers).

Seasonal Restricted Areas (Open to ropeless, closed to persistent buoy lines) (Figure 3.4)

- Modify current closures to allow fishing without persistent buoy lines; allow conditional EFPs for ropeless fishing in Massachusetts and Great South Channel Restricted Areas with the exception of the Outer Cape LMA would remain closed to all lobster fishing consistent with the ASMFC lobster FMP.

- The LMA 1 Restricted Area in offshore waters (approximately 30 nautical miles/55.6 kilometers offshore) spanning Maine zones C, D, and E from Oct through January.
- Risk reduction credit for existing MRA closure.
- Expand MRA into Massachusetts State waters north to the New Hampshire border from February through April (MRA North).
- Consider risk reduction in the state measures that will not be implemented in the federal regulations: maintenance of the MRA in state waters until May 15 unless whales leave the area, soft opening or extension can be done under state authority.
- Establish a large new seasonal restricted area closed to persistent buoy lines south of Nantucket from February through April.

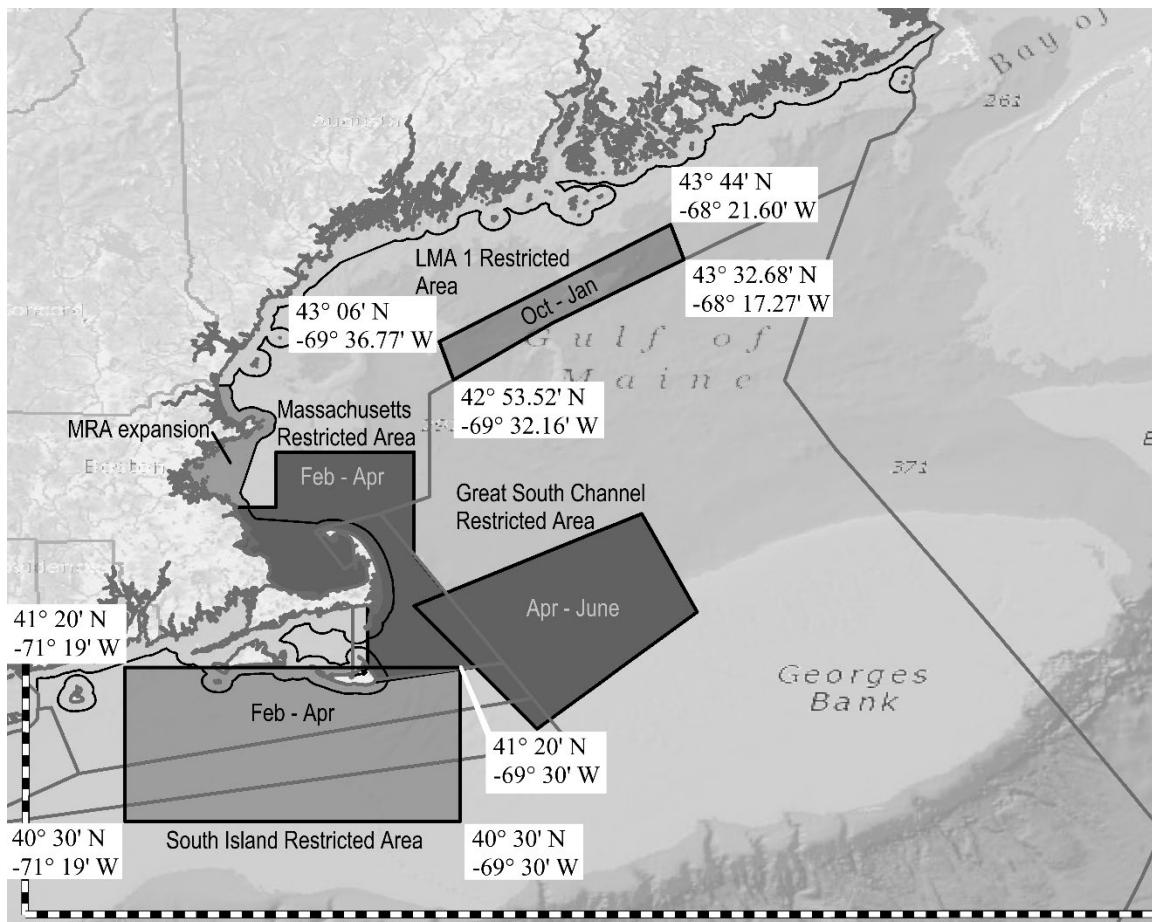


Figure 3.4: The trap/pot buoy line closure areas proposed in Alternative 2 (Preferred) shaded in light gray. LMAs are delineated by the grey lines. The new South Island Restricted Area is proposed as closed to trap/pot buoy lines from February through April and the LMA 1 Restricted area is proposed from October through January. An expansion of the MRA into Massachusetts State waters to the New Hampshire border (MRA North) and extended in state waters in LMA 1 and the Outer Cape through at least May 15th, with a potential opening if whales are no longer present, is also included. In dark gray are existing seasonal restricted areas that would become areas with restrictions to fishing with buoy lines, with the exception of the Outer Cape LMA.

Weak Line and Weak Insertion Modifications

Add weak inserts (break at less than 1,700 pounds (771 kilograms) at depths based on distance from shore or add full weak rope to same depth on line for added risk reduction:

Lobster Management Area One, Maine

- Coast to 3 nautical miles (5.6 kilometers): one insert halfway down the buoy line
- Zone A West**, B, C, D, E; federal waters 3 – 12 nautical miles (5.6 – 22.2 kilometers): two weak insertions, at 25 percent and 50 percent down line
- Zone A East**, F, and G; federal waters 3 – 12 nautical miles (5.6 – 22.2 kilometers): one weak insertion 33 percent down the line
- Over 12 nautical miles (22.2 kilometers): one insert 33 percent of the way down the buoy line

Lobster Management Area One, Outside of Maine & Outer Cape

- New Hampshire State Waters: 1 weak insertion 50 percent down the line
- Massachusetts State Waters: Weak inserts every 60 feet (18.3 meters) or full weak line in top 75 percent of line
- 3 to 12 nautical miles (5.6 – 22.2 kilometers): two inserts, one 50 percent and one 25 percent down the buoy line
- Over 12 nautical miles (22.2 kilometers): one insert 33 percent of the way down the buoy line

Lobster Management Area Two

- Weak inserts every 60 feet (18.3 meters) or full weak line in top 75 percent of line

Lobster Management Area Three

- Year round require one buoy line on each trawl to be weak rope on the top 75 percent of the buoy line.

Buoy Weak Link Modification

- Remove requirement for a weak link at the buoy.

3.2.1.3 Alternative 3: Non-Preferred Alternative

Alternative 3 takes an alternate approach to achieving risk reduction across the proposed areas, making use of more buoy line closures and buoy line allocations rather than trawling up measures. This FEIS Alternative 3 is modified from the DEIS Alternative 3. The weak link at the buoy is retained with the option to place it lower, at the base of the surface system. Additionally, only one South Island Restricted Area closure is analyzed within the FEIS Alternative 3. Alternative 3 retained only the seasonal weak line option in LMA 3 because the other option is analyzed in the Preferred Alternative. Alternative 3 also includes the spatial expansion of the MRA to include the state waters north to New Hampshire, as implemented by state Regulations (see Table 3.5).

Figure 3.5: A summary of changes in Alternative 3 from the DEIS to the FEIS.

DEIS Alternative 3 (Non-preferred)	FEIS Alternative 3 (Non-preferred)
Restricted Areas	
No expansion of MRA included	Expanded MRA closure in MA state waters north to the border, keep the area closed along with all other state waters from the Outer Cape LMA through to NH border until May 15th, with soft opening option. Final Rule will include closure until April.
Two South Island Options (Feb - May): A) Large closure B) L-shaped closure	Move large area from Alternative 3 A in DEIS to Alternative 2 for Feb-Apr, keep only L-Shaped area from Feb - May in Alternative 3
Weak Link	
For all buoy lines incorporating weak line or weak insertions, remove weak link requirement at surface system	Retain current weak link/line requirement at surface system but allow it to be at base of surface system or, as currently required, at buoy
Weakened Rope	
LMA 3: two options for weak rope 1) fully weak line in the top 75 percent of one line, 2) May - August: one weak line to 75% and 20% on other end. Sep – Apr: two weak “toppers” to 20%	Keep seasonal option: May - August: one weak line to 75% and 20% on the other end. Sep – Apr: two weak “toppers” to 20%

Gear Modifications

Cap the total number of lines available for trap/pot fishing outside of state waters:

Throughout federal waters of the Northeast Region

- Cap the number of buoy lines to 50 percent of the average baseline number of lines (2017) outside of state waters.

Increase the number of traps per trawl seasonally in LMA 3 and increase length of trawl:

Lobster Management Area Three

- Minimum 45 traps per trawl, May through August. To accommodate this modification, increase the allowable length of lobster trawl from 1.5 nautical miles (2.8 kilometers) to 1.8 miles (3.2 kilometers).

Seasonal Restricted Areas (Open to ropeless, closed to persistent buoy lines; Figure 3.5)

- Modify current closures to areas closed to buoy lines; allow conditional EFPs for ropeless fishing in Massachusetts and Great South Channel Restricted Areas. Federal waters in the Outer Cape LMA would remain closed to all lobster fishing from February 1 through March 31 consistent with the ASMFC lobster FMP.
- The LMA 1 Restricted Area in offshore waters (approximately 30 nautical miles/55.6 kilometers offshore) spanning Maine zones C, D, and E from October through February.
- Extend the entire MRA closure to buoy lines through May with the potential to open it early when surveys indicate that the whales have left the area.
- Extend the MRA into Massachusetts State waters north to the New Hampshire border February through May (MRA North)
- A buoy line closure in the core Georges Basin Restricted Area from May through August. L-shaped South Island Restricted Area from February through May (see Fig 3.2).

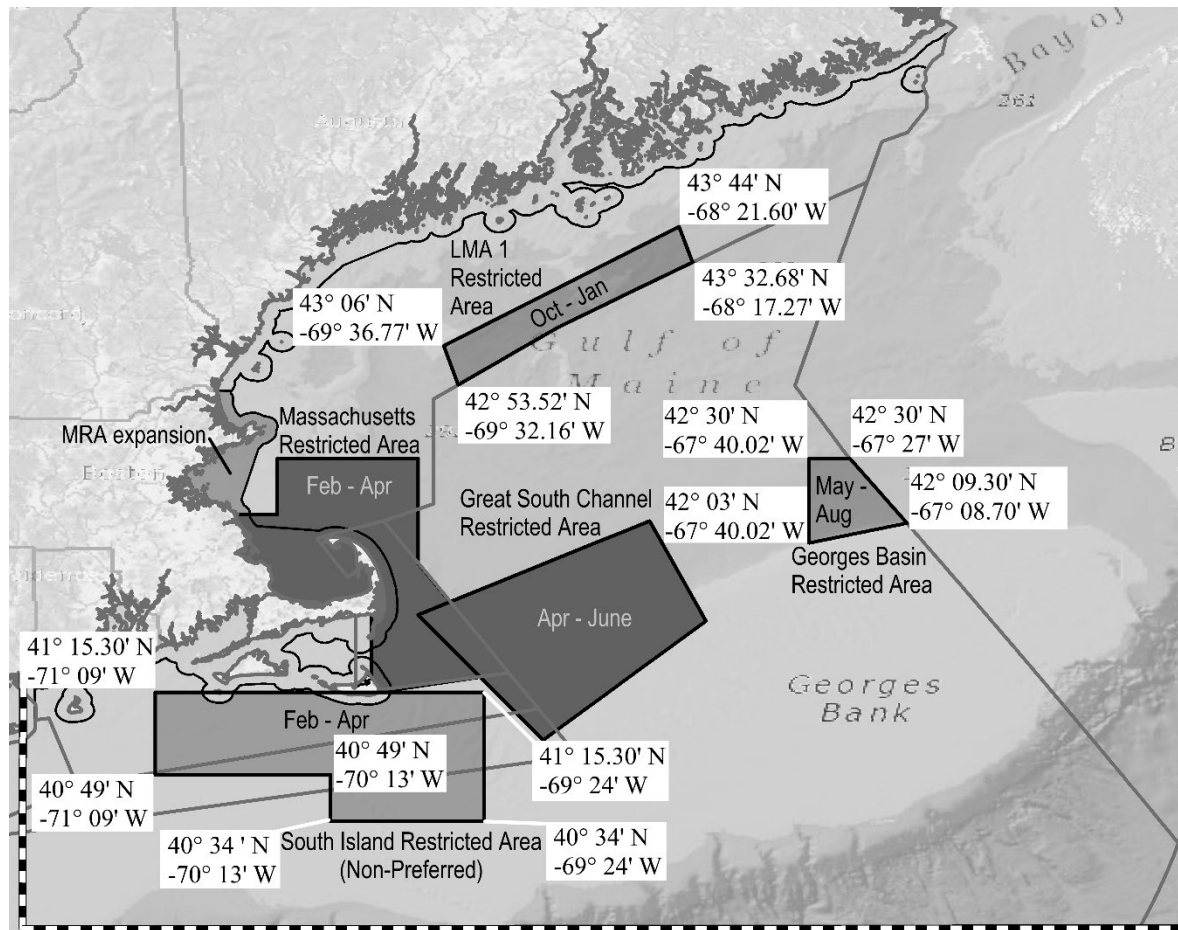


Figure 3.5: The restricted area options proposed in Alternative 3 (Non-preferred) shaded in light gray. The L-shaped South Island Restricted Area from February through April. The LMA 1 Restricted Area is proposed from October through February. The Georges Basin Restricted Area is proposed from May through August. An expansion of the MRA into Massachusetts State waters to the New Hampshire border and extended through at least May 15th (MRA North), with a potential opening if whales are no longer present, is also included. In dark gray are existing seasonal restricted areas that would become areas with restrictions to fishing with buoy lines, with the exception of the Outer Cape LMA.

Weak Line

Throughout Northeast Region

- Year round require one buoy line on each trawl to be weak rope (breaks at less than 1,700 pounds/771 kilograms) on the top 75 percent of both buoy lines, except in lobster management area three

Lobster Management Area Three

- Seasonally, May through August, one buoy line on each trawl would consist of a full weak rope on the top 75 percent of the line. The second buoy line would have a weak topper in the top 20 percent of the buoy line. The rest of the year both buoy lines will have a weak topper in the top 20 percent of the buoy line.

3.2.2 Gear Marking Alternatives

As discussed in Section 3.1.6, the Atlantic Large Whale Take Reduction Team supported efforts to expand gear marking to further improve efforts to determine entanglement location. The current gear marking strategy does not support observation of marks from platforms such as boats and planes, and the expansion of gear marking in 2014/2015 did not substantially increase the ability to determine original entanglement locations. The Maine DMR has regulations, effective September 1, 2020, to require gear marking throughout Maine waters using purple as their unique color (DMR Chapter 75.02). Alternative 2 (Preferred) of this FEIS has a modified gear marking scheme compared to the DEIS. Additional 1 foot green marks would be required in federal waters under Alternative 2 (Preferred) for better discernment between fishing in U.S. and Canada and between state and federal waters and waters of the Northeast Trap/Pot Management Area.

3.2.2.1 Alternative 1: No Action Alternative

Under Alternative 1, NMFS would continue with the status quo, i.e., the baseline set of Plan requirements currently in place. A description of the current requirements can be found in Chapter 2, Appendix 2.1.

Table 3.6: The proposed gear marking alternatives by principle port state and/or management area. The surface system color designations are the same for both alternatives. The shaded portion (also represented by an *) represents an area that will be managed by a state agency rather than NMFS. The number of markings required represent a minimum number and length of marks.

Area	Alternative 2	Alternative 3
Entire Northeast Region	One 3 foot (91.4 cm) long state-specific (see color below) mark within 2 fathoms (60.96 cm) of the buoy. In federal waters, at least four additional 1 foot (30.5 cm) green marks within 6 inches (15.2 cm) of each state-specific mark.	One 3 foot (91.4 cm) long state-specific (see color in Alt 2) mark within two fathoms of the buoy & ID tape throughout buoy line denoting home state and trap/pot fishery
Maine State Waters	Purple. At least two 1 foot (30.5 cm) marks (by depth) on top and bottom half of buoy line below the surface system, through state regulation only*	See “Entire Northeast Region”
Maine Federal Waters	Purple. In federal waters, at least three 1 foot (30.5 cm) state colored marks in the buoy line below the surface system: at top, middle and bottom of line. At least four additional 1 foot (30.5 cm) green marks within 6 inches (15.2 cm) of each state-specific mark.	See “Entire Northeast Region”
New Hampshire	Yellow. In state waters: at least two additional 1 foot (30.5 cm) marks in the buoy line below the surface system: on top half and bottom half of buoy line. In federal waters, at least three 1 foot (30.5 cm) state colored marks in the buoy line below the surface system: at top, middle and bottom of line and at least four additional 1 foot (30.5 cm) green marks within 6 inches (15.2 cm) of each state-specific mark.	See “Entire Northeast Region”
Massachusetts	Red. In state waters: at least two 1 foot (30.5 cm) marks in the buoy line below the surface system: on top half and bottom half of buoy line. In federal waters, at least three 1 foot (30.5 cm) state colored marks in the buoy line below the surface system: at top, middle and bottom of line and at least four additional 1 foot (30.5 cm) green marks within 1 inches (15.2 cm) of each state-specific mark.	See “Entire Northeast Region”
Rhode Island	Silvery/Gray. In state waters: at least two 1 foot (30.5 cm) marks in the buoy line below the surface system: on top half and bottom half of buoy line. In federal waters, at least three 1 foot (30.5 cm) state colored marks in the buoy line below the surface system: at top, middle and bottom of line and at least four additional 1 foot (30.5 cm) green marks within 6 inches (15.2 cm) of each state-specific mark.	See “Entire Northeast Region”
LMA 3	Black. Add at least four additional one foot (30.5 cm) green marks within 6 inches (15.2 cm) of each LMA 3 specific black mark.	See “Entire Northeast Region”

3.1.1.1 Alternative 2: Preferred Alternative

Under Alternative 2 (Preferred), NMFS would mirror the Maine regulations in all non-exempted state waters, and implement analogous marking for the other New England states (one state-specific 3 foot (91.4 centimeter) colored mark within two fathoms of the buoy, at least two additional 1 foot long (30.5 centimeter) marks in top and bottom half of gear in state waters, and at least three additional 1 foot long (30.5 centimeter) marks in federal waters. Additionally, gear in federal waters would be required to include at least four 1 foot long (30.5 centimeter) green marks within 6 inches (15.2 centimeter) of each state specific mark. The number of marks in

federal waters has increased from the DEIS (four 1 foot marks instead of one six inch marks). This change is responsive to public comment, within the scope of the DEIS, and will likely be more effective at distinguishing state from federal waters than Alternative 2 in the DEIS (See table 3.7). This proposal would paint or tape for visibility in surface system markings but would continue to allow multiple methods for marking line below the surface system (paint, tape, rope tracers, etc.). Table 3.6 outlines the proposed gear marking colors.

Figure 3.7: A comparison of changes in gear marking Alternative 2 from the DEIS to the FEIS

DEIS	Alternative 2
Gear Marking	
State Colors in lower buoy line: 2 in buoy line below surface system in state waters, 3 in federal waters (top, middle and bottom)	At least two in below surface system in state waters and at least three in federal waters (top, middle and bottom)
Federal waters: 6 inch green mark within 1 foot of large surface system mark	Federal waters: Four 1 foot green marks adjacent to ALL state color mark

3.2.2.2 Alternative 3: Non-Preferred Alternative

Under Alternative 3 (Non-preferred) one 3 foot (91.4 centimeter) state specific color would be marked on the buoy line within two fathom of the buoy, as in the Preferred Alternative, but the entire buoy line would also have to be replaced with a line woven with identification tape with the home state and fishery (for example Maine, lobster/crab trap/pot) repeated in writing along the length of the buoy line. This alternative is the same as Alternative 3 for gear marking in the DEIS.

3.3 Justification for Regulatory Options Considered

3.3.1 Buoy Line Reduction

There are multiple approaches to accomplish line reduction in areas where right whales occur, including increasing trap/trawl requirements so that fewer buoy lines are used to fish the same number of traps and restricted areas that eliminate buoy lines during predictable seasons when whales aggregate. The 2014/2015 rulemakings used both of these approaches. Assuming that the co-occurrence (overlap in seasonal distribution and abundance) of buoy lines and whales is a proxy for risk due to reduced opportunity for encounters and entanglements, those rulemakings intended to reduce co-occurrence to reduce risk. Similar measures are considered for the alternatives analyzed in this FEIS.

Ongoing and imminent (RIN 0648-BF01) Lobster Plan fishery management modifications that result in line reductions relative to the 2017 baseline through trap restrictions would provide risk reduction in the lobster fishery that would be counted towards the 60 percent goal. Phased in lobster management measures as well as ongoing independent rulemaking being developed concurrently with this Plan modification will restrict aggregate trap limits. Discussed in Chapter 5 and in the proposal analysis from Massachusetts and Rhode Island (Appendix 3.3), declines in the southern New England lobster stocks as well as lobster management measures have modified the fishery to reduce the number of permitted traps that could be fished in the fishery, known as latent effort. In LMA 2, actively fished traps and buoy lines have declined annually since

measures were implemented in 2015. Buoy line numbers did not decline in LMA 3 but with fewer latent traps available for transfer, measures currently in development are anticipated to reduce the number of lines fished in LMA 3 (discussed further in section 3.3.5, Appendix 3.3, and in Section 5.2.1.1.1). Inclusion of fishery management risk reduction measures towards the risk reduction target was supported by the Team in their April 2019 recommendation.

3.3.2 Conservation Equivalencies

This FEIS analyzes conservation equivalencies submitted by states and fishermen, including the Atlantic Offshore Lobstermen's Association as comments on the DEIS Alternative 2 and associated Proposed Rule.

- Rhode Island suggested requiring weak line on the top 75 percent of the buoy lines fished in LMA 2 (analyzed in this FEIS as a weak insertion every 60 feet in the top 75 percent of the buoy line in line with Massachusetts State measures) in lieu of trawling up measures because some Rhode Island vessels do not have deck capacity to handle more traps. The risk reduction offered by this measure in this specific area was slightly greater for expanded weak inserts than for the trawling up proposed in the DEIS' Preferred Alternative. Most boats in this area already fish with the proposed trawl lengths except for a few smaller boats that are unequipped for longer trawls. Adding weak inserts to line that is stronger than 1,700 pounds (771 kilograms) provides more substantive risk reduction in this particular region (40 percent with the DEIS measures and 58 percent for the equivalency in this FEIS).
- The Atlantic Offshore Lobstermen's Association comments suggested a conservation equivalency that would alter trawl length by area, allowing variation based on where whale risk is highest but on the whole achieving similar risk reduction (47 percent with the DEIS and 48 percent for the equivalency in the FEIS; Figure 3.6). Other Atlantic Offshore Lobstermen's Association recommendations were not adopted primarily due to an inability to implement or analyze the effectiveness of their proposed measures.

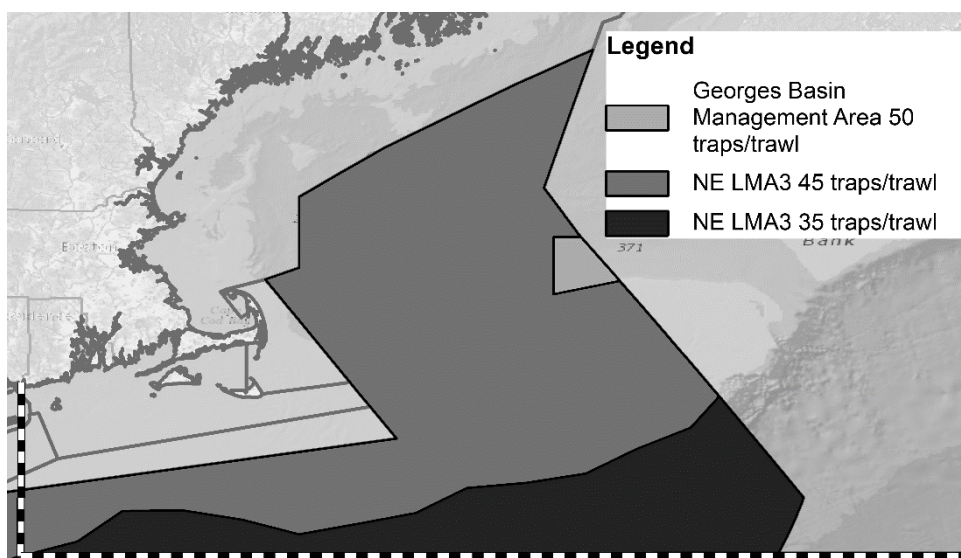


Figure 3.6: The conservation equivalency suggested by the Offshore Lobstermen's Association to vary trawl length based on specific areas within the Northeast Region

Table 3.8: The proposed trawl lengths and weak points proposed by Maine’s Department of Marine Resources during the public comment period. Zone A, is split between three and twelve nautical miles from north to the south at 67° 18’ longitude, south from Cross Island.

	DEIS	Distance (nm)	Zone G	Zone F	Zone E	Zone D	Zone C	Zone B	Zone A West	Zone A East
Traps Per Trawl	3	Exemption Line-3	3's per one buoy line	3's per one buoy line	2's per one buoy line	2's per one buoy line	2's per one buoy line	3's per one buoy line	3's per one buoy line	3's per one buoy line
	8	3-6	5's per one buoy line; 10's per two buoy lines	5's per one buoy line; 10's per two buoy lines	5's per one buoy line; 10's per two buoy lines	5's per one buoy line; 10's per two buoy lines	5's per one buoy line; 10's per two buoy lines	5's per one buoy line	4's per one buoy line; 8's per two buoy lines	10's per one buoy line; 20's per two buoy lines
	15	6-12	10's per one buoy line; 20's per two buoy lines	5's per one buoy line; 10's per two buoy lines	5's per one buoy line; 10's per two buoy lines	5's per one buoy line; 10's per two buoy lines	10's per one buoy line; 20's per two buoy lines	5's per one buoy line; 10's per two buoy lines	8's per one buoy line; 15's per two buoy lines	10's per one buoy line; 20's per two buoy lines
	25	12+	25's per two buoy lines	25's per two buoy lines	20's per two buoy lines	20's per two buoy lines	20's per two buoy lines	25's per two buoy lines	25's per two buoy lines	25's per two buoy lines
Weak Points		0 - 3	1 weak point 50% down line	1 weak point 50% down line	1 weak point 50% down line	1 weak point 50% down line	1 weak point 50% down line	1 weak point 50% down line	1 weak point 50% down line	1 weak point 50% down line
		3-12	1 weak point 33% down line	1 weak point 33% down line	2 weak points 25% and 50% down line	2 weak points 25% and 50% down line	2 weak points 25% and 50% down line	2 weak points 25% and 50% down line	2 weak points 25% and 50% down line	1 weak point 33% down line
		12+	Buoy line 1: 1 weak point 33% down line, Buoy line 2: 2 weak points at 25% and 50% down line	1 weak point 33% down line	2 weak points 25% and 50% down line	2 weak points 25% and 50% down line	2 weak points 25% and 50% down line	2 weak points 25% and 50% down line	1 weak point 33% down line	1 weak point 33% down line

- The Maine DMR proposed an equivalent line reduction and weak rope scenario than was in the DEIS that varied the trawling up and weak insertion combinations by state management zones and distance from shore (Table 3.8). A primary component of this change was the inclusion of conservation equivalencies that allow an individual to fish in configurations that vary by distance from shore and allow a different number of traps depending on the number of buoy lines fished. For example, where 20 traps would be the minimum number of traps with two buoy lines there would be an option to fish 10 traps with one buoy line. NMFS analyzed Maine's conservation equivalencies and found most of the proposed configurations to be an equivalent risk reduction in federal waters between 3 and 12 nautical miles (5.6 to 22.2 kilometers; 10.4 percent with the DEIS measures and 10.5 percent for the equivalency in the FEIS). Alternative 2 analyzes those equivalencies recommended in this area and they would be implemented by the Final Rule. However, there was less risk reduction in the proposal for some zones outside of 12 nautical miles (22.2 kilometers) and therefore Alternative 2 maintains the 25 traps per trawl analyzed in the DEIS and proposed in the Proposed Rule to maintain equivalent risk reduction in offshore waters nearby known right whale hotspots (Figure 3.7). There was also a smaller risk reduction inside state waters in non-exempt waters (4 percent with the DEIS measures and 1 percent in this FEIS) but the newly proposed trawl lengths in this area were maintained in the FEIS because of the lower risk predicted in Maine State waters.

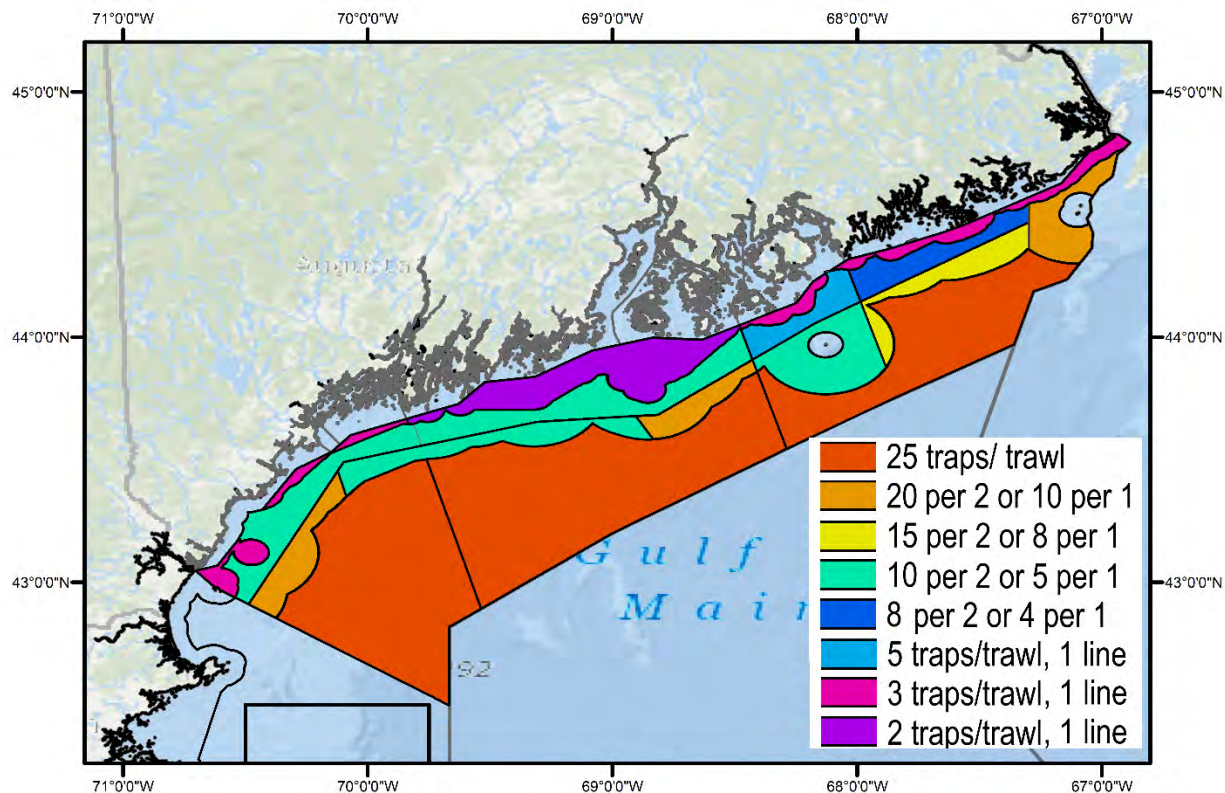


Figure 3.7: Alternative 2(Preferred) and Final Rule Maine traps/trawl requirements: The trawl length from Maine's Department of Marine Resources incorporated into Alternative 2 were within state waters and federal waters between 3 and 12 nautical miles (5.6 to 22.2 kilometers). Outside of 12 nautical miles (22.2 kilometers), a 25 trawl length was retained to maintain risk reduction near a predicted right whale hotspot.

3.3.3 *Seasonal Restrictions to Buoy Lines that Allow Ropeless Fishing*

The alternatives analyzed and the measures that would be implemented in the Final Rule do not require, or in themselves authorize, ropeless fishing. Rather, the analyzed measures would allow fishermen with the appropriate exemptions from surface marking requirements to harvest lobster and Jonah crab in the ALWTRP seasonal management areas. The intention of this modification from the former approach to closing these areas to harvest is to encourage the development of ropeless fishing technology in collaboration with fishermen under a variety of commercial fishing conditions. Operational challenges that fishing under exempted fishing permits would continue to address within and beyond seasonal restricted areas include improvements to sturdiness of gear to withstand commercial fishing operations, surface detection of bottom gear to reduce gear conflicts and enforcement detection, development of gear retrieval and reset options or other methods to allow gear inspection.

In an effort to provide new options to reduce large whale entanglements in buoy lines, scientists, fishermen, conservationists, and resource managers are increasingly looking to new gear and technological options that may provide an alternative to complete area closures and other risk reduction measures that attempt to separate whales from rope in the water column. Ropeless systems allow fishermen to retrieve the gear from the bottom using methods such as: remotely releasing a buoy line stored on the bottom, by remotely inflating a bag that brings the trap and groundline to the surface, by using galvanized releases that decay over time to release a buoy line, or by grappling the ground line from the surface, which is often done when buoys have been parted from fishing gear. Ropeless designs are usually not actually rope-free but it is a commonly used term. In addition to buoy lines that are often deployed for retrieval, groundlines would continue to connect traps in a “trawl” along the seafloor. However, if operationally feasible, “ropeless” fishing would allow fishermen to operate around whales with a greatly reduced risk of entanglement and would provide an alternative to closures.

A number of technological, regulatory, financial, and operational barriers must be addressed before this type of fishing gear can be considered operationally feasible on a broad scale. Only small scale use of remote buoy line retrieval in U.S. commercial lobster fisheries has been done to date. Gear manufacturers are continuing to adapt the gear to meet the rigors of commercial conditions. The potential for an increase in gear conflict continues to be a major concern. In current trap/pot operations, persistent buoy lines are required; they connect a buoy at the surface to bottom gear including trawls of pots to allow retrieval of pots. Surface systems including buoys and radar reflectors are also required to alert other mariners of gear being fished on the bottom. Bottom fishing vessels which drag nets along the bottom, as well as gillnet and other trap/pot fishermen, can avoid trawling up or overlaying gear over the lobster and Jonah crab trawls. Ropeless fishing could also hamper enforcement as illegal trawls could be hidden and enforcement operations would not have an easy way to retrieve fishing gear for inspection or reset inspected gear.

Technology will be needed that allows mariners and enforcement to locate fishing gear on the seafloor, at some cost to vessel operators in fisheries that are not causing right whale entanglements. If developed and affordable or subsidized, technology and regulations requiring

vessel operators to fish without buoy lines and to use technology to detect gear set on the bottom could replace current surface system regulations. Until then, fishermen developing ropeless fishing practices to harvest lobster and Jonah crabs without a surface system must obtain state or federal authorization exempting them from requirements to mark the ends of their trawls with visible surface systems. Technology to allow enforcement to inspect the gear is also needed.

Recognizing the current hurdles, the 2020 Appropriations Bill covering the Department of Commerce (Senate Report 116-127) directed funds toward the development of a program to develop and test “innovative fishing gear technologies designed to reduce right whale entanglements in partnership with relevant stakeholder. . .” NMFS, in partnership with fishermen, environmental organizations and other nonprofits, and whale and gear researchers, has developed and continues to expand a ropeless gear cache and partners are working under exempted fishing permits to pilot ropeless technology. This effort is expanding to include mobile gear fishermen working with technology already on their vessels to see if they can avoid gear that is fished without buoy lines. The goal of this effort is to address the current challenges under operational conditions so that ropeless fishing could allow trap/pot fisheries to continue while also preventing right whale entanglements.

Prior to piloting ropeless research, NMFS convened a subgroup of the Atlantic Large Whale Take Reduction Team members in 2018 to investigate the feasibility of ropeless fishing. The subgroup evaluated the existing barriers and considered that while there might be a ropeless fishing opportunity in the future, short-term risk reduction was a greater priority for the Team. NMFS published an Advance Notice of Proposed Rulemaking (ANPR) investigating changing existing seasonal closure areas to closures to trap/pot buoy lines (83 FR 49046, September 28, 2018). Team members at the October 2018 in-person Team meeting, as well as fishermen responding to the ANPR and to NMFS during scoping for the DEIS expressed skepticism that ropeless fishing would replace traditional and successful fishing methods and focused discussions instead on immediately available risk reduction solutions. If the right whale population continues to decline, broad implementation of seasonal closures may be required. Further testing of ropeless retrieval and bottom gear detection is needed to resolve operational barriers and to develop ropeless fishing methods as an alternative to broad closures. While testing can and is being done outside of restricted areas, controlled experiments in areas closed to the majority of lobster and Jonah crab traps and pots could accelerate ropeless testing and demonstrate efficacy. NMFS and collaborators have invested a substantial amount of funding in the industry's development of ropeless gear, in specific geographic areas and in general. We anticipate that these efforts to facilitate and support the industry's development of ropeless gear will continue, pending further appropriations. NMFS anticipates that their gear cache will grow to about 300 ropeless units and sufficient onboard technology to support up to 30 vessels testing 10 trawls and adjacent mobile gear fishermen by 2025.

Some Team members representing environmental organizations considered seasonal closures in areas of high whale occurrence, such as Cape Cod Bay, to be more protective than ropeless fishing, and necessary to provide sufficient protection to right whales. NMFS believes experimentation by fishermen during commercial fishery operations is essential to any future operational success of ropeless fishing technology. Complete fishing closures may provide marginally more conservation benefit in the near-term by reducing vessel traffic and removing

ground line and bottom-stored buoy line from closed areas. However, remotely retrieved buoy lines would only be present in the water column upon command. As described below, amendments to other fishery regulations with surface gear requirements would be required to allow large scale ropeless fishing.

Because ropeless fishing requires an exemption through authorizations or permits, ropeless in seasonal restricted areas can and would be conditioned to minimize impacts on right whales and to include monitoring and reporting requirements. We anticipate that applicants to fish in restricted areas (other than the Outer Cape LMA) will be required to:

- Assess up-to-date right whale survey data and constrain fishing to areas that avoid the most densely populated areas within the restricted areas (i.e. Cape Cod Bay within the MRA) at any given time.
- Use only acoustic releases, which provide participants with the ability to maintain control over the amount of time any buoy line remains in the water column as a potential entanglement risk. Using these systems, fishermen must be within a close distance of the gear in order for the signal to be received and the line released, which minimizes the time the line spends in the water column unsupervised. If the gear is released as intended, the risk posed by the released buoy line is minimal. Failures in tested acoustic release systems reported to date have been caused by failed release, not early release (NMFS gear team, pers comm, 2021). Relative to other release mechanisms (i.e. galvanized time release), acoustic release provides a minimal timeframe where the released buoy line will be left unattended.
- Use technology that has been tested elsewhere.
- Have previous experience using these new technologies.

Finally, reporting and monitoring conservation measures would ensure these experimental fishing efforts successfully contribute to the commercial development of this gear. To the extent that gear testing in these areas helps advance cost effective and operational solutions for ropeless fishing, long-term entanglement risk may be reduced more quickly by fishermen's development and use of these technologies under commercial fishing conditions, providing long-term positive impacts on these populations.

Based on outreach by the NMFS gear team, interest does not appear to be substantial among the commercial fishery in the Northeast Region, and participation within any restricted area can be limited through the authorization process. We anticipate that at least through 2025, ropeless fishing in these restricted areas is likely to be done primarily by collaborators borrowing gear from the NMFS gear cache, with up to an additional 10 percent of effort by other researchers and fishermen coast wide. The NEFSC gear team projects that by 2025 they expect to have about 300 ropeless units and enough deck controllers for about 30 vessels, as well as technology to support adjacent mobile fishing vessels. That is, at the most, coast wide, there would be up to 33 vessels fishing 10 ropeless trawls. If congressionally appropriated and private funding remains available, NMFS will continue to reimburse fishermen for some of their time and will provide the onboard and in-water technology so that costs to fishermen will be minimal. To incentivize participation, the alternatives consider modifying current seasonal restricted areas and defining new restricted areas as seasonal closures to trap/pot fishing that use persistent buoy lines.

3.3.3.1 Seasonal Restricted Areas Open to “Ropeless” Fishing

Seasonal closures of predictable right whale aggregation areas have been in place to reduce right whale exposures to buoy lines since the earliest Plan measures, when Cape Cod Bay and the Great South Channel were seasonally closed to trap/pot fisheries (62 FR 39157, July 22, 1997). Modified in 2015, there are currently two large seasonal trap/pot fishery closure areas, the MRA (50 CFR 229.32(c)(3)) and the Great South Channel Trap/Pot Restricted Area (50 CFR 229.32(c)(4)). The MRA prohibits fishing with, setting, or possessing trap/pot gear in this area unless stowed in accordance with § 229.2 from February 1 to April 30. The Great South Channel Restricted Area prohibits fishing with, setting, or possessing trap/pot gear in this area unless stowed in accordance with § 229.2 from April 1 through June 30. The change would not include the Outer Cape Cod (OCC) Lobster Management Area (LMA), which would remain closed to the lobster and Jonah crab trap-pot fishery under Massachusetts and Federal regulations (32 Mass. Reg 6.02 paragraph(7)(a) and 50 CFR 697.7(c)(1)(xxx)) implementing the Atlantic State Marine Fisheries Commissions’ Interstate Fishery Management Plan for American Lobster.

Under both Alternatives 2 and 3, additional seasonal restricted areas are identified; however, rather than prohibiting commercial fishing, the alternatives would modify existing closed areas and require the new seasonal restricted areas to be open to ropeless fishing, and closed to the use of persistent buoy lines. Under this modification, commercial fishing would be allowed using pots or trawls that can be retrieved remotely, releasing a buoy line or the first trap on a line of trawls, using what has become known as ropeless fishing technology in existing ALWTRP closed areas. However, this will not lift the closure in the Outer Cape LMA, which would remain closed to all lobster fishing consistent with the Atlantic Lobster FMP. Exemptions to fishery management regulations that require the use of buoy lines would be needed (see Section 3.3.3.2). Fishing would continue as normal once the seasonal time frame of the restricted areas has passed. However, ropeless fishing may continue if the EFP or state authorization allows.

In the DEIS and proposed rule, reviewers that believe these additional restricted areas are not warranted to achieve PBR were asked to provide specific information or analyses in support of recommended removal of restricted areas from the Preferred Alternative. Comments were received suggesting that the LMA One Restricted Area was overvalued due to dated whale data that did not document the reduced use of the Gulf of Maine by right whales in recent years. As indicated, the initial hotspot analyses for the Gulf of Maine were conducted with a version (version two) of the right whale density model that spanned from 1998 through 2018. The model has since been updated (version 11) and allows comparison of whale distribution before and after 2010. As commenters indicated, the Gulf of Maine, including this area, is slightly less important for right whales. However, the more recent data confirms that this area remains a relative hotspot for right whales during late fall and early winter months (Roberts et al. 2020). Additionally, acoustic surveys have detected right whales in this area in recent years.

Without the seasonal restricted area, the risk reduction measures in Maine LMA One waters were not enough to achieve 60 percent reduction in risk in this area. Commenters suggested that rather than a default buoy line closure of the area, closure should be triggered by documented interactions in Maine LMA 1 waters. However right whale entanglements can rarely be

identified to the incident location and 60 percent of right whale mortalities are unobserved, negating the practicality of a detection-dependent trigger. For that reason, Alternative 2 and 3 analyze an LMA 1 Seasonal Restricted Areas across two seasonal configurations and with an allowance for harvest without the use of a persistent buoy line with the proper authorization.

3.3.3.2 Requirements for Exemption from Surface System Regulations

Regulations implemented under the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA), at 50 CFR Part 697.21 requires buoys (with identification marking) and for larger trawls, radar reflections on each end of trawls of lobster pots. Similar regulations for bottom tending fixed gear have been implemented under the MSA at 50 CFR 648.84. These surface systems allow all mariners to know that there is gear on the ocean bottom between the buoys.

If ropeless fishing develops further and methods are developed that support surface detection of bottom gear and that resolve gear conflicts and enforcement challenges, modifications to surface system regulations could be made to negate the need for exemptions. The development of operational solutions are the purpose of ongoing collaborative ropeless technology efforts discussed above. Until those regulations are revised, ropeless fishing will require authorization or exempted fishing permission from states or NMFS. Applicants will likely be required to provide details on their operations, including objectives, reporting and monitoring plans, approach to minimize gear conflict, and a description of possible environmental impacts including anticipated impacts on marine mammals or endangered species. NMFS will particularly solicit Team and public input on conditions for authorizations and exemptions in areas with seasonal buoy line closures to protect right whales.

As required for other exempted fishing permits, conditions including those listed in Section 3.3.3 will be required to ensure safe and successful testing of the technology and reduce potential risk posed by ropeless fishing (Table 3.9). Applicants can adopt conservation measures (Table 3.9) for their EFP applications for buoy-lineless fishing in the restricted areas and the environmental analysis conducted here can be relied upon to support their EFP application process and environmental impact assessments. However, these conservation measures are not regulatory and applicants may choose to provide separate conservation measures with an EFP application. EFP applicants with alternative conservation measures will need to provide additional analyses to demonstrate their alternative conservation measures meet the EFP conservation measure objectives of minimizing environmental risks and ensuring successful research and development. Conservation measures will meet the risk reduction conservation objectives: maintain the ALWTRP standards, minimize risk to large whales and other protected species, as well as provide means to minimize the chances of gear malfunction, reduce impacts on other fisheries, and provide monitoring and reporting components. Applicants will also be required to adhere to the current closure to lobster fishing in federal Outer Cape LMA waters from February 1 through March 31.

Given that the current restricted areas represent areas of importance to large whales, ropeless gear should be tested in a manner that minimizes the likelihood that operations will contribute to entanglement or other risks to whales in these areas. As seen in Table 3.9, these include measures that ensure that existing ALWTRP and right-whale approach protections are known and followed, areas of high right-whale densities are avoided, and applicants are prompted to

become actively involved in sighting and reporting of right whales. A number of measures also aim to reduce the likelihood of unattended buoy lines in the water by ensuring gear is pre-tested for potential technical malfunctions, operators are experienced using the gear, and that release of buoy lines is only activated by fishermen ready to immediately retrieve the gear. Given that mobile fisheries are not regulated under the Plan and are still active in the area, gear conflicts are important for EFP holders to address. To minimize gear conflict in these areas, measures also include documenting coordination with other EFP holders and mobile fishing fleets. Though coordination efforts may vary from one EFP to another depending on the discrete areas being fished and the likelihood of gear conflicts in the area, documenting these efforts for federal and state review during the application and authorization process will help identify if further coordination is needed. Lastly, several measures focus on monitoring and reporting specifications that will ensure these experimental fishing efforts successfully contribute to the development of this gear.

Table 3.9: Description of required EFP conservation measure objectives and conservation measures considered to meet objective

EFP conservation measures objective	Conservation measures to help meet objective
Minimize activity's impact on large whales	Adhere to the ALWTRP standards and restrictions, including but not limited to, gear marking, sinking groundline between traps, breaking strength restrictions, and trawl lengths requirements. Maintain a 500 yard buffer if right whales are sighted, unless in the act of setting, retrieving, or closely tending gear to maintain compliance with 50 CFR 224.104(c). Avoid discrete areas of highest right whale abundance within the restricted areas (i.e. Cape Cod Bay within the MRA) by assessing real time right whale sightings data prior to trip. Maintain vessel speeds not exceeding 10 knots. Avoid vessel operation between dusk and dawn. Report right whale sightings to ne.rw.survey@noaa.gov or to NOAA (866-755-6622) or U.S. Coast Guard and incidental take of non-endangered/threatened marine mammals through the Marine Mammal Authorization Program. Crew must have prior experience setting and hauling gear being tested.
Minimize chances of gear malfunction or early release of stored buoy line	
Reduce impacts on other fisheries Monitoring and Reporting	Demonstrate that gear being tested has been successfully tested elsewhere, under comparable environmental conditions, by multiple fishermen over several days so basic safety and operational feasibility is understood, and malfunction (i.e. early release) rates are low. Acoustic or remote release devices are used to ensure that the applicant is in the area when buoy lines are released. Coordination measures are documented to minimize gear conflicts with other EFP holders and mobile fishing fleets. Include unique buoy line identifiers, such as unique colored markings.
	Include details in application for how efforts will be monitored for compliance with

EFP conservation measures objective	Conservation measures to help meet objective
	application, EFP objectives, and other applicable regulations. Data collection objectives (i.e., data collection sheet) provided with application as required by the EFP process. Data collection example is provided in Appendix 3. Trip start and trip end hail requirements using vessel monitoring systems or Fish OnLine for federal permit holders. Submit final report no more than 6 months after project completion including information on sets/effort to support future efficacy of ropeless trap/pot gear.

Because EFP applications will vary in scale and location, several of the conservation measures noted above broadly call for EFP applicants to detail the methodology that they are planning on using to avoid environmental risks, rather than prescribing specific ways in which these risks may be avoided. For example, to avoid gear conflict, fishermen have noted that ropeless fishing may be ideal in areas where bottom habitat is not suitable for mobile gear. In these circumstances local coordination to provide notification to the mobile fleet about the areas that will be fished may be sufficient to avoid conflicts. Alternatively, in other circumstances coordination may include notifying a larger number of vessels of work being done in the area, or working directly with vessels in the mobile fleet to identify test location methods or devices that would help the mobile fleet avoid conflicts with ropeless gear that has been set. With documentation of the coordination methodology provided directly with the application, any necessary increased coordination can be identified in collaboration between the applicant by federal and state reviewers.

3.3.4 *Weak Links, Weak Inserts, and Weak Rope*

3.3.4.1 **Weak Links**

Weak links attaching the buoy to the rope have been required for trap/pot fisheries in some areas since the first Take Reduction Plan regulations were implemented, modified over time to include more areas and to lower breaking strength (for a summary, see Borggaard et al. 2017). Weak links were one of the earliest gear modifications under the take reduction plan, believed to allow the buoy to break away and the rope to pull through the baleen if an entanglement occurs near the surface. It is difficult to assess how well the weak link connecting the buoy to the rope line reduces mortality and serious injury, and comments on the DEIS and proposed rule were solicited to inform final rulemaking.

Alternative 2 (Preferred) in this FEIS and the final rule would remove the requirement for a weak link at the buoy. This alternative was considered in Alternative 3 of the DEIS. Under the final rule, all ropes in the Northeast Trap/Pot Management Area will be weak or have weak insertions below the surface system. Knowlton et al. (2021) models whale interactions with weak ropes and weak insertions, and the model suggests that rope parts below where a whale’s movement applies force on the rope. This model suggests the weak insertion at the buoy would not necessarily part the buoy from the rope quickly, and may not have much effect on entanglement severity. Some commenters indicated a preference for retaining the buoy on the rope so that in the event of an entanglement some additional information about the location of the incident could be obtained from the buoy. Additionally at Team meetings some Team members suggested that drag caused by the buoy could pull rope away from the whale and facilitate the shedding of

gear, and suggested that the buoy could provide a disentanglement team with improved access to entangling rope. While retention of the buoy may be beneficial for some large whales, given right whale behavior in surface aggregations, buoys may be rubbed off of gear whether or not a weak link is present. Given the lack of confidence that a weak link in a surface system is effectively reducing risk to right whales and the potential benefit of buoy retention for some entangled large whales, the final rule will remove this requirement. Fishermen however would not be prohibited from retaining a weak link in the surface system.

Alternative 3 would remove the weak link requirement for lobster/crab trap buoy lines that would be required to use weak rope or weak insertions where weak rope or insertions are required further down on the buoy line. A lower weak rope or insertion would presumably allow a whale to break free of entangling gear below the surface system. Fishermen in these areas could still use a weak link at the buoy but it would not be required.

3.3.4.2 Weak Inserts and Weak Rope

The Team's consideration of weak line was largely based on Knowlton et al. (2016) findings that no ropes retrieved from entangled right whales of all ages had breaking strengths that were below 7.56 kN (1,700 pounds/771 kilograms) and suggests they can break free from these weaker ropes and thereby avoid a life threatening entanglement. This is consistent with estimates of the force that large whales are capable of applying, based on axial locomotor muscle morphology study conducted by Arthur et al. (2015). The authors suggested that the maximum force output for an adult right whale is likely sufficient to break line at that breaking strength. That study and others recognized that a whale's ability to break free from an entanglement is also somewhat dependent on the complexity of the gear configuration (van der Hoop et al. 2017).

The Team recommended risk reduction measures that included comprehensive weak rope (engineered rope that breaks at 1,700 pounds/771 kilograms or less) or weak insertions (e.g. sleeves, generally discussed by the Team as insertions every 40 feet (12.2 meters) along the buoy lines, although that was not explicit in the recommendations). A full buoy line of 1,700 pounds (771 kilograms) breaking strength would theoretically allow a whale to break free no matter where the whale encounters the line, though it is less clear where the rope would break than with a weak insertion. Insertion of weak sleeves or other weak configurations predictably break at the weakest point where they are attached to the line and may offer risk reduction depending on how they are configured (MEDMR 2020). Weak rope modeling suggest that there are several factors that contribute to likelihood a weak insert will break when a whale interacts with the line and the time it will take to break, including the number of traps on a trawl and the location of the weak point in relation to where the whale interacts with the rope (DeCew et al. 2017). Data from these simulations found that tensions caused by a whale moving the buoy line are greatest at, and part at, the weak insertions below where the whale encounters the line (DeCew et al. 2017, Knowlton et al. 2020). The greater the number of weak points on a line, the greater the likelihood that a weak point will be located outside of the mouth where the whale has a better chance of breaking free from the entanglement. The lower the lowest weak insert the greater the chance that there will be a weak insert below a whale that encounters the rope. Trawl configurations with over five traps are more likely to break with an insert and in a shorter amount of time than without an insert, assuming there is an insert between the whale and the traps and enough force is present to

allow a whale to break free of the traps. It is less clear how a weak point would break if in the middle of a complex entanglement. Given the data available, inserts at regular intervals is optimal to reduce the amount or likelihood of trailing line and gear involved in an entanglement. NMFS evaluated insertions placed close enough together to minimize wrapping of a whale in full strength rope without a weak point present (estimated to be approximately 40 feet (12.2 meters), determined by the average adult right whale length), as equivalent to an engineered weak rope.

Configurations that are knot-free may also pose less risk, though an expert elicitation is currently being conducted to determine the safety of using knots as weak inserts. Currently, the Plan recommends the use of gear that is knot-free, and/or free of attachments, until the expert elicitation is complete due previous ALWTRT recommendations that considered that smooth line may be more likely to slide through the whale's baleen without becoming lodged in the mouth or elsewhere, decreasing the risk of serious injury or mortality. Insertions that have large knots could potentially get caught in baleen if an entanglement occurs. Note that, while lacking the 'slide-through' benefits of smooth line, there is evidence that splices and knots introduce weaknesses into buoy lines. Lines undergoing breaking strength testing broke on the weaker side of a knot or splice (MEDMR 2020).

Knowlton et al. (2016) reviewed forces needed to retrieve gear and suggested that this breaking strength should also be strong enough to allow successful retrieval of pots in commercial trap/pot fisheries, depending on the gear configuration, set location, and hauling behavior (for example, less force is needed to haul while traveling over the trawl than to drag the trawl to the boat). Preliminary studies of hauling forces encountered during commercial lobster fishing suggest that most hauls in waters within 50 fathoms do not approach or exceed 1,700 pounds (771 kilograms; Knowlton et al. 2018, Maine DMR 2020, Maine DMR Proposal to NMFS 2019, Appendix 3.3 see Figure 8). In deeper waters, additional force occurs on the lines once multiple pots have been pulled up off the bottom and are in the water column. Uncontrollable conditions can also cause additional force on the line, including gear conflict (such as a trawl overlaid on the fished trawl); high seas, tides or currents; and trawls set in deeper water with more pots per trawl resulting in multiple pots hanging from the buoy line during the haul. As measured during commercial operations, while forces greater than 1,700 pounds (771 kilograms) breaking strength were required to retrieve gear, particularly for gear of 35 traps and more in waters greater than 50 fathoms (91.4 m; MEDMR 2020), timed haul data indicated those higher forces were not detected on the line until well past halfway through hauling the buoy line (for example, Figure 7 in ME proposal, Appendix 3.3). This suggests that under most operational conditions, weak rope or a weak insertion within the top half of a buoy line would not be subjected to forces approaching or greater than 1,700 pounds (771 kilograms) during haul. It is important to avoid putting a weak point in areas where forces may exceed the breaking strength of the rope to minimize safety risks to fishermen and occurrence of gear loss. The proposed regulation would only require weak insertions or full weak rope for buoy lines, not sinking groundlines, to a depth where it is operationally safe.

NMFS and fishing industry organizations are working with fishing rope manufacturers and distributors to identify or develop commercially available line of appropriate diameters that break at 1,700 pounds (771 kilograms) or less. Other options that would allow fishermen to use their existing gear include using weak insertions (e.g. the South Shore Sleeve, a braided sleeve

fed over a parted line, or other configurations employing spliced-in weaker line) that reduces the breaking strength of the line in several locations along the length of the rope. NMFS considers a weak rope or weak insertion to be a line or gear configuration that consistently breaks within 10 percent of 1,700 pounds (771 kilograms) with at least 10 trials. Weak insert configurations should be easily replicated, detectable, and enforceable. A few options have already been approved for use in Massachusetts State waters under regulations effective May 1, 2021 (322 CMR 12.00). The approved configurations include weak sleeves and engineered red and red and white weak line spliced into buoy lines (see Appendix 3.6 for detailed descriptions). NMFS is continuing to work with fishermen to explore new options for weak line and weak inserts as they are tested and will make these publicly available once they are tested and approved.

3.3.5 Considering Existing Risk Reduction Credits

Overall the goal of this FEIS is to evaluate new regulations to reduce entanglement risk to right whales by at least 60 percent in the northeast lobster and Jonah crab trap/pot fisheries. However, the take reduction team agreed at the April 2019 meeting that there are a few areas where existing regulations or ongoing effort reduction since 2017 should contribute toward the overall risk reduction analyzed here. Note that the economic analysis within this FEIS considers only the economic impacts of measures that would be implemented by NMFS to modify the Take Reduction Plan by federal rulemaking.

3.3.5.1 Massachusetts Restricted Area Credit

Given the large scale of the current MRA and increasing importance of the area for right whales, the take reduction team agreed that Massachusetts fishermen should get equivalent credit for maintaining the MRA closure from February through April. This closure was implemented effective June 2015 through modifications to the Atlantic Large Whale Take Reduction Plan, impacting a portion of LMA 1 and the Outer Cape LMA. As summarized in the Massachusetts DMF proposal (MADMF 2020, Appendix 3.3), up to 65 percent of the known right whale population forages each spring in the Mass Bay Restricted Area, especially within Cape Cod Bay. In a single day in April 2017, 179 individual right whales were documented. A number of studies document the increase in importance of Cape Cod Bay in recent years, with the largest proportion of right whales observed in the Bay than anywhere else in right whales' range (Mayo et al. 2018, Ganley et al. 2019). Massachusetts DMF estimates up to 10 right whales per square mile of water have been in Cape Cod Bay in a peak foraging season. The Take Reduction Team recognized the high and increasing value of this recently expanded area, and its disproportionate impact on Massachusetts fishermen when they recommended inclusion of the closure area risk reduction towards the 60 percent risk reduction target.

3.3.5.2 2021 Massachusetts State Measures

Massachusetts DMF implemented new regulations in state waters to reduce entanglement risk to right whales (Division of Marine Fisheries 322 CMR 12.00, see <https://www.mass.gov/doc/322-cmr-12-protected-species/download>). They implemented an extension of the state waters portion of the MRA in LMA 1 north to the Massachusetts-New Hampshire border from February through May 15 (MRA North). State waters will restrict trap/pot fishing during this time period.

After May 1, they will implement a dynamic opening in all state waters within the new state waters MRA bounds between May 1st and May 15th where the area will remain closed until no more than three whales remain in the area. Additionally, lobster end lines in state waters will require weak rope or weak inserts year round, in the form of full weak rope or inserts every 60 feet (18.3 meters) in the top 75 percent of the line. This FEIS includes the risk reduction from both of these measures in Alternative 2 (Preferred) given their large contributions to right whale risk reduction. However, federal procedural requirements make the implementation of a soft opening a challenge and therefore the final rule will only be mirroring the extension of the closure in state waters, and will not extend the closure period in federal waters into May. Alternative 3 considered risk reduction from the state water extension of the MRA, but does not include weak line measures implemented by state regulations because the weak line measures in the Non-preferred Alternative offer more risk reduction than those in the Preferred Alternative.

3.3.5.3 Ongoing Effort Reduction

As described below, lobster fishery management efforts in LMA 2 and 3 have or will soon reduce the estimated buoy lines fished relative to 2017 buoy line estimates due to ongoing trap reductions. As recommended by the Take Reduction Team, because this line reduction has reduced entanglement risk to right whales relative to the 2017 baseline year, or will reduce the number of lines within the timeline of the rulemaking associated with the Plan modifications, estimated reductions are applied toward the 60 percent risk reduction targets. As detailed below, LMA 2 has observed annual effort reduction that is expected to continue through 2021. Since 2017, the baseline year, Massachusetts and Rhode Island demonstrate that the 18 percent line reduction for vessels fishing in LMA 2 identified within the Team recommendations will be achieved. LMA 3 is anticipated to achieve a 12 percent line reduction in the Northeast Region as a result of previous trap consolidation and ongoing trap aggregation efforts being developed in Addendum XXII to the Amendment 3 of the American Lobster Fishery Management Plan.

3.3.5.4 Planned Weak Insertion Risk Reduction in Maine Exempt Waters

Maine is planning to implement precautionary measures in exempt waters to aid in efforts to reduce the severity of potential entanglements. All lines in exempt waters within the state of Maine will be required to have one weak insert placed halfway down the buoy line. Given the depth of the water column in this area, the risk reduction this offers is close to but slightly under the equivalent of weak rope (an insert every 40 feet/12.2 m) when accounting for the scope ratio of the buoy line (estimated at 1.5 times depth in this areas, further analysis is presented in Chapter 5). As right whales are rare in this area, this offers a reasonably precautionary measure to reduce entanglement severity in the chance that a whale gets entangled in this area and therefore was counted towards risk reduction in the Preferred Alternative.

3.3.5.5 Estimated Line Reduction in Response to a Line Cap

To estimate the likely reduction in line numbers with a buoy line cap, NMFS used the 2017 baseline buoy line data to test how different approaches might shift buoy line numbers and selected likely scenarios. Table 3.10 describes how monthly line numbers might change as a result of a 50 percent line cap based on the average number of buoy lines currently being used

across the Northeast Region. A cap in federal waters to 50 percent of the average lines fished would likely result in a buoy line reduction closer to 45 percent given the current level of fluctuation in buoy lines used throughout a fishing year. This estimate is the result of regional variation and our anticipation of a complex response by fishermen to a line cap. Implementing a line cap without accounting for variation across all fisheries achieves a near 50 percent reduction in line in federal waters. However, given variation between regions and months, if this was implemented on a regional level (a likely scenario) the actual average monthly line reduction is closer to 45 percent due to areas with higher variation in monthly line numbers. For LMA 2 in particular, where some months had lower line numbers than half of the monthly average, we considered three scenarios (see below) to capture a range in responses that could not be assessed through the co-occurrence model. Depending on how vessels respond to this line cap, during months where 2017 line numbers fall below the line cap, vessels could either:

1. Low effort: Continue fishing at 2017 levels during months where line numbers typically fall below the line cap and only fish at their full halved line allocation level during months they previously fished at high effort.
2. Medium effort: Fish their entire line allocation each month even if they did not previously fish or fished fewer lines in some months. This could make up lost wages in other months.
3. High effort: Fish an average number of lines between the line cap and their 2017 line number in months where 2017 effort fell below the line cap, and fish their full allotment of lines.

Since line caps result in a very large reduction of lines during high effort months, we anticipate the most likely scenario falls somewhere between scenarios two and three, with an increase in use of buoy lines during months that previously had lower fishing effort. The most conservative scenario was analyzed using the DST by using the average percent line reduction for each LMA, with different estimates for Maine and Massachusetts in LMA 1. The average of responses two and three above were used to estimate percent line reduction for LMA 2. Using these estimates, federal waters still achieved well over the 60 percent risk reduction target.

Table 3.10: A breakdown of the monthly line numbers fished by region in 2017 and the number of lines would be allowed under a line cap in each area. Low, Mid, and High represent the scenarios described above where, if monthly line numbers fall below the cap, they either remain as is (low), in between the cap and 2017 line numbers (mid), or at the line cap (high). MA = Massachusetts, ME = Maine, OC = Outer Cape.

Month	LMA 2				OC				LMA 2/3		LMA 3		MA LMA1		ME LMA1		Federal Waters	
	2017 Lines	Low	Med	High	2017 Lines	Low	Med	High	2017 Lines	%	2017 Lines	%	2017 Lines	%	2017 Lines	%	2017 Lines	%
Jan	1,061	9%	9%	9%	156	0%	-10%	-19%	201	51%	3,036	44%	3,261	59%	47,728	52%	55,287	51%
Feb	701	0%	-19%	-37%	71	0%	-81%	-162%	251	61%	3,102	45%	1,834	27%	31,811	28%	37,699	28%
March	733	0%	-16%	-31%	43	0%	-167%	-333%	116	16%	2,791	39%	1,628	18%	34,704	34%	39,972	32%
April	1,416	32%	32%	32%	0	0%			99	2%	2,358	27%	1,869	28%	42,232	46%	47,974	44%
May	2,146	55%	55%	55%	167	0%	-6%	-12%	135	28%	3,029	43%	2,269	41%	41,213	44%	48,792	45%
June	2,684	64%	64%	64%	282	34%	34%	34%	170	43%	4,153	59%	2,026	34%	44,820	49%	53,853	50%
July	2,915	67%	67%	67%	339	45%	45%	45%	167	42%	3,913	56%	1,797	25%	44,742	49%	53,534	50%
Aug	3,165	70%	70%	70%	430	57%	57%	57%	179	46%	3,852	56%	2,331	42%	47,366	52%	56,893	53%
Sept	2,931	67%	67%	67%	521	64%	64%	64%	244	60%	3,807	55%	3,277	59%	54,484	58%	64,743	58%
Oct	2,266	58%	58%	58%	526	65%	65%	65%	317	69%	4,078	58%	3,644	63%	56,454	59%	66,759	60%
Nov	1,596	40%	40%	40%	578	68%	68%	68%	228	57%	3,307	48%	4,206	68%	57,176	60%	66,513	59%
Dec	1,452	34%	34%	34%	355	48%	48%	48%	233	58%	3,692	54%	4,035	67%	47,529	52%	56,941	53%
Average	1,922	41%	38%	36%	372	32%	40%	39%	195	44%	3,427	49%	2,681	44%	45,855	49%	54,080	48%
Line Cap	961				186				98		1,713		1341		22,927		27,040	

3.3.6 *Selecting Gear Marking and Other Information Gathering Elements*

3.3.6.1 **Gear Marking**

The Atlantic Large Whale Take Reduction Team supported efforts to expand gear marking to further improve efforts to determine entanglement location. Morin et al. (2018) summarized gear characteristics from 2013 to 2017 right whale entanglement incidents. During those five years NMFS evaluated 62 documented right whale entanglements. No gear was present in 32 of those incidents. Only 17 cases in which gear was present included sufficient information to identify country of origin, including 12 that had the easy-to-identify Canadian snow crab gear, one incident involving marked gear indicative of U.S. lobster gear (without information to further identify state or specific area within the U.S.), one incident with gear from a Canadian weir, one unknown Canadian case, and two cases of unknown U.S. gear. As this summary demonstrates, gear is not present on more than half of all right whale entanglement injuries investigated. Although disentangling efforts attempt to retrieve gear when present, their primary focus is on saving the animal and therefore gear is not always retrieved (for more on disentangling efforts, see NMFS, 2020). When gear is retrieved, it cannot always be identified to fishery or location. The Team discussed measures to increase visibility of marks from vessels and airplanes as well as requiring marks in all waters including those currently exempt. The gear marking schemes in Alternatives 2 (Preferred) and 3 (Non-preferred) would include the entire Northeast Region from coast through the EEZ, including waters currently exempted from gear marking requirements, and would add state-specific color markings or identification tape to lobster and Jonah crab trap/pot fisheries in the Northeast Region.

Effective September 1, 2020, Maine requires fishermen landing fish in Maine to include state-specific buoy line marking (MEDMR Regulations 13 188 Chapter 75, as amended by a modification proposed February 19, 2020) consistent with the measures proposed in Alternative 2. Under their revised measures, Maine requires purple markings on lobster pot/trap buoy lines fished by all state permitted fishermen from the coast to the LMA 1/LMA 3 boundary. Buoy lines in Maine exempted water are also required to have one 3 foot (91.4 centimeter) mark within two fathoms of the buoy. For buoy lines less than 100 feet (30.5 meter) in length one additional mark 1 foot long would be required about half way down the line. Longer buoy lines in the exemption area are required to have the 3 foot mark and two additional 1 foot marks, one midway along the buoy line and one at the bottom of the buoy line. In the sliver area (between the Maine Exemption Line and the 3 nautical mile line) and offshore throughout LMA 1, Maine permitted fishermen are required to mark buoy lines with a 3 foot mark within the top two fathoms and three additional 1 foot marks at the top third, middle and bottom third. And as discussed in Section 3.1.6.1, if weak links at the buoy are no longer required on buoy lines that are weak or have weak inserts, buoys with their identifying marks may be retained on an entangled whale more often, providing information that can help NMFS determine the original location of entanglements.

3.3.6.2 **Non-regulatory Components**

Monitoring requirements are a non-regulatory but important part of the Atlantic Large Whale Take Reduction Plan. Three non-regulatory monitoring components are proposed to align with recommendations from the Team in April 2019:

1. **Enforcement and associated compliance monitoring:** compliance support and monitoring is achieved through outreach and enforcement efforts that inform fishermen of the regulatory requirements to support their ability to comply, as well as through active inspection of gear and associated enforcement actions. In state waters, NMFS supports enforcement related to marine mammal protection through funding for joint enforcement agreements in Maine, New Hampshire, Massachusetts and Rhode Island. NMFS, in coordination with the U.S. Coast Guard and state enforcement personnel, has developed an offshore enforcement plan that combines traditional enforcement practices with the use of new technologies such as drones and electronic monitoring to support enforcement throughout the EEZ (See appendix 3.5).
2. **North Atlantic right whale population monitoring:** In 2019, NMFS convened an Expert Working Group to develop recommendations to (1) improve right whale population status by identifying and tracking essential population metrics and (2) improve our understanding of distribution and habitat use. Recommendations from the Working Group (Oleson et al. 2020) will be used to modify surveys on a three-year monitoring cycle that includes a report to the Team every three years to evaluate and reconsider restricted management areas. Along with annual presentations on right whale monitoring, the monitoring cycle report results will be considered by the Team to recommend changes, openings, or further area management. The data included in monitoring plans will include whale abundance and distribution as well as other environmental characteristics that impact whale habitat use and population health, including copepod abundance and oceanographic parameters.
3. **Fishery monitoring and reporting:** Lobster trap/pot gear makes up the vast majority of buoy lines fished in the Northeast Region. The ASMFC adopted Addendum XXVI in February 2018 to improve harvester reporting and biological data collection in both state and federal waters to improve the spatial resolution of harvesting data, improve and expand fishery effort data, and obtain better data on the offshore fishery and lobster stock through biological sampling. NMFS is working on a proposed rule at this time that would require 100 percent harvester reporting by federal permit holders as early as 2022. Maine, currently the only New England State that does not require 100 percent harvester reporting, has committed to 100 percent reporting by no later than 2023 and is actively seeking funding to support harvester reporting efforts. Additionally, ASMFC has piloted a vessel tracking study with the intention of requiring vessel tracking in federal waters. NMFS intends to work with the ASMFC, through their open and public process, to develop additional high resolution spatial data collection objectives and requirements, while balancing the financial burden to industry. Fishery data will be used to monitor effort and distribution of the lobster and Jonah crab fisheries and inform Team discussions.

3.4 Alternatives Considered but Rejected

In the scoping efforts conducted for this rulemaking, stakeholders recommended a variety of approaches for reducing entanglement risk to large whales. Scoping discussions included the meeting of the full Take Reduction Team as well as a series of public meetings held at key locations on the northeast Atlantic coast.

While NMFS solicited and considered all input from stakeholders, a number of approaches were rejected in the formulation of alternatives. Table 3.11 summarizes these approaches and briefly explains why NMFS chose not to integrate the approach into the regulatory alternatives under consideration. Additional information on some of these may be found in the responses to comments in Appendix 1.1. The rejected approaches are organized by topic. Stakeholders identified many approaches that would apply to more than one fishery or region; hence, many of the concepts are repeated in the table. The alternatives described are not mutually exclusive; i.e., some were recommended in combination, despite the fact that they are listed and addressed separately in the table. The rejected alternatives are wide-ranging in content. Concepts that recur frequently in the alternatives include the following:

Table 3.11: A list of the primary alternative components that were considered but rejected, with the reason for the rejection.

<i>Topic</i>	<i>Alternative Considered but Rejected</i>	<i>Rationale for Rejection</i>
Line Reduction	LMA 3: In Georges Basin, trawl up to 70 traps per trawl, year round or seasonally	Less preferable to broader scale measures, insufficient risk-reduction
	LMA 1 Maine: Trap reductions	Given varied state landings reporting requirements and rates, measures that require documented vessel landings histories are difficult to design, assess and implement outside of a fishery management Commission/Council process
	LMA 1 Mass and NH : 30 percent line reduction	Less than the 50% line reduction analyzed within Alternative 3
	Only use one buoy line in LMA 3 year round	Unpopular with stakeholders, potential gear conflicts and safety concerns
	Outside 12 nm 1/2 of buoy lines ropeless	Unpopular with stakeholders, potential increased gear conflict and safety concerns
	Reduce all traps 50 percent	Direct line reduction preferred, considered in Alternative 3
	3-4 year phase-in of 400 traps/fisherman trap limit with commensurate reduced end lines	Given varied state landings reporting requirements and rates, measures that require documented vessel landings histories are difficult to design, assess and implement outside of a fishery management Commission/Council process
	Reduce trap tag limits by 50 percent commensurate with buoy line reduction.	Given varied state landings reporting requirements and rates, measures that require documented vessel landings histories are difficult to design, assess and implement outside of a fishery management Commission/Council process
	Reduced trap limits if fishing in modified Mass Restricted Area	Would add risk
	Do not change gear configurations in state waters	Insufficient risk reduction

<i>Topic</i>	<i>Alternative Considered but Rejected</i>	<i>Rationale for Rejection</i>
Closures	Trap or line cap to include all fisheries including EFPs, gillnet, trap/pot, aquaculture, includes seines	Given varied state landings reporting requirements and rates, measures that require documented vessel landings histories are difficult to design, assess and implement outside of a fishery management Commission/Council process
	Requiring 15-25 traps per trawl in LMA 2, based on distance from shore	A conservation equivalency requested due to vessel capacity, economic, and safety concerns expanded weak inserts instead, and provided more risk reduction
	3 traps/trawl throughout Maine State waters outside the exempted area	Allowing an exemption in zones C, D, and E based on zone specific scoping and conservation equivalencies
	8 traps/trawl between 3-6 nautical miles in Maine LMA 1	Accepted a conservation equivalency that redistributed trawl length based on zone specific scoping
	15 traps/trawl between 3-6 nautical miles in Maine LMA 1	Accepted a conservation equivalency that redistributed trawl length based on zone specific scoping
	Close statistical area 529	Too large, unpopular with stakeholders
	LMA 3 above 40.3 degrees Oct - Dec	Too large, unpopular with stakeholders
	LMA 1 Feb - May 15	Too large, unpopular with stakeholders
	Everywhere Jan - Apr	Too large, unpopular with stakeholders
	Extension of Massachusetts Restricted Area to May 15	Unpopular with stakeholders
	Extension of Massachusetts Restricted Area to the New Hampshire border	Unpopular with stakeholders
	Extension of Massachusetts Restricted Area to Cape Anne	Unpopular with stakeholders
	Cape Cod Bay Closure January	Unpopular with stakeholders, little additional risk reduction
	Close Area 537, Nov 1 – May 14	Too large and too long, unpopular with stakeholders
	Closure west GOM- April	Unpopular with stakeholders, little additional risk reduction
	South of Nantucket/Martha's Vineyard March - May	Not sufficient risk reduction
	Closure south of Nantucket bounded by 30-minute squares capturing 80 percent of sightings in the last three years Dec-May	Length of closure unpopular with stakeholders
	Emergency action to close area south of Martha's Vineyard and Nantucket until ruling	Not a part of this FEIS, potentially under a different authority
	Emergency action to close area in offshore Maine in summer and fall (LMA 1 and 3)	Unpopularity with stakeholders
	Create dynamic closures	Not currently feasible with regulatory process
	Buoy line trap/pot closures during the summer and fall in offshore waters east of Maine in LMA 1 and LMA 3	Data supported slightly different seasons for closures in each area
	NEAQ proposed area closure south of Nantucket for Feb-May 15	Unpopular with stakeholders and/or did not achieve sufficient risk reduction
	Modify opening and closures of Mass. Bay Restricted Area via MA Dynamic Seasonal Extension	Not feasible
	Massachusetts' proposed South Island Restricted Area	Updated data suggest that the restricted area will push effort into adjacent waters with equally high whale density.

<i>Topic</i>	<i>Alternative Considered but Rejected</i>	<i>Rationale for Rejection</i>
Ropeless Fishing	PEW Petition for three large closures in the Gulf of Maine and a year round closure south of Cape Cod.	In total, the risk reduction of the four areas proposed by PEW achieved a 9.3% risk reduction across the entire northeast. Some of these areas predicted large shifts in gear density in areas outside of the closure. Without more broad line reduction, these closures shift risk more than reducing it overall risk.
	CBD petition for emergency rulemaking in existing closures and the DEIS Massachusetts proposed SIRA	Emergency rulemaking does not exempt NMFS from the NEPA process. Initiating a new EIS for an emergency rulemaking suspend this rulemaking and restart the lengthy rulemaking clock. It would also dismiss the TRT process as well as the public input requirements of the APA. It would also be difficult to assess the effect of the rule given it is highly dependent on when it is implemented. For example, if NMFS implemented an emergency rule closing the Massachusetts South Island Restricted Area as requested starting in July, the first month would only reduce 0.3 percent to 1.9 percent of risk within a given month. Broader line reduction is needed to reduce overall risk.
	Buoyless everywhere >100m	Needs more testing
	Mass Area B- Buoyless fishing Feb-Apr	Eliminates closure and increases risk
	Mass Area C Buoyless in April	Eliminates closure and increases risk
	Limit new and transferred federal trap/pot permits to ropeless-only fishing (only 25 percent by grapple). All trap/pot ropeless by 1/1/20.	Needs more testing
	Experimental and operational support for a 5 year transition to ropeless fishing in waters greater than 300 feet in depth	Needs more testing
	Ropeless in all of LMA 3	Needs more testing
	Where weak rope is not feasible, 5-yr phase in of ropeless	Needs more testing
	Require ropeless for new fixed gear operations or fisheries, emerging gear such as aquaculture or experimental fisheries	Needs more testing
Weak Line	Within finite sections of closed area, allow/fund ropeless experimentation	May occur under alternatives that require EFP but opportunity for broader options
	Weak line at top 50 percent both buoy lines, everywhere	Safety concerns in deeper waters with more and heavier traps/trawl
	LMA 3 Northeast (outside of N of Georges Management Area), on remaining strong buoy line, weak insertion at 35 percent of scope	Safety concerns, unpopular with stakeholders, needs more testing
	Mass waters: sleeves	Unpopular with stakeholders
	ME 12+ 1,700 lb (771 kg) on 3/4 toppers	Unpopular with stakeholders
	1,700 lb rope in top 2/3	Unpopular with stakeholders
	LMA 3: Sleeves top 500m	Unpopular with stakeholders
	Outside of 100m Toppers	Unpopular with stakeholders
	Inside of 100m 1,700 lb (771 kg) rope	Unpopular with stakeholders

Topic	Alternative Considered but Rejected	Rationale for Rejection
Gear Marking	Inside 100 ft isobaths, 1,700 lb rope, outside use add-ons	Unpopular with stakeholders
	Sleeves everywhere	Unpopular with stakeholders
	1,700 lb (771 kg) tag line everywhere >100m	Unpopular with stakeholders
	Area 537 full weak rope or equivalent	Unpopular with stakeholders
	Sub Area 537- 1,700 lb (771 kg) or sleeves	Unpopular with stakeholders
	Reduce breaking strength in all ropes used in depths of less than 300 feet to 1,700 lb (771 kg) or sleeves every 40 feet	Unpopular with stakeholders
	Tiered buoy line strength: 1,700 lb (771 kg) breaking strength as standard where safely feasible. Where not safe, consider using taglines. If neither is an option, ropeless within 5 years	Unpopular with stakeholders
	Require 1,700 lb (771 kg) breaking strength line for all fixed gear fisheries in Area 537	Unpopular with stakeholders
	Try 1,900-2,000 lb (862 – 907 kg) breaking strength	Insufficient risk reduction
	Use predetermined bleach soak time to weaken rope	Difficult to standardize
	Test reduced breaking strength gear beyond 300 feet (91 meters)	Does not reduce risk
	Cap buoy line diameter in non-exempt ME state waters, and federal waters out to the Area 1 line varied by distance from shore, to reduce breaking strength and prevent its escalation	Unclear risk reduction
	Individual fishermen/permit numbers specific ID tape throughout buoy line	Unpopular with stakeholders
	Distinctively marked 1,700 lb (771 kg) breaking strength rope	Manufacturing challenges
	In Maine, only add a single tracer to existing markings	Does not add additional info when gear is not collected.
	Existing marking is sufficient	Does not meet needs
	Different marks for different fisheries, area fished, subregion, etc	Limited color options
	Mark all fixed gear fisheries	Not all included in this ruling
	Increase marking frequency	Unpopular with stakeholders
	Marking lengthener	Unpopular with stakeholders
	Mark to ID line type (groundline and buoy lines)	Unpopular with stakeholders
	Mark ropeless gear	Unpopular with stakeholders
	Mark gear every 40 feet	Unpopular with stakeholders
	Red sleeves as gear marking	Unpopular with stakeholders
	Use high visibility rope	Unpopular with stakeholders
	Replace and mark 20 percent of lines each year for a 5 year phase in	Too slow
	Include unique country of origin tracer in line to identify as U.S. gear	Increased marking should help distinguish U.S. gear
	Unique for exempted areas	Limited color options

Topic	Alternative Considered but Rejected	Rationale for Rejection
Reporting	Unique mark for sinking line in buoy line systems	Unpopular with stakeholders
	Include unique marks closure areas (when open) and certain other key areas.	Limited color options
	Require VMS/AIS on all buoy line fisheries	Logistical challenges
	Require mandatory lost gear reporting for all trap/pot and gillnet gear not already required to report.	Unpopular with stakeholders
Monitoring	Effort along the U.S. east coast with increased effort south of the islands and in the mid-Atlantic more than once per month. Year-round throughout the U.S. east coast with increased effort in the mid-Atlantic region.	Unpopular with stakeholders
	Year round throughout U.S. east coast with increased effort in the mid-Atlantic region	Logistical challenges
	Train lobstermen as whale observers and disentangle teams	Funding and logistical challenges
	VMS and AIS use in fishery at 100 percent	VMS implemented by a different authority, logistical challenges
Weak Links	Require VMS and VTR	VMS implemented by a different authority, VTR will be implemented in a separate monitoring plan.
	Annually review and amend, high density right whale closure areas	Logistical challenges
	Weak link alternatives in northern Area 537: 600 lb weak-link or 1,100 lb weak-link for pot gear buoy lines	Unpopular with stakeholders
	In statistical area 537 lower the breakaway requirement for all fixed gear from a maximum of 1,500 lb to a lower level. Analyze options for a 600 lb breakaway and another for a 1,100 lb breakaway.	Unpopular with stakeholders
Other	Allow participating fishermen to fish reduced number of traps with SSL installed every 40 feet in line in January and in green sections of the Mass Bay Restricted Area February - April (PSSLA)	Increases entanglement risk
	Mass Feb-Apr, sleeves, some traps go back in	Increases entanglement risk
	Adopt all provisions agreed upon at the TRT	Does not take into account additional information/data available since
	Only implement new measures in Maine over 30 mi from shore	Insufficient risk reduction
	Remove exemption line	Unpopular with stakeholders
	Establish triggers in advance which would result in prescribed management actions for example reduced buoy lines in a region	Logistical challenges

Topic	Alternative Considered but Rejected	Rationale for Rejection
	Reduce line in surface systems in Maine	Unpopular with stakeholders
	Oppose any experimentation with grappling for gear that would allow any type of floating or buoyant groundline	Not risk reduction
	Implement measures that apply equally to all fishermen in federal waters	Doesn't take into account operation size.
	No aquaculture in any closed areas at any time of year	Beyond the scope of the FEIS
	Require all trap/pot fisheries to use sinking groundlines with no exemptions	Unpopular with stakeholders
	5 year transition to red/orange buoy lines to increase visibility	Unpopular with stakeholders
	Colored lines throughout Area 537	Unpopular with stakeholders

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CHAPTER 4 AFFECTED ENVIRONMENT

This chapter describes the valued ecosystem components (VECs) that may be affected by the Atlantic Large Whale Take Reduction Plan (ALWTRP or Plan) modifications. Four major valued ecosystem components are examined in detail:

- **Atlantic Large Whales:** The large whale valued ecosystem component includes the three large whale species that are the focus of the ALWTRP, the North Atlantic right whale, the humpback whale, and the fin whale, as well as the minke whale, which also benefits from the plan and is frequently entangled by fishing gear.
- **Other Protected Species:** Other protected species are included in a separate valued ecosystem component from the four large whales above and includes all other protected species that may be impacted by the proposed regulations (i.e., marine mammals and sea turtles; Table 4.1).
- **Habitat:** The habitat valued ecosystem component represents marine habitats, with a focus on Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (HAPC). This includes the physical environment and benthic organisms that provide important ecological functions.
- **Human Communities:** This valued ecosystem component encompasses potentially affected fisheries (lobster and Jonah crab trap/pot) with an emphasis on the economic effects of the proposed alternatives. The proposed actions are not expected to have significant impacts on the biological aspects of the fisheries and therefore fish biology is not included in this analysis.

This chapter is broken down as follows:

- Section 4.1 discusses the status of protected species that may be impacted by elements of the ALWTRP. This has two sections: one focusing on large whales and another on all other protected species.
- Section 4.2 provides information on potentially impacted habitats and their physical characteristics.
- Section 4.3 considers the economic and social aspects of the potentially impacted fisheries.

4.1 Protected Species

The following discussion examines the potential impact of management actions on protected species. Table 4.1 shows the protected species that were considered and identifies which of those may be impacted by the proposed action.

Table 4.1: The species and critical habitat that were considered, their current status, and which ones are likely to be impacted by the proposed regulations.

Potential Effect	Category	Species	Status
Potentially Impacted	Marine Mammals	North Atlantic Right Whale	Endangered
		Humpback Whale	Protected
		Fin Whale	Endangered
		Minke Whale	Protected
		Sei Whale	Endangered
		Sperm Whale	Endangered
	Sea Turtles	Loggerhead Sea Turtle (Northwest Atlantic Ocean DPS)	Threatened
		Leatherback Sea Turtle	Endangered
Not Likely to Be Impacted	Fish	Giant Manta Ray	Endangered
		Oceanic Whitetip Shark	Endangered
		Atlantic Salmon	Endangered
		Shortnose Sturgeon	Endangered
		Atlantic Sturgeon	New York, Chesapeake Bay, Carolina, and South Atlantic DPSs - endangered, Gulf of Maine DPS as threatened
	Marine Mammals	Bryde's Whale	Protected
		Harbor Porpoise	Protected
		Blue Whale	Endangered
		WNA Coastal Bottlenose Dolphin	Protected
		Atlantic White-Sided Dolphin	Protected
		Risso's Dolphin	Protected
		Spotted Dolphin	Protected
		Striped Dolphin	Protected
		Pilot Whale	Protected
		Offshore Bottlenose Dolphin	Protected
		Common Dolphin	Protected
	Seals	Harbor Seal	Protected
		Gray Seal	Protected
		Harp Seal	Protected
	Sea Turtles	Kemp's Ridley Sea Turtle	Endangered
		Green Sea Turtle (North Atlantic DPS)	Threatened
		Hawksbill Sea Turtle	Endangered

Potential Effect	Category	Species	Status
		Olive Ridley Sea Turtle	Threatened
	Critical Habitat	North Atlantic Right Whale	ESA (Protected)

The information here was compiled from a variety of sources including published literature and official reports. The abundances, potential biological removal levels (PBR), and serious injury and mortality rates for all marine mammals were taken from the annual NMFS stock assessments and, if possible, supplemented by additional data from the Northeast Fisheries Science Center (NEFSC) that has yet to be published. Sea turtle abundance and trends were available from government and non-government reports. It should be noted that annual mortality rates for protected species that were calculated from the detected mortalities should be considered a biased representation estimate of human-caused mortality. Detections are arbitrary and not the result of a systematic survey of mortality. As such, they represent a minimum estimate of human-caused mortality which is almost certainly biased low (Hayes et al. 2020, Pace et al. 2021b).

4.1.1 *Atlantic Large Whales*

4.1.1.1 North Atlantic Right Whale

The North Atlantic right whale (*Eubalaena glacialis*) is a baleen whale found in temperate and subpolar latitudes in the North Atlantic Ocean. Today they are mainly found in the western North Atlantic, but were historically recorded south of Greenland and in the Denmark strait, as well as in eastern North Atlantic waters (Kraus and Rolland 2007, Monsarrat et al. 2016), and with possible historic calving grounds in the Mediterranean Sea (Rodrigues et al. 2018). Although some individuals are occasionally sighted off of Europe and in the Gulf of Mexico, the current geographic range is primarily from Florida, Georgia, and South Carolina in the south, where calving occurs, through the mid-Atlantic to the north along the east coast of North America and further extending north and west to the waters of Greenland and Iceland (Lien et al. 1989, Mate et al. 1997, Morano et al. 2012, NMFS 2013, Wikgren et al. 2014, Oedekoven et al. 2015, Davis et al. 2017, Krzystan et al. 2018, Davies et al. 2019). Other than right whales that aggregate in small numbers on the calving grounds in the winter, aggregations are most frequently observed in the mid-Atlantic and New England throughout Cape Cod Bay and the Gulf of Maine (Mate et al. 1997, Wikgren et al. 2014, Davis et al. 2017, Mayo et al. 2018) as well as in Canadian waters, such as the Bay of Fundy, Scotian Shelf, and Gulf of Saint Lawrence (Davies et al. 2019, Plourde et al. 2019) likely in search of food.

Right whales feed primarily on copepods, in particular *Calanus finmarchicus*, where they occur in high abundance (Watkins and Schevill 1976, Wishner et al. 1988, Mayo and Marx 1990, Wishner et al. 1995, Woodley and Gaskin 1996, Kenney 2001, Baumgartner et al. 2003, Baumgartner and Mate 2003). Right whale foraging occurs commonly at the surface or subsurface in the spring in Cape Cod Bay (Mayo and Marx 1990) but at depth in the summer, fall, and early winter where high densities of copepods occur (Kenney et al. 1995, Baumgartner and Mate 2003, Baumgartner et al. 2017). Baumgartner et al. (2017) observed right whales using all depth strata, including surface feeding on *C. finmarchicus* coincident with spring phytoplankton blooms and feeding at depth spring through late fall. The high lipid content of

diapausing copepods that occur in late summer and early fall at depth, from 300 m (83 fm) to 1500 m (250 fm), in the Gulf of Maine Basins may be of particular importance to right whales (Baumgartner et al. 2017, Krumhansl et al. 2018). By mid-winter, there is a decline in *C. finmarchicus* availability and right whales are required to target other prey. Seasonal patterns in *C. finmarchicus* aggregations and phenology have been changing (Pershing and Stamieszkin 2020), shifting distribution throughout the Gulf of Maine (Record et al. 2019) making it more challenging to predict aggregations in known hotspots. In Canada, whales in the Bay of Fundy were observed less often and earlier in the season in recent years in line with shifting prey overlap (Davies et al. 2019) and foraging habitat was recently identified on the Scotian Shelf and in the Gulf of Saint Lawrence (Plourde et al. 2019).

From 1990 to 2010, the right whale population grew at a rate of 2.8 percent from an estimated 270 in 1990 to high of 483, but has declined since 2010 (Pace et al. 2017) and is experiencing an unusual mortality event beginning in 2017 that is related to both vessel strikes and entanglement in fishing gear (Daoust et al. 2018), particularly in the Canadian Gulf of St. Lawrence. Serious injury and mortalities were attributed to entanglements for 63 percent of all serious injuries and mortalities documented between 2010 and 2019 (see Chapter 2). During this time frame, there were 185 documented incidents in the U.S. and Canada. The following is a broad overview of the incident data:

- Of all 185 incidents reported, 152 of those showed injuries confirmed as caused by entanglements or vessel strikes, 78 of which resulted in serious injury or mortality (Table 4.2).
- Eleven of these entanglements would have resulted in serious injury or mortality but were disentangled.
- The vast majority of incidents cannot be identified to a known gear type. Of those with gear retrieved and identified, more were confirmed as trap/pot gear incidents than incidents caused by netting (see Chapter 2).
- Among all entanglement incidents by country, while there appears to be a spike in Canada, there are also a large proportion that do not have a country of origin identified.
- Yearly trends demonstrate a particular increase in serious injury and mortality of right whales since 2014.
- Seventeen mortalities occurred in 2017, including 12 in Canada and 5 in the U.S. Entanglement was identified as the cause of four of the mortalities, two in Canada's Gulf of St. Lawrence, and two in the U.S. Two serious injuries, one in each country, were also documented as caused by entanglement
- Three mortalities showing signs of acute entanglement were documented in 2018, all in US waters and including one in January 2018 from which snow crab gear was removed.
- During 2019, another ten mortalities were documented, including nine in the Gulf of St. Lawrence. Four of the six examined were caused by injuries compatible with blunt force trauma and attributed to vessel strikes. One individual was too decomposed to determine cause of death. One was last seen with a new entanglement in the Gulf of St. Lawrence shortly before stranding dead in New York where the cause of death was attributed to Canadian line.
- A number of entanglement-related serious injuries were also documented in 2019, including a right whale disentangled from Canadian snow crab gear east of

Provincetown, Massachusetts.

Between 1990 and 2015, survival rates appeared relatively stable, but differed between the sexes, with males having higher survivorship than females (males: 0.985 ± 0.0038 ; females: 0.968 ± 0.0073) leading to a male-biased sex ratio (approximately 1.46 males per female, Figure 2.4; Pace et al. 2017). The best estimate of the right whale population at the end of 2019 is 368 whales with a strong male bias (approximately 60 percent male; Pace et al 2017, Pace 2021). Additionally, an Unusual Mortality Event was declared in 2017 when 17 individuals died on the Atlantic coast in both U.S. and Canadian waters (Pettis et al. 2018b). This event has continued through 2021, with an additional three mortalities documented in 2018, 10 in 2019, two in 2020, and two as of April 2021. In 2020, 15 serious injuries were included in the Unusual Mortality event tally, including two in 2017, five in 2018, one in 2019, four in 2020, and three in 2021 (see: <https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2021-north-atlantic-right-whale-unusual-mortality-event>).

Table 4.2: The number of entanglement and vessel strike cases, 2010 – 2019, by country, that resulted in serious injury or mortality. This list includes individuals with prorated injuries where outcome was uncertain and assigned a probability of serious injury and where serious injury or mortality was averted through disentangling.

Country	Cause	# of Cases
US	Entanglement	3
	Vessel Strike	7
First Seen US	Entanglement	28
	Vessel Strike	1
Canada	Entanglement	14
	Vessel Strike	8
First Seen Canada	Entanglement	16
	Vessel Strike	1
Total	Entanglement	61
	Vessel Strike	17

Based on the best available information, the greatest entanglement risk to large whales is posed by fixed gear used in trap/pot or sink gillnet fisheries (Angliss and Demaster 1998; Cassoff et al. 2011; Kenney and Hartley 2001; Knowlton and Kraus 2001; Hartley et al. 2003; Johnson et al. 2005; Whittingham et al. 2005a,b; Knowlton et al. 2012; NMFS 2014; Hamilton and Kraus 2019; Henry et al. 2016; Henry et al. 2021; Sharp et al. 2019; Pace et al. 2021). Specifically, while foraging or transiting, large whales are at risk of becoming entangled in buoy lines, or groundlines of gillnet and trap/pot gear, as well as the net panels of gillnet gear that rise into the water column (Baumgartner et al. 2017; Cassoff et al. 2011; Hamilton and Kraus 2019; Hartley et al. 2003; Henry et al. 2014; Henry et al. 2015; Henry et al. 2016; Henry et al. 2017; Henry et al. 2019; Johnson et al. 2005; Kenney and Hartley 2001; Knowlton and Kraus 2001; Knowlton et al. 2012; NMFS 2014; Whittingham et al. 2005a,b; Hayes et al. 2020). Large whale interactions (entanglements) with these features of trap/pot and/or sink gillnet gear often result in the serious injury or mortality to the whale (Angliss and Demaster 1998; Cassoff et al. 2011; Henry et al. 2014, Henry et al. 2015, Henry et al. 2016; Henry et al. 2017; Henry et al. 2019; Knowlton and Kraus 2001, Knowlton et al. 2012; Moore and Van der Hoop 2012; NMFS 2014; Pettis et al.

2019; Sharp et al. 2019; van der Hoop et al. 2016; van der Hoop et al. 2017). Many entanglements, including serious injury or mortality events, go unobserved, and the gear type, fishery, and/or country of origin for reported entanglement events are often not traceable. The rate of large whale entanglement, and thus, rate of serious injury and mortality due to entanglement, are likely underestimated (Hamilton et al. 2018; Hamilton et al. 2019; Knowlton et al. 2012; Pace et al. 2017; Robbins 2009).

Anthropogenic mortality has limited the recovery of the right whale (Corkeron et al. 2018). With whaling prohibited, the two major known human causes of mortality are vessel strikes and entanglement in fishing gear (Hayes et al. 2018b). While vessel strikes declined after vessel speed regulations were implemented (78 FR 73726; Conn and Silber 2013), both entanglement in fishing gear and vessel strikes remain a significant threat (Kraus et al. 2016, Sharp et al. 2019) and appear to be worsening (Hayes et al. 2018b). Other potential threats to recovery include low genetic diversity, pollution, nutritional stress, and other sublethal stressors (Best et al. 2001, Kraus et al. 2001, Rolland et al. 2012, Rolland et al. 2016, Meyer-Gutbrod and Greene 2018).

There is evidence of declining physiological health in the population since the early 1990s, which was also linked to several periods of poor reproduction (Rolland et al. 2016, Christiansen et al. 2020). Calving rates have varied substantially, with low calving rates coinciding with all three periods of decline or no growth, and with low female survival further reducing the number of birthing females (Pace et al. 2017). This has been acute in recent years, when calf production has decreased and the time between births has nearly doubled. Between 2009 and 2017, Pettis et al. (2018a) observed an increased calving interval from an average of 4 to 10 years. In recent years, low birth rates are an increasing concern for right whale recovery, with the detection of only five births in 2017 (Pettis et al. 2018b), no births in 2018 (Pettis et al. 2018a), seven births in 2019 (Pettis et al. 2020), and ten births in 2020 (Pettis et al. 2021). This is well below the average: 12.8 calves per year from 2010 through 2019 or 22 per year from 2000 through 2009. More recently, there were 17 calves in the 2020/2021 calving season, as of March 29 (<https://www.fisheries.noaa.gov/national/endangered-species-conservation/north-atlantic-right-whale-calving-season-2021>). While the number of births in the most recent season is encouraging, the persistent low births are insufficient to counteract current population mortality rates (Pace 2021), increasing concern regarding current levels of entanglement mortality. Many factors could explain the low birth rate, including poor female health (Rolland et al. 2016) and reduced prey availability (Meyer-Gutbrod et al. 2015, Johnson et al. 2018, Meyer-Gutbrod et al. 2018, Meyer-Gutbrod and Greene 2018). Entanglement in fishing gear also can have substantial health and energetic costs that affect both survival and reproduction (Robbins et al. 2015, Pettis et al. 2017, Rolland et al. 2017, van der Hoop et al. 2017, Hayes et al. 2018a, Hunt et al. 2018, Lysiak et al. 2018, Moore et al. 2021).

The resilience of the right whale to future stressors is considered very low given the existing threats (Hayes et al. 2018a) but would be improved by the absence of human-caused serious injury and mortality (Kenney 2018). Hayes et al. (2018a) estimates that by 2029 the population will decline to the 1990 estimate of 123 females if the current rate of decline is not mitigated. Recent modelling efforts by Meyer-Gutbrod et al. (2018) further indicate that because right whales feed primarily on dense aggregations of *Calanus* spp. copepods, the population may decline towards extinction if prey conditions worsen as predicted under future climate scenarios

(Grieve et al. 2017, Johnson et al. 2018, Krumhansl et al. 2018), and anthropogenic mortalities are not reduced (Meyer-Gutbrod et al. 2018). Recent data from the Gulf of Maine and Gulf of St. Lawrence indicate prey densities may already be declining (Johnson et al. 2018, Meyer-Gutbrod et al. 2018, Meyer-Gutbrod and Greene 2018, Record et al. 2019). Additionally, changes in prey distribution has shifted right whales into new areas with nascent mitigation measures so they are at additional risk of anthropogenic mortality (Plourde et al. 2019, Record et al. 2019)

The right whale is listed as endangered under the Endangered Species Act (ESA). NMFS believes that the right whale is well below the optimum sustainable population level. NMFS determines a population's PBR as the product of minimum population size, one-half the maximum net productivity rate and a "recovery" factor for endangered, depleted, threatened stocks or stocks of unknown status relative to an optimum sustainable population. The recovery factor for right whales is 0.10 because this species is listed as endangered under the ESA. The most recent abundance estimate suggests the average population size was 368 (± 11) in 2019 (Pace 2021). The PBR for the right whale has been less than one serious injury or mortality each year, and although PBR will likely go down in the next stock assessment, it was identified as 0.8 per year for the 2019 stock assessment. (Hayes et al. 2020). During that same time frame, the minimum estimated annual mortality and serious injury value for right whales between 2014 and 2018 was 8.15, including 6.85 attributed to fishery interactions (Hayes et al. 2020, Henry et al. 2021), well above PBR.

4.1.1.2 Humpback Whale

The Gulf of Maine humpback whale (formerly Western North Atlantic, *Megaptera novaeangliae*) was previously listed as endangered under the ESA. In 2016, several distinct population segments were removed from listing, including the West Indies distinct population segment. The Gulf of Maine stock is largely composed of whales that reproduce in the West Indies (81 FR 62259, September 2016). The Gulf of Maine stock is still protected under the Marine Mammal Protection Act.

In the western North Atlantic, humpback whales calve and mate in the West Indies during the winter and migrate to northern feeding areas during the summer months. They occur along the entire east coast of North America and north and east across Greenland, Iceland and the Norwegian Sea (Christensen et al. 1992, Palsbøll et al. 1997). Although not clearly delineated, matrilineally determined stock separation between feeding grounds is evident, with a northern boundary for the Gulf of Maine stock somewhere along the Scotian Shelf (Hayes et al. 2020).

Since the early 1990s, humpbacks, particularly juveniles, have been observed stranded dead with increasing frequency in the mid-Atlantic (Swingle et al. 1993, Wiley et al. 1995) and have been sighted in wintertime survey in the Southeast and mid-Atlantic (Hayes et al. 2020). In the Gulf of Maine, sightings are most frequent from mid-March through November, with a peak in May and August, from the Great South Channel east of Cape Cod northward to Stellwagen Bank and Jeffreys Ledge (CETAP 1982). Acoustic detections of humpbacks indicate year-round presence in New England waters, including the waters of Stellwagen Bank (Davis et al 2020). Distribution in these waters appears to be correlated with prey species, including herring (*Clupea harengus*), sand lance (*Ammodytes* spp.), and other small fishes as well as euphausiids (Paquet et al. 1997).

More recent surveys conducted in recent years, summarized in the 2019 Stock Assessment Report (Hayes et al. 2020) confirm similar seasonal humpback distribution trends.

Current data suggest that the Gulf of Maine humpback whale stock is increasing (Hayes et al. 2020). The most recent population estimate calculated an abundance of 1,396 animals in this stock and a minimum population estimate is 1,380. The maximum productivity rate is 0.065 and the “recovery” factor is assumed to be 0.50, the default for stocks of unknown status, because the listing for the distinct population segment was removed in 2016. Thus, the PBR for the Gulf of Maine humpback whale stock is 22 whales per year (Hayes et al. 2020).

The primary known sources of anthropogenic mortality and injury of humpback whales are commercial fishing gear entanglements and ship strikes. Robbins et al. (2009) found that 64.9 percent of the North Atlantic population had entanglement scarring in 2003, encountering new scarring at an annual rate of 12.1 percent. From 2010 to 2019, 38.8 percent of all observed mortality and serious injury were attributed to entanglements from interactions with trap/pot, monofilament line, netting, and unidentified gear (see Chapter 2). From 2014 through 2018, observed human-caused mortality averaged 15.25 animals per year, with 9.45 incidental fishery interactions and 5.8 vessel collisions (Henry et al. 2021). These results include only observed mortality and serious injury. Unobserved anthropogenic impacts on humpback whales is likely but to date has not been calculated. An unusual mortality event was declared in 2016 after a spike in strandings along the east coast of the U.S. and fifty percent of the cases where cause of death was examined had evidence of ship strike or entanglement.

Humpback whales may also be adversely affected by habitat degradation, habitat exclusion, anthropogenic sound, harassment, or reduction in prey resources attributable to commercial fishing, coastal development, vessel traffic, and other influences. Changes in humpback distribution in the Gulf of Maine have been found to be associated with changes in herring, mackerel, and sand lance abundance associated with local fishing pressures (Payne et al. 1986). Likewise, there are strong indications that a mass mortality of humpback whales in the southern Gulf of Maine in 1987/1988 was the result of the consumption of mackerel whose livers contained high levels of a red-tide toxin (Geraci et al. 1989).

4.1.1.3 Fin Whale

The fin whale is found in all major oceans and was composed of three subspecies until recently: *Balaenoptera physalus physalus* in the Northern Hemisphere, and *B. p. quoyi* and *B. p. patachonica* (a pygmy form) in the Southern Hemisphere. New genetic data suggest that fin whales in the North Atlantic and North Pacific oceans represent two different subspecies (Archer et al. 2019). The International Whaling Commission defines a single stock of the North Atlantic fin whale off the eastern coast of the U.S., north to Nova Scotia, and east to the southeastern coast of Newfoundland (Donovan 1991). Fin whales are common in the waters of the U.S. Exclusive Economic Zone principally from Cape Hatteras northward (Hayes et al. 2020).

Of the three to seven stocks thought to occur in the North Atlantic Ocean (approximately 50,000 individuals), one occurs in U.S. waters, where National Marine Fisheries Services’ (NMFS) best estimate of abundance is 7,418 individuals (Hayes et al. 2020, Palka 2012). The species’ overall

population size may provide some resilience to current threats, but trends are largely unknown. The minimum population size of the North Atlantic fin whale stock is 6,029, and the maximum productivity rate is 0.04, the default value for cetaceans. The “recovery” factor is assumed to be 0.10 because the fin whale is listed as endangered under the ESA. Thus, PBR for the western North Atlantic fin whale is 12 (Hayes et al. 2020).

Like right whales and humpback whales, documented sources of anthropogenic mortality of fin whales include entanglement in commercial fishing gear and ship strikes. Additional threats include reduced prey availability and anthropogenic sound. Experts believe that fin whales are struck by large vessels more frequently than any other cetaceans (Laist et al. 2001).

Approximately 22.7 percent of all observed mortality and serious injury were attributed to entanglements between 2010 and 2019, with most interactions occurring with trap/pot and unidentified gear (see Chapter 2). The minimum annual rate of anthropogenic mortality and serious injury to fin whales, between 2014 and 2018, was 2.35 per year, 1.55 of those from fishing entanglement, and 0.8 per year from ship strikes (All U.S.) (Hayes et al. 2020, Henry et al. 2021).

4.1.1.4 Minke Whale

The minke whale (*Balaenoptera acutorostrata*) is not listed as endangered or threatened under the ESA but is protected under the Marine Mammal Protection Act. Minke whales off the eastern coast of the United States are considered to be part of the Canadian east coast population, which inhabits the area from the eastern half of Davis Strait south to the Gulf of Mexico. Minke whales are most frequently observed in New England waters from spring to fall and are largely absent by winter (Hayes et al. 2020). There is evidence of high acoustic occurrence during September through April in deep-ocean waters in the eastern North Atlantic (Risch 2013, Risch et al. 2014). Research conducted by Clark and Gagnon (2002) and Rish et al. (2014) confirmed winter distribution in the West Indies and in mid-ocean waters southeast of Bermuda.

Data are insufficient for determining a population trend for this species. The best estimate of population size is 24,202 (CV=0.30) minke whales in the 2019 stock assessment report, which is substantially higher than in the 2018 stock assessment report because it now includes updated survey data in Canadian waters. The minimum population size is calculated at 18,902 (Hayes et al. 2020). The maximum productivity rate is 0.04, the default value for cetaceans and the recovery factor is assumed to be 0.5 because the stock is of unknown status. Thus, PBR for this stock of minke whales is 189 (Hayes et al. 2020).

As with other large whales in this VEC, documented sources of anthropogenic mortality of minke whales include entanglement in commercial fishing gear and ship strikes. Minke whales have been entangled in a variety of fishing gear, including unspecified fishing nets, unspecified cables or lines, fish traps, weirs, seines, gillnets, and lobster gear. Between 2010 and 2019, nearly 30 percent of all observed mortality and serious injury were attributed to entanglements, most of which resulted from interactions with trap/pot, netting, and unidentified gear (see Chapter 2). An unusual mortality event was declared in 2017 following an uptick in strandings along the east coast of the U.S. Though the specific cause of the high mortality has not been determined, several stranded whales have shown evidence of human interaction. From 2014 to

2018, the average annual human-caused mortality and serious injury was 10.15 minke whales per year (below the PBR of 189), which is the sum of 8.95 minke whales per year (unknown CV) from U.S. and Canadian fisheries using strandings and entanglement data, 1.2 per year from vessel strikes, 0.2 takes in observed U.S. fishing gear, and 0.2 non-fishery entanglement takes (Hayes et al. 2020).

4.1.2 *Other Protected Species*

4.1.2.1 **Marine Mammals**

4.1.2.1.1 Sei Whale

Sei whales (*Balaenoptera borealis*) are listed as endangered throughout their range under the ESA. The western North Atlantic sei whale population belongs to the Northern Hemisphere subspecies (*B. b. borealis*) and consists of two stocks, a Nova Scotian Shelf stock and a Labrador Sea stock (Baker and Clapham 2004, Mitchell and Chapman 1977). The Nova Scotian Shelf stock is the only sei whale stock within ALWTRP boundaries and range from the U.S. east coast to Cape Breton, Nova Scotia and east to 42°00'W longitude (Hayes et al. 2020). The Nova Scotia stock in the North Atlantic is estimated at 6,292 individuals with a minimum population size of 3,098 individuals (Hayes et al. 2020). Population growth rates for sei whales are not available at this time as there are little to no systematic survey efforts to study sei whales.

Sei whales are often found in the deeper waters that characterize the edge of the continental shelf (Hain et al. 1985) but NMFS aerial surveys also found substantial numbers of sei whales south of Nantucket in spring and summer (Stone et al. 2017) and on Georges Bank in the spring and summer (CETAP 1982). Sei whales (like right whales) are largely planktivorous, primarily feeding on euphausiids and copepods, which has resulted in reports of sei whales in more inshore locations.

Current threats include vessel strikes, fisheries interactions (including entanglement), climate change, habitat loss, reduced prey availability, and anthropogenic sound. Between 2010 and 2019 eighteen serious injuries and mortalities were observed: eight with unknown causes, five vessel strikes (all confirmed US), two entanglements, and three non-human caused mortality. Based on Henry et al. (2021), the average annual rate of confirmed human-caused mortality and serious injury to sei whales, between 2014 and 2018, is 1.2 incidents per year. This value includes incidental fishery interaction records, 0.4, and records of vessel collisions, 0.8. Possible causes of natural mortality, particularly for compromised individuals, are shark attacks, killer whale attacks, and endoparasitic helminthes (Perry et al. 1999).

4.1.2.1.2 Sperm Whale

In the western North Atlantic, sperm whales range from Greenland to the Gulf of Mexico and the Caribbean. The International Whaling Commission recognizes one stock for the entire North Atlantic (Waring et al. 2002). The sperm whales that occur in the western North Atlantic are believed to represent only a portion of the total stock (Blaylock et al. 1995). Waring et al. (2015) suggests sperm whale distribution shifts north in spring to the central mid-Atlantic bight and

southern end of Georges Bank and into the northern end of Georges Bank, the continental shelf, and the Northeast Channel in summer. Sperm whale presence on the continental shelf south of New England is highest in the fall (Waring et al. 2015).

Total numbers of sperm whales off the U.S. or Canadian Atlantic coast are unknown, although estimates from selected regions of the habitat do exist for select time periods. The best recent abundance estimate for sperm whales is the sum of the 2016 surveys and is 4,349 (CV=0.28; Hayes et al. 2020). However, this is likely an underestimate given the data were not corrected for dive-time, which can be long for sperm whales (Watwood et al. 2006).

Few instances of injury or mortality of sperm whales due to human impacts have been recorded in U.S. waters. Recently, there were 38 sperm whale strandings counted between 2008 and 2020, one of which was determined to be from interaction with fishery gear (MMHSRP Database, queried, 2021). Human interaction was confirmed in four of the cases, only one that was found in U.S. waters (with no confirmed country of origin) and the other three were related to Canadian pelagic longline or trap/pot fisheries. No sperm whale mortalities or serious injuries were reported between 2013 and 2017, though unobserved mortalities have not been calculated (PBR is 3.9; Hayes et al. 2020). Ships can also strike sperm whales, but the offshore distribution of this species reduces the likelihood of interactions (both ship strikes and entanglements) being reported compared to those involving right, humpback, and fin whales, which are more often found in nearshore areas.

Another potential human-caused source of mortality for sperm whales may be the exposure to contaminants, such as polychlorinated biphenyls (PCBs), chlorinated pesticides, polycyclic aromatic hydrocarbons, and heavy metals. Though not conclusive, tissue samples from 21 sperm whales that mass stranded in the North Sea in 1994/95 showed cadmium levels twice as high as those found in North Pacific sperm whales and possibly affected the stranded animals' health and behavior (Holsbeek et al. 1999). Sperm whales in the North Atlantic also have higher levels of DDT and PCBs than baleen whales (Borrell 1993).

4.1.2.2 Sea Turtles

Loggerhead and leatherback sea turtles spend all or part of the year in the waters potentially affected by new ALWTRP regulations and have interacted with trap/pot fisheries, with interactions primarily associated with entanglement in buoy lines associated with this gear type. However, they can also become entangled in groundlines or surface system lines of trap/pot gear (Sea Turtle Disentanglement Network (STDN), unpublished data). Sea turtles continue to be affected by many of the original threats that prompted their ESA listing, including interactions with fishing gear, degradation of nesting beach sites, poaching, nesting predation, vessel strikes, channel dredging, and marine pollution (including ingestion of marine debris, Lutcavage et al. 1997).

4.1.2.2.1 Loggerhead Sea Turtle

Loggerhead turtles (*Caretta caretta*) are circumglobal and are found in temperate and tropical regions of the Pacific, Indian, and Atlantic Oceans. The species was first listed as threatened under the ESA in 1978 (43 FR 32800). On September 22, 2011, the NMFS designated nine

distinct population segments (DPSs) of loggerhead turtles, with the Northwest Atlantic Ocean DPS listed as threatened. The Northwest Atlantic Ocean DPS of loggerhead turtles are found along eastern North America, Central America, and northern South America. In the U.S. Atlantic, loggerhead sea turtles occur from Florida north to Canadian waters, though primary northern foraging habitats are in the mid-Atlantic (Braun-McNeill et al. 2020) and north through Massachusetts (NMFS and USFWS 2008; Conant et al. 2009). They arrive at foraging areas in the mid-Atlantic as early as mid-April and in the Gulf of Maine around June. In fall, the trend is reversed with most turtles leaving the region's waters by the end of November. Recent climate-driven changes in northeast U.S. Atlantic waters may increase the northern range and seasonal duration for loggerheads along the Northwest Atlantic shelf in future years (Patel et al. 2021).

In 2010, NMFS preliminarily estimated approximately 588,000 individuals (greater than 30 cm in size, approximate inter-quartile range of 382,000 to 817,000) from Cape Canaveral, FL to the mouth of the Gulf of St. Lawrence. When a portion of the unidentified turtles were considered to be loggerheads, the number increased to 801,000 (inter-quartile range of approximately 521,000–1,111,000) (NMFS 2011).

Sea turtle census nesting surveys are important in that they provide information on the relative abundance of nesting each year, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. Ceriani and Meylan (2017) reported a 5-year average (2009-2013) of more than 83,717 nests per year in the southeast United States and Mexico (excluding Cancun, Quintana Roo, Mexico). Based on genetic information, the Northwest Atlantic Ocean DPS of loggerhead turtles is further categorized into five recovery units (NMFS and USFWS 2008). In assessing the population, Ceriani and Meylan (2017) and Bolten et al. (2019) looked at trends by recovery unit. While overall the Northwest Atlantic loggerhead population trend has been positive (+2%) (Ceriani and Meylan 2017), trends by recovery unit were variable (Ceriani and Meylan 2017, Bolten et al. 2019) and several recovery criteria delineated in the 2008 recovery plan including target annual recovery rates have not yet been met (Bolten et al. 2019). At core index beaches in the Peninsular Florida Recovery Unit (the largest nesting aggregation in the DPS), nesting totaled a minimum of 28,876 nests in 2007 and a maximum of 65,807 nests in 2016 (Figure 4.1). In 2020, more than 53,000 nests were documented. There have been three intervals observed in Peninsular Florida nesting: increasing (1989-1998), decreasing (1998-2007), and increasing (2007-2020) (<https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>). Nest counts at Florida Panhandle index beaches show an upward trend since 2010 (Figure 4.2). An analysis of Northern Gulf of Mexico Recovery Unit (which includes Florida Panhandle) nesting from 1997 to 2018 found that there has been a non-significant increase of 1.7 percent (Bolten et al. 2019). Nesting in the Northern Recovery Unit shows a 35 percent increase from 2009 through 2013 (Ceriani and Meylan 2017), but a longer-term trend analysis based on data from 1983 to 2019 indicates that the annual rate of increase is 1.3 percent (Bolten et al. 2019). In the trend analysis by Ceriani and Meylan (2017), a 53 percent increase for the Greater Caribbean Recovery Unit was reported from 2009 through 2013. No trend analysis is available for the Dry Tortugas Recovery Unit (Ceriani and Meylan 2017; Bolten et al. 2019).

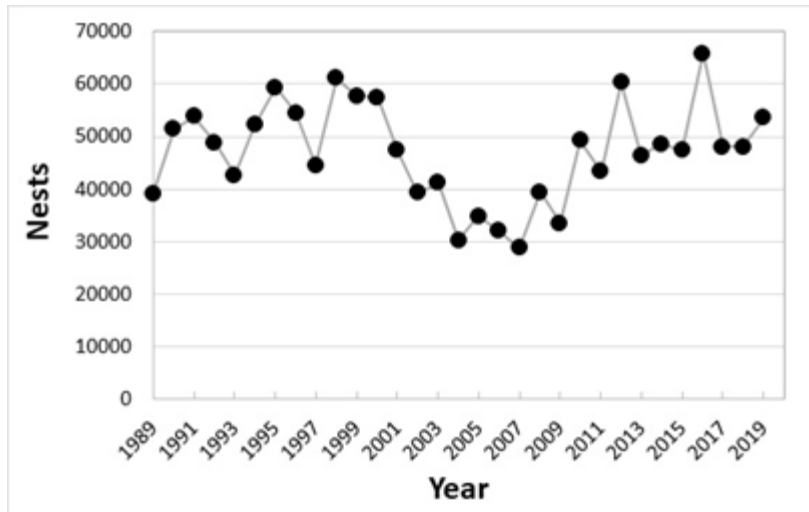


Figure 4.1: Annual nest counts for loggerhead sea turtles on Florida core index beaches in peninsular Florida, 1989-2019. Source: <https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>.

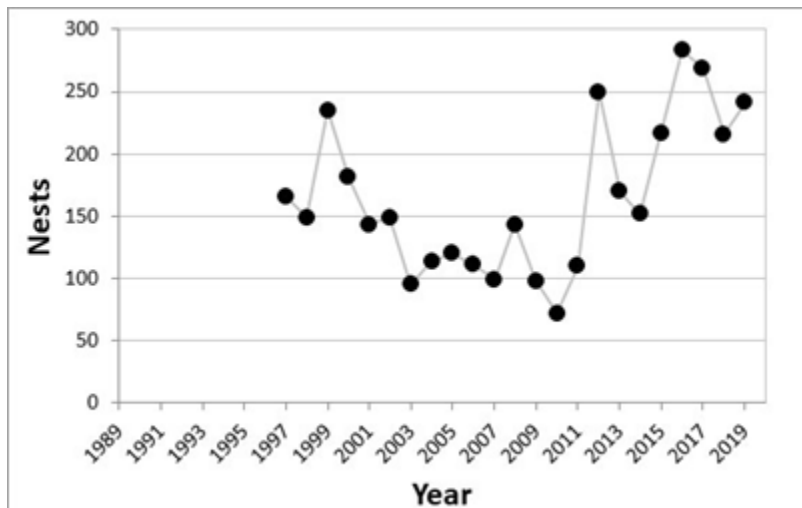


Figure 4.2: Annual nest counts on index beaches in the Florida Panhandle, 1989-2019. Source: <https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/>.

Significant threats to loggerhead populations in the Atlantic include commercial fisheries, coastal development, erosion of nesting beaches, pollution (including ingestion of marine debris), marine habitat degradation, and vessel strikes. Loggerhead turtles interact with a variety of fishing gear, including pots, gillnets, pelagic longlines, trawls, pound nets, and scallop dredges (Bolten et al. 2019, Murray 2020, NMFS and USFWS 2008). Stranding reports indicate that from 2010-2019, approximately 3,193 total loggerhead turtles stranded or were incidentally captured along the U.S. coast from Virginia through Maine (319 annually, on average) from a variety of causes, 144 of which were from entanglements or other fisheries interactions (NMFS STSSN database, 2021). Of the cases with evidence of vertical fishing line entanglement, crab, conch, and lobster gear were identified (Table 4.3).

Table 4.3: Loggerhead and leatherback buoy line entanglements by fishery between 2010 and 2019 (NMFS STSSN database, 2021).

Fishery	Leatherback	Loggerhead	Grand Total
Blue Crab	6	6	12
Conch	13	5	18
Conch and lobster	1		1
Fish	2		2
Lobster	82	1	83
Research	1		1
Unknown	151	3	154
Unknown VL and Lobster	1		1
Total	257	15	272

4.1.2.2.2 Leatherback Sea Turtle

The leatherback turtle (*Dermochelys coriacea*) is unique among sea turtles for its large size, wide distribution (due to thermoregulatory systems and behavior), and lack of a hard, bony carapace. Leatherback sea turtles are found worldwide from tropical to sub-polar latitudes. Leatherbacks range throughout the North Atlantic Ocean to 71 degrees North latitude. While the largest nesting aggregations occur in Trinidad, French Guiana, and Panama (NMFS and USFWS 2020), some nesting occurs in Florida and foraging habitats occur throughout U.S. coastal and pelagic Atlantic waters north to the Gulf of St Lawrence (James et al. 2006, Nordstrom et al. 2020). Leatherbacks occur in the Gulf of Maine from approximately June to November and in mid-Atlantic waters south of Massachusetts from May through November. By late fall, they have migrated out of the region (Dodge et al. 2020).

In the North Atlantic, previous assessments of leatherbacks concluded that the Northwest Atlantic population was stable or increasing (TEWG 2007, Tiwari et al. 2013). However, more recent analyses indicate that the overall regional, abundance-weighted trends are negative (The Northwest Atlantic Leatherback Working Group 2018, 2019). Leatherback nesting in the Northwest Atlantic showed an overall negative trend through 2017, with the most notable decrease occurring during the most recent period of 2008-2017 (The Northwest Atlantic Leatherback Working Group 2018). NMFS and USFWS (2020) also found decreasing nest trends at nesting aggregations with the greatest indices of nesting female abundance, suggesting a declining trend overall. The most recent, published IUCN Red List assessment for the Northwest Atlantic Ocean subpopulation estimated 20,000 mature individuals and approximately 23,000 nests per year (estimate to 2017; The Northwest Atlantic Leatherback Working Group 2019). However, the leatherback status review estimated that the total index of nesting female abundance for the NW Atlantic is 20,659 females (NMFS and USFWS 2020).

NMFS and USFWS (2020) summarizes threats to the Northwest Atlantic leatherback across its range. These include threats on nesting beaches such as the harvest of nesting females and eggs, predation, and loss of nesting habitat due to development, erosion, and sand extraction. Lights on or adjacent to nesting beaches alter nesting adult behavior and are often fatal to emerging hatchlings as they are drawn to light sources and away from the sea. As with the other sea turtle species, mortality due to fisheries interactions (including trawl, gillnet, pelagic longline, and trap/pot gear) accounts for a large proportion of annual human-caused mortality in the ocean.

Other marine threats include pollution (including ingesting marine debris), oil and gas activities, and vessel strikes. Plastic ingestion is common in leatherbacks and can block gastrointestinal tracts leading to death. Furthermore, climate change may alter sex ratios (as temperature determines hatchling sex), range (through expansion of foraging habitat), and habitat (through the loss of nesting beaches, because of sea-level rise, erosion, and more frequent/severe storm events). The species' resilience to additional perturbation is low. Between 2010 and 2019 there were 744 strandings or incidental captures of leatherback turtles along the U.S. coast from Virginia through Maine (74 average annually), 323 of which had evidence of entanglement (NMFS STSSN database, 2021). Of these vertical fishing line entanglements, lobster, fish, crab, and conch were identified as gears involved (Table 4.3). While a large portion of leatherbacks are released from entanglements alive, sub lethal initial impacts can cause post interaction mortality, which was calculated between 57 and 62 percent for reported U.S. buoy line interactions from 2015 to 2019 (Memorandum from Carrie Upite, Sea Turtle Recovery Coordinator, to Jennifer Anderson, ARA for Protected Resources, April 26, 2021).

4.1.3 Species and Critical Habitat Not Likely to be Impacted

Based on the best available information, Table 4.1 provides a list of species not likely to be impacted by the proposed action. This determination has been made because either the occurrence of the species has limited to no overlap with the trap/pot fisheries operating in the proposed action area and/or interactions have never been documented or are extremely rare between the species and trap/pot gear (see Marine Mammal Stocks Assessment Reports at <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region>; NMFS 2021; Sea Turtle Disentanglement Network, unpublished data; NMFS Observer Program, unpublished data; see OBIS-SEAMAP at <https://seamap.env.duke.edu/>). The proposed actions will not affect the essential physical and biological features of critical habitat designated for North Atlantic right whale, the Northwest Atlantic Ocean DPS of loggerhead sea turtle or Gulf of Maine DPS of Atlantic salmon; therefore, will not result in the destruction or adverse modification of either species critical habitat (NMFS 2014a; NMFS 2015a,b).

4.2 Habitat

Modification of the ALWTRP may affect EFH. Under the Magnuson-Stevens Act (MSA) (16 U.S.C. 1801), EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (16 U.S.C. 1802(10)). To help guide regional Fishery Management Councils (Councils) in the implementation of EFH provisions, regulations developed by NMFS encourages Councils to identify HAPC (50 CFR 600 Subpart J; 62 FR 66531; 67 FR 2343). HAPC are subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPC are not afforded any additional regulatory protection under the Magnuson-Stevens Act. However, federal projects with potential adverse impacts to HAPC must be more carefully scrutinized.

This section has three basic objectives:

- First, it defines the EFH and HAPC associated with the Atlantic trap/pot fisheries regulated by the ALWTRP.
- Second, it describes key components of lobster habitat in detail.
- Finally, it discusses how the ALWTRP can influence habitat, with a particular focus on potential disturbances to benthic habitat.

4.2.1 *Identification of Essential Fish Habitat*

The 1996 reauthorization of the Magnuson-Stevens Act requires that NMFS and the regional Councils specifically describe and identify Essential Fish Habitat (EFH). In addition, the Magnuson-Stevens Act requires that fishery management plans minimize, to the extent practicable, adverse effects on EFH caused by fishing activities. According to the EFH regulations found at 50 CFR 600, information necessary to identify EFH for each managed species includes its geographic range and habitat requirements by life stage, the distribution and characteristics of those habitats, and current and historic stock size as it affects occurrence in available habitats (50 CFR 600.815(a)(1)(ii)(A)). Information on the temporal and spatial distribution of each life history stage is needed to understand each species' relationship to, or dependence on, its various habitats.

Atlantic trap/pot fisheries are geographically widespread on the Atlantic coast and target a diverse array of fish and shellfish species. In the context of this Environmental Impact Statement, EFH includes the habitat for all non-target species during relevant life history stages that take place within the proposed area (Table 4.4). Because this action is not expected to affect pelagic habitats, the species and life stages listed below are all benthic. When viewed in the aggregate, across all species, EFH is all benthic habitat in the Atlantic Exclusive Economic Zone. It is important to note that corals are currently only listed as EFH in the Northeast Region Trap/Pot Management Area (Northeast Region) for one species, Acadian redfish. However, they are a component of complex hard bottom habitats where a variety of structure-forming organisms are found.

Table 4.4: A list of Essential Fish Habitat for different species and life history stages that are within the proposed area.

Species	Life Stage	Depth (meters)	Habitat Type and Description
Acadian redfish	Juveniles	50-200 in Gulf of Maine, to 600 on slope	Sub-tidal coastal and offshore rocky reef substrates with associated structure-forming epifauna (e.g., sponges, corals), and soft sediments with cerianthid anemones
Acadian redfish	Adults	140-300 in Gulf of Maine, to 600 on slope	Offshore benthic habitats on finer grained sediments and on variable deposits of gravel, silt, clay, and boulders
American plaice	Juveniles	40-180	Sub-tidal benthic habitats on mud and sand, also found on gravel and sandy substrates bordering bedrock
American plaice	Adults	40-300	Sub-tidal benthic habitats on mud and sand, also gravel and sandy substrates bordering bedrock
Atlantic cod	Juveniles	Mean high water-120	Structurally-complex intertidal and sub-tidal habitats, including eelgrass, mixed sand and gravel, and rocky habitats (gravel pavements, cobble, and boulder) with

Species	Life Stage	Depth (meters)	Habitat Type and Description
			and without attached macroalgae and emergent epifauna
Atlantic cod	Adults	30-160	Structurally complex sub-tidal hard bottom habitats with gravel, cobble, and boulder substrates with and without emergent epifauna and macroalgae, also sandy substrates and along deeper slopes of ledges
Atlantic halibut	Juveniles & Adults	60-140 and 400-700 on slope	Benthic habitats on sand, gravel, or clay substrates
Atlantic herring	Eggs	May-90	Sub-tidal benthic habitats on coarse sand, pebbles, cobbles, and boulders and/or macroalgae
Atlantic sea scallop	Eggs	18-110	Inshore and offshore benthic habitats (see adults)
Atlantic sea scallop	Larvae	No information	Inshore and offshore pelagic and benthic habitats: pelagic larvae ("spat"), settle on variety of hard surfaces, including shells, pebbles, and gravel and to macroalgae and other benthic organisms such as hydroids
Atlantic sea scallop	Juveniles	18-110	Benthic habitats initially attached to shells, gravel, and small rocks (pebble, cobble), later free-swimming juveniles found in same habitats as adults
Atlantic sea scallop	Adults	18-110	Benthic habitats with sand and gravel substrates
Atlantic surfclams	Juveniles and adults	Surf zone to about 61, abundance low >38	In substrate to depth of 3 ft
Atlantic wolffish	Eggs	<100	Sub-tidal benthic habitats under rocks and boulders in nests
Atlantic wolffish	Juveniles	70-184	Sub-tidal benthic habitats
Atlantic wolffish	Adults	<173	A wide variety of sub-tidal sand and gravel substrates once they leave rocky spawning habitats, but not on muddy bottom
Barndoor skate	Juveniles and adults	40-400 on shelf and to 750 on slope	Sub-tidal benthic habitats on mud, sand, and gravel substrates
Black sea bass	Juveniles and adults	Inshore in summer and spring	Benthic habitats with rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas, also offshore clam beds and shell patches in winter
Clearnose skate	Juveniles	0-30	Sub-tidal benthic habitats on mud and sand, but also on gravelly and rocky bottom
Clearnose skate	Adults	0-40	Sub-tidal benthic habitats on mud and sand, but also on gravelly and rocky bottom
Deep-sea red crab	Eggs	320-640	Benthic habitats attached to female crabs
Deep-sea red crab	Juveniles	320-1300 on slope and to 2000 on seamounts	Benthic habitats with unconsolidated and consolidated silt-clay sediments
Deep-sea red crab	Adults	320-900 on slope and up to 2000 on seamounts	Benthic habitats with unconsolidated and consolidated silt-clay sediments
Golden tilefish	Juveniles and adults	100-300	Burrows in semi-lithified clay substrate, may also utilize rocks, boulders, scour depressions beneath boulders, and exposed rock ledges as shelter
Haddock	Juveniles	40-140 and as shallow as 20 in coastal Gulf of Maine	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel

Species	Life Stage	Depth (meters)	Habitat Type and Description
Haddock	Adults	50-160	Sub-tidal benthic habitats on hard sand (particularly smooth patches between rocks), mixed sand and shell, gravelly sand, and gravel and adjacent to boulders and cobbles along the margins of rocky reefs
Little skate	Juveniles	Mean high water-80	Intertidal and sub-tidal benthic habitats on sand and gravel, also found on mud
Little skate	Adults	Mean high water-100	Intertidal and sub-tidal benthic habitats on sand and gravel, also found on mud
Monkfish	Juveniles	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine, and to 1000 on the slope	Sub-tidal benthic habitats on a variety of habitats, including hard sand, pebbles, gravel, broken shells, and soft mud, also seek shelter among rocks with attached algae
Monkfish	Adults	50-400 in the Mid-Atlantic, 20-400 in the Gulf of Maine, and to 1000 on the slope	Sub-tidal benthic habitats on hard sand, pebbles, gravel, broken shells, and soft mud, but seem to prefer soft sediments, and, like juveniles, utilize the edges of rocky areas for feeding
Ocean pout	Eggs	<100	Sub-tidal hard bottom habitats in sheltered nests, holes, or rocky crevices
Ocean pout	Juveniles	Mean high water-120	Intertidal and sub-tidal benthic habitats on a wide variety of substrates, including shells, rocks, algae, soft sediments, sand, and gravel
Ocean pout	Adults	20-140	Sub-tidal benthic habitats on mud and sand, particularly in association with structure forming habitat types; i.e. shells, gravel, or boulders
Ocean quahogs	Juveniles and adults	9-244	In substrate to depth of 3 ft
Offshore hake	Juveniles	160-750	Pelagic and benthic habitats
Offshore hake	Adults	200-750	Pelagic and benthic habitats
Pollock	Juveniles	Mean high water-180 in Gulf of Maine, Long Island Sound, and Narragansett Bay; 40-180 on Georges Bank	Intertidal and sub-tidal pelagic and benthic rocky bottom habitats with attached macroalgae, small juveniles in eelgrass beds, older juveniles move into deeper water habitats also occupied by adults
Pollock	Adults	80-300 in Gulf of Maine and on Georges Bank; <80 in Long Island Sound, Cape Cod Bay, and Narragansett Bay	Pelagic and benthic habitats on the tops and edges of offshore banks and shoals with mixed rocky substrates, often with attached macro algae
Red hake	Juveniles	Mean high water-80	Intertidal and sub-tidal soft bottom habitats, esp those that provide shelter, such as depressions in muddy substrates, eelgrass, macroalgae, shells, anemone and polychaete tubes, on artificial reefs, and in live bivalves (e.g., scallops)
Red hake	Adults	50-750 on shelf and slope, as shallow as 20 inshore	Sub-tidal benthic habitats in shell beds, on soft sediments (usually in depressions), also found on gravel and hard bottom and artificial reefs
Rosette skate	Juveniles and adults	80-400	Benthic habitats with mud and sand substrates
Scup	Juveniles	No information	Benthic habitats, in association with inshore sand and mud substrates, mussel and eelgrass beds

Species	Life Stage	Depth (meters)	Habitat Type and Description
Scup	Adults	No information, generally overwinter offshore	Benthic habitats
Silver hake	Juveniles	40-400 in Gulf of Maine, >10 in Mid-Atlantic	Pelagic and sandy sub-tidal benthic habitats in association with sand-waves, flat sand with amphipod tubes, shells, and in biogenic depressions
Silver hake	Adults	>35 in Gulf of Maine, 70-400 on Georges Bank and in the Mid-Atlantic	Pelagic and sandy sub-tidal benthic habitats, often in bottom depressions or in association with sand waves and shell fragments, also in mud habitats bordering deep boulder reefs, on over deep boulder reefs in the southwest Gulf of Maine
Smooth skate	Juveniles	100-400 offshore Gulf of Maine, <100 inshore Gulf of Maine, to 900 on slope	Benthic habitats, mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks in the Gulf of Maine
Smooth skate	Adults	100-400 offshore Gulf of Maine, to 900 on slope	Benthic habitats, mostly on soft mud in deeper areas, but also on sand, broken shells, gravel, and pebbles on offshore banks in the Gulf of Maine
Summer flounder	Juveniles	To maximum 152	Benthic habitats, including inshore estuaries, salt marsh creeks, seagrass beds, mudflats, and open bay areas
Summer flounder	Adults	To maximum 152 in colder months	Benthic habitats
Spiny dogfish	Juveniles	Deep water	Pelagic and epibenthic habitats
Spiny dogfish	Female sub-adults	Wide depth range	Pelagic and epibenthic habitats
Spiny dogfish	Male sub-adults	Wide depth range	Pelagic and epibenthic habitats
Spiny dogfish	Female adults	Wide depth range	Pelagic and epibenthic habitats
Spiny dogfish	Male adults	Wide depth range	Pelagic and epibenthic habitats
Thorny skate	Juveniles	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 on slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
Thorny skate	Adults	35-400 offshore Gulf of Maine, <35 inshore Gulf of Maine, to 900 on slope	Benthic habitats on a wide variety of bottom types, including sand, gravel, broken shells, pebbles, and soft mud
White hake	Juveniles	Mean high water - 300	Intertidal and sub-tidal estuarine and marine habitats on fine-grained, sandy substrates in eelgrass, macroalgae, and un-vegetated habitats
White hake	Adults	100-400 offshore Gulf of Maine, >25 inshore Gulf of Maine, to 900 on slope	Sub-tidal benthic habitats on fine-grained, muddy substrates and in mixed soft and rocky habitats
Windowpane flounder	Juveniles	Mean high water - 60	Intertidal and sub-tidal benthic habitats on mud and sand substrates
Windowpane flounder	Adults	Mean high water - 70	Intertidal and sub-tidal benthic habitats on mud and sand substrates

Species	Life Stage	Depth (meters)	Habitat Type and Description
Winter flounder	Eggs	0-5 south of Cape Cod, 0-70 Gulf of Maine and Georges Bank	Sub-tidal estuarine and coastal benthic habitats on mud, muddy sand, sand, gravel, submerged aquatic vegetation, and macroalgae
Winter flounder	Juveniles	Mean high water - 60	Intertidal and sub-tidal benthic habitats on a variety of bottom types, such as mud, sand, rocky substrates with attached macro algae, tidal wetlands, and eelgrass; young-of-the-year juveniles on muddy and sandy sediments in and adjacent to eelgrass and macroalgae, in bottom debris, and in marsh creeks
Winter flounder	Adults	Mean high water - 70	Intertidal and sub-tidal benthic habitats on muddy and sandy substrates, and on hard bottom on offshore banks; for spawning adults, also see eggs
Winter skate	Juveniles	0-90	Sub-tidal benthic habitats on sand and gravel substrates, are also found on mud
Winter skate	Adults	0-80	Sub-tidal benthic habitats on sand and gravel substrates, are also found on mud
Witch flounder	Juveniles	50-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates
Witch flounder	Adults	35-400 and to 1500 on slope	Sub-tidal benthic habitats with mud and muddy sand substrates
Yellowtail flounder	Juveniles	20-80	Sub-tidal benthic habitats on sand and muddy sand
Yellowtail flounder	Adults	25-90	Sub-tidal benthic habitats on sand and sand with mud, shell hash, gravel, and rocks

4.2.2 *Identification of Habitat Areas of Particular Concern*

The EFH regulations developed by NMFS encourage regional Councils to identify Habitat Areas of Particular Concern (HAPC) and essential fish habitat areas (EFHAs) within areas designated as EFH (Figure 4.3). In New England, these HAPCs were created for juvenile cod and multi-species Fishery Management Plans (FMPs) and EFHAs for monkfish and multispecies FMPs. A few mid-Atlantic HAPCs for golden tilefish and EFHAs for tilefish, mackerel, squid, and butterfish FMPs overlap with the proposed area as well. The intent of this action is to help focus conservation priorities on specific habitat areas that play a particularly important role in the life cycles of federally managed fish species (Dobrzynski and Johnson 2001).

HAPC are defined based on the following criteria:

- The importance of the ecological function provided by the habitat
- The extent to which the habitat is sensitive to human-induced environmental degradation
- Whether and to what extent development activities are or will be stressing the habitat
- The rarity of the habitat type

The designation of HAPC has been approached in various ways according to the discretion of the different Councils. The following sections summarize the HAPC designated by the Councils for

EFH in the geographic area that could be affected by this action. Several of these HAPCs are also EFH areas closed to mobile, bottom-tending gear (trawls and dredges).

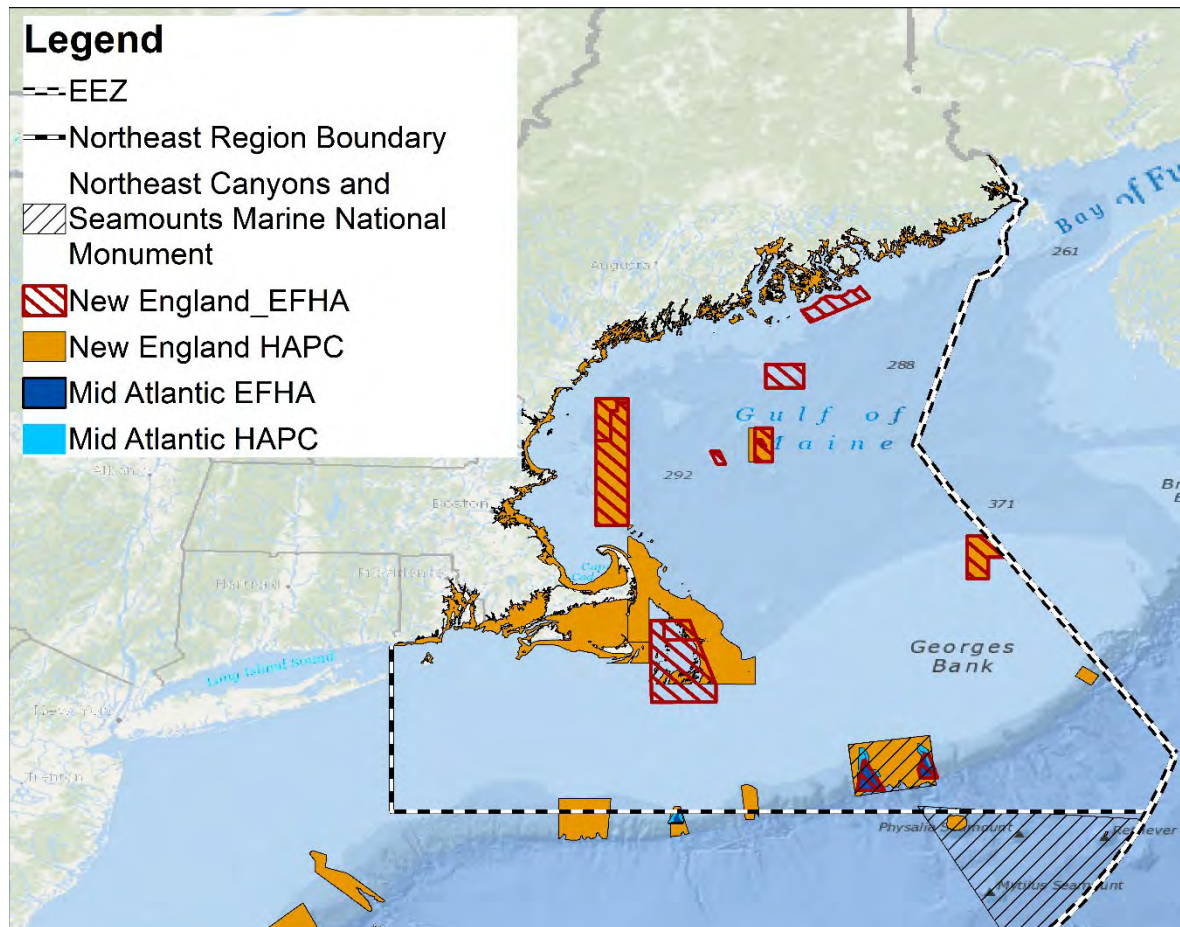


Figure 4.3: The Habitat Areas of Particular Concern (HAPC) and essential fish habitat currently protected from fishing (EFHA) within the proposed area, including those overseen by the Mid-Atlantic and New England Fishery Management Councils.

4.2.2.1 New England Fishery Management Council

The New England Fishery Management Council (NEFMC) previously designated discrete geographic areas as HAPC for two of its managed species (NEFMC 1998): Atlantic cod and Atlantic salmon. In 2018, NMFS approved the NEFMC's Omnibus Essential Fish Habitat Amendment 2, which revised EFH and HAPC in the region. Although corals are currently not listed as HAPCs in the northeast, they have been included as a component of HAPCs for managed species in the region that rely on complex hard bottom habitats where corals and other types of structure-forming organisms are found.

Atlantic Cod

For juvenile Atlantic cod, the NEFMC has designated a gravel/cobble bottom area on the northern edge of Georges Bank as HAPC. This area meets the first criterion for HAPC of providing an important ecological function, in that the gravel/cobble substrate provides a place

for newly settled juvenile cod to find shelter from predation, helping to decrease typically high mortality rates associated with the juvenile life stage. In addition, these areas are typically rich in important prey items. This habitat also meets the second HAPC criterion of sensitivity to human-induced environmental degradation, in that it is vulnerable to fishing practices that use mobile fishing gear.

Atlantic Salmon

The NEFMC has designated eleven rivers in Maine as HAPC for juvenile Atlantic salmon: the Dennys, Machias, East Machias, Pleasant, Narraguagus, Ducktrap, Kennebec, Penobscot, St. Croix, Tunk Stream, and Sheepscot Rivers provide habitat for the distinct population segment of Atlantic salmon. These rivers are also extremely vulnerable to anthropogenic threats, thus fulfilling the first two criteria for designation of Habitat Area of Particular Concern: provision of an important ecological function and sensitivity to human-induced environmental degradation.

Inshore Juvenile Cod

This area includes waters between 0-20 meters within the Gulf of Maine and Southern New England and recognizes inshore areas that are thought to be important for juvenile cod. This area consists of complex rocky-bottom habitat and meets the first two criteria for designation of Habitat Area of Particular Concern: provision of an important ecological function and sensitivity to human-induced environmental degradation.

Great South Channel Juvenile Cod

Important habitat for juvenile cod was identified near the Great South Channel and extends the shallow inshore juvenile cod HAPC with waters from 30 and 120 meters. It is characterized by structurally complex gravel, cobble, and boulder habitat and supports a highly productive benthic habitat. It also meets the first two criteria for designation of HAPC: provision of an important ecological function and sensitivity to human-induced environmental degradation.

Cashes Ledge

Cashes Ledge provides a unique and productive habitat characterized by rocky pinnacles. It provides areas of refuge from predators and supports several managed species. As such, it provides an important ecological function and is also sensitive to anthropogenic degradation.

Jeffreys Ledge/Stellwagen Bank

This area is shallow and has a variety of habitat types, such as gravel/cobble, boulder reefs, sand plains, and deep mud basins. It is not only known as a productive area for fishing but is also frequented by marine mammal species (CETAP 1982, Clapham 1993, Weinrich 2000). The area is sensitive to development and fishing activities and is currently closed to certain types of fishing.

Canyon/canyon complexes

Eleven canyons and canyon complexes located near Georges Bank and within the offshore of the Mid-Atlantic Bight were also designated as HAPC Concern because they support a variety of species and habitats. Five of these HAPCs (Heezen, Lydonia, Gilbert, Oceanographer, and Hydrographer) occur within the geographic area included in this action.

Deep Sea Coral Amendment

Though not an HAPC, the Omnibus Deep Sea Coral Amendment will protect deep-water corals and their sensitive habitat off the continental slope and deep sea canyons south of Georges Bank beginning at a depth of 600 meters and extends to the 200-mile Exclusive Economic Zone limit by prohibiting the use of bottom tending gear within the designated area (red crab pots exempt). The new protection zone encompasses 25,153 square miles, including 82 percent of the Northeast Canyons and Seamounts Marine National Monument (see Monument Section). It also protects corals from bottom tending mobile gear at Outer Schoodic Ridge and Mt. Desert Rock in the Gulf of Maine, and establishes a designated research area in Georges Basin. Once implemented, lobster and Jonah crab trap/pots would be restricted from this area. The Amendment is currently under review at the Office of Management and Budget and could be implemented by late 2021.

4.2.2.2 Mid-Atlantic Fishery Management Council

The Mid-Atlantic Fishery Management Council (MAFMC) has designated HAPC for summer flounder and tilefish. HAPC have not been designated for other species under the MAFMC's jurisdiction due to a lack of information linking habitat type with recruitment success.

Summer Flounder

Aggregations of submerged aquatic vegetation, defined as rooted, vascular, flowering plants that, except for some flowering structures, live and grow beneath the surface, have been identified as HAPC for summer flounder. More specifically, this designation includes all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations used by adults and juveniles. These HAPC meet the first criterion of an important ecological function, in that they provide both shelter from predators and sources of prey for the juvenile and larval stages of summer flounder (MAFMC 1998).

Tilefish

Clay outcrop habitats in four submarine canyons on the outer continental shelf at depths between 100 and 300 meters (MAFMC 2008). This habitat type is also referred to as a "pueblo village" – see Offshore Lobster Habitat, section 4.4.3.2. Five of these canyons (Lydonia, and Oceanographer) are located within the geographic range of the habitat VEC for this action (Figure 4.3). These HAPC meet three of the criteria required for designation: 1) they provide shelters for tilefish, which live in burrows that they dig in the clay; 2) this habitat type is rare, occurring only in areas on the outer continental shelf like the canyons where Pleistocene clay deposits are exposed; and 3) they are highly susceptible to damage and

loss from any type of disturbance, such as that caused by mobile, bottom-tending fishing gear. In addition, three of these canyons have been added to the National System of Marine Protected Areas (see Section 12.13).

4.2.2.3 Northeast Canyons and Seamounts Marine National Monument

On September 15, 2016, former President Barack Obama established the Northeast Canyons and Seamounts Marine National Monument (Monument) by [Presidential Proclamation 9496 \(81 FR 65159\)](#), under the authority of the Antiquities Act of 1906. The Monument consists of approximately 4,913 square miles (12,724 square kilometers) and is located about 130 miles east-southeast of Cape Cod (see Figure 4.3). Approximately the size of Connecticut, the monument includes two distinct areas, one that covers three canyons along the continental shelf and one that covers four seamounts. It is the first national marine monument in the Atlantic Ocean.

These undersea canyons and seamounts contain fragile and largely pristine deep marine ecosystems and rich biodiversity, including important deep sea corals, endangered whales and sea turtles, other marine mammals and numerous fish species. Relevant to this action, sperm whales are strongly attracted to the environments created by the submarine canyons, and fin and sei whales have been observed in both the canyons and seamounts areas. During aerial surveys, researchers have observed several marine mammals feeding, some accompanied by calves, indicating that this area is likely important as feeding and nursery habitat for many species of whales and dolphins. Marine mammal migration has also been noted to occur through the monument.

The submarine canyons and seamounts create dynamic currents and eddies that enhance biological productivity and provide feeding grounds. Because of the steep slopes of the canyons and seamounts, oceanographic currents that encounter them create localized eddies and result in upwelling. Currents lift nutrients, like nitrates and phosphates, critical to the growth of phytoplankton from the deep to sunlit surface waters. These nutrients fuel an eruption of phytoplankton and zooplankton that form the base of the food chain. Aggregations of plankton draw large schools of small fish and then larger animals that prey on these fish.

Under the original Presidential Proclamation, lobster and crab fishing in the Monument is allowed through September 15, 2023. In June 2020, former President Trump issued a Presidential Proclamation allowing all commercial fishing, as managed by the NEFMC, in the Monument. That decision is currently under review. Once the Deep Sea Coral Amendment is implemented (see Deep Sea Coral Amendment section), 82 percent of the Monument (waters 600 meters and deeper) will be protected from bottom tending gear (red crab pots exempt) if management remains the responsibility of the NEFMC.

4.2.3 American Lobster Habitats

With more than 1,926 actively fishing permit holders, the American lobster fishery accounts for the majority of affected vessels and gear regulated by the ALWTRP. Because lobster habitat may

be influenced by the proposed ALWTRP modifications, this section examines the unique aspects of lobster habitat in greater detail.

Bottom dwelling American lobster (*Homarus americanus*) is distributed throughout the Northwest Atlantic Ocean from Newfoundland to Cape Hatteras, North Carolina. Juvenile and adult American lobsters occupy a wide variety of benthic habitats from the intertidal zone to depths of 700 meters. They are most abundant in relatively shallow coastal waters. Temperature and salinity along with other characteristics of water, as well as substrate and diet, are critical habitat components (ASMFC 2015). They feed on a variety of plants and animals according to seasonal availability, and bait in lobster traps is believed to be an important food source in areas of intense fishing pressure ((Lawton and Lavalli 1995, Grabowski et al. 2010) cited in ASMFC 2015). Recent studies document and project future climate-driven changes in the northeast U.S. Atlantic waters that could shift lobster habitat to deeper offshore Gulf of Maine waters as nearshore and Southern New England waters warm to temperatures above lobster preferences (Tanaka et al., 2020).

The following description of lobster habitats in the northeast of the U.S. (Maine to North Carolina) is based primarily on a report prepared by Lincoln (1998) from a variety of primary source documents. Table 4.5 provides a summary of lobster densities by habitat type. This information has been supplemented by the addition of some more recent research results.

4.2.3.1 Inshore Lobster Habitats

Estuaries represent one key component of inshore lobster habitat, and encompass the following environments:

- **Mud Base with Burrows:** These habitats occur primarily in harbors and quiet estuaries with low currents. Lobster shelters are formed from excavations in soft substrate. This is an important habitat for juveniles and densities can be very high, reaching 20 animals per square meter.
- **Rock, Cobble and Gravel:** Juveniles and adolescents have been reported on shallow bottom with gravel and gravelly sand substrates in the Great Bay Estuary, New Hampshire; on gravel/cobble substrates in outer Penobscot Bay, Maine (Steneck and Wilson 1998); and in rocky habitats in Narragansett Bay, Rhode Island (Lawton and Lavalli 1985). Densities in Penobscot Bay exceeded 0.5 juveniles and 0.75 adolescents/m². According to unpublished information cited by Lincoln (1998) juvenile lobsters in Great Bay prefer shallow bottoms with gravelly sand substrates.
- **Rock/Shell:** Adult lobsters in the Great Bay Estuary utilize sand and gravel habitats in the channels, but appear to prefer a rock/shell habitat more characteristic of the high temperature, low salinity regimes of the central bay.

Inshore rock areas make up another important category of lobster habitat. These include the following:

- **Sand Base with Rock:** This is the most common inshore rock type in depths greater than 40 meters. It consists of sandy substrate overlain by flattened rocks, cobbles, and boulders. Lobsters are associated with abundant sponges, Jonah crabs, and rock crabs. Shelters are formed by excavating sand under a rock to form U-shaped, shallow tunnels. Densities of sub-adult lobsters are fairly high in these areas.
- **Boulders Overlaying Sand:** This habitat type is relatively rare in inshore New England waters. Compared to other inshore rocky habitats, lobster densities are low.
- **Cobbles:** Lobsters occupy shelters of varying size in the spaces between rocks, pebbles, and boulders. Densities as high as 16 lobsters/m² have been observed, making this the most densely populated inshore rock habitat for lobsters in New England.
- **Bedrock Base with Rock and Boulder Overlay:** This rock type is relatively common inshore, from low tide to depths of 15 to 45 meters. Shelters are formed by rock overhangs or crevices. Encrusting coralline algae and attached organisms such as anemones, sponges, and mollusks cover exposed surfaces. Green sea urchins and starfish are common. Cunner, tautog, sculpin, sea raven, and redfish are the most abundant fish. Lobster densities generally are low.
- **Mud-Shell/Rock Substrate:** This habitat type is usually found where sediment discharge is low and shells make up the majority of the bottom. It is best described off the Rhode Island coast. Lobster densities generally are low.

Table 4.5: A summary of American lobster habitats and densities

<i>Habitat Category</i>	<i>Habitat Subtypes</i>	<i>Lobster Densities (per sq. meter)</i>	<i>Lobster Sizes</i>	<i>Source</i>
<i>Estuaries</i>	Mud base with burrows	Up to 20	Small juveniles	Cooper and Uzmann, 1980
		< 0.01	Adults	Cooper and Uzmann, 1980
	Rock, cobble & gravel	> 0.5	Juveniles	Steneck and Wilson, 1998
		> 0.75	Adolescents	Steneck and Wilson, 1998
	Rock/shell	N.A.		
<i>Inshore Rock Types</i>	Sand base with rock	3.2	Avg. 40 mm carapace length	Cooper and Uzmann, 1980
	Boulders overlaying sand	0.09-0.13		Cooper and Uzmann, 1980
	Cobbles	Up to 16		Cooper and Uzmann, 1980
	Bedrock base with rock and boulder overlay	0.1-0.3		Cooper and Uzmann, 1980
	Mud-shell/rock substrate	0.15		Cooper and Uzmann, 1980
<i>Submarine Canyons</i>	Canyon rim and walls	0-0.0002	Adolescents and adults	Cooper et al., 1987
	Canyon walls	Up to 0.001	Adolescents and adults	Cooper et al., 1987
	Rim and head of canyons	0.0005-0.126	Adolescents and adults	Cooper et al., 1987

<i>Habitat Category</i>	<i>Habitat Subtypes</i>	<i>Lobster Densities (per sq. meter)</i>	<i>Lobster Sizes</i>	<i>Source</i>
	and at base of walls Pueblo villages	0.0005-0.126	Adolescents and adults	Cooper et al., 1987
Other	Peat	Up to 5.7		Barshaw and Lavalli, 1988
	Kelp beds	1.2-1.68	Adolescents	Bologna and Steneck, 1993
	Eel grass	<0.04	Juveniles and adolescents	Barshaw and Lavalli, 1988
		0.1	80% adolescents	Short et al., 2001
	Sand base with rock	N.A.		
	Clay base with burrows and depressions	Minimum 0.001		Cooper and Uzmann, 1980
	Mud-clay base with anemones	Minimum 0.001	50-80 mm carapace length in depressions	Cooper and Uzmann, 1980

Other lobster habitat types are significant. For example, kelp beds represent another form of lobster habitat. Kelp beds in New England consist primarily of *Laminaria longicruris* and *L. saccharina*. Lobsters were attracted to transplanted kelp beds at a nearshore study site in the mid-coast region of Maine, reaching densities almost ten times higher than in nearby control areas (Bologna and Steneck 1993). Lobsters did not burrow into the sediment, but sought shelter beneath the kelp. Only large kelp (greater than 50 cm in length) was observed sheltering lobsters and was used in the transplant experiments.

Lobster shelters also are formed from excavations cut into peat. Reefs form from blocks of salt marsh peat that break and fall into adjacent marsh creeks and channels and appear to provide moderate protection for small lobsters from predators (Barshaw and Lavalli 1988). Densities are high (up to 5.7/m²) in these areas.

Lobsters have been associated with eelgrass beds in the lower portion of the Great Bay Estuary in New Hampshire (Short et al. 2001). Eighty percent of the lobsters collected from eelgrass beds were adolescents. Average density was 0.1/m², higher than reported by Barshaw and Lavalli (1988). In mesocosm experiments, Short et al. reported that lobsters showed a clear preference for eelgrass over bare mud. This research showed that adolescent lobsters burrow in eelgrass beds, utilize eelgrass as an overwintering habitat, and prefer eelgrass to bare mud.

Finally, research in Maine has demonstrated the presence of early settlement, postlarval, and juvenile lobsters in the lower intertidal zone (Cowan 1999). Two distinct size classes were consistently present: three to 15 mm and 16 to 40 mm. Monthly mean densities during a five-year period ranged from zero to 8.6 individuals/m² at 0.4 meters below mean low water. Preliminary results indicate that areas of the lower intertidal zone serve as nursery grounds for juvenile lobster.

4.2.3.2 Offshore Lobster Habitats

Offshore areas supply several types of lobster habitat. First, more than 15 submarine canyons cut into the shelf edge on the south side of Georges Bank. These canyons were first surveyed in the 1930s, but were not fully explored until manned submersibles were used extensively in the

1980s. Detailed information on canyon habitats for American lobster are available primarily for Oceanographer Canyon, but this information is generally applicable to other major canyons on Georges Bank. Concentrations of adolescents and adult lobsters are substantially greater in submarine canyons than in nearby areas that are occupied mostly by adults (Cooper and Uzmann 1980, Cooper et al. 1987). These canyons present a diverse group of habitat types:

- **Canyon Rim and Walls:** Sediments consist of sand or semi-consolidated silt with less than five percent overlay of gravel. The bottom is relatively featureless. Burrowing mud anemones are common but lobster densities are low.
- **Canyon Walls:** Sediments consist of gravelly sand, sand, or semi-consolidated silt with more than five percent gravel. The bottom is relatively featureless. Burrowing mud anemones are common, as are Jonah crabs, ocean pout, starfish, rosefish, and red hake. Lobster densities are somewhat higher than in substrates that contain less gravel (see above).
- **Rim and Head of Canyons at Base of Walls:** Sand or semi-consolidated silt substrate is overlain by siltstone outcrops and talus up to boulder size. The bottom is very rough and is eroded by animals and current scouring. Lobsters are associated with rock anemones, Jonah crabs, ocean pout, tilefish, starfish, conger eels, and white hake. Densities are highly variable, but reach as high as 0.13 lobsters/m².
- **Pueblo Villages:** This habitat type exists in the clay canyon walls and extends from the heads of canyons to middle canyon walls. It is heavily burrowed and excavated. Slopes range from five to 70 degrees, but are generally between 20 and 50 degrees. Juvenile and adult lobsters and associated fauna create borings up to 1.5 meters in width, one meter in height, and two meters or more in depth. Lobsters are associated with Jonah crabs, tilefish, hermit crabs, ocean pout, starfish, and conger eels. This habitat may well contain the highest densities of lobsters found offshore.

In addition to canyons, lobster are associated with several other offshore habitat types, including the following:

- **Sand Base with Rocks:** Although common inshore (see above), this habitat is rather restricted in the offshore region except along the north flank of Georges Bank.
- **Clay Base with Burrows and Depressions:** This habitat is common on the outer continental shelf and slope. Lobsters excavate burrows up to 1.5 meters long. There are also large, bowl-like depressions that range in size from one to five meters in diameter and may shelter several lobsters at a time. Minimum densities of 0.001 lobsters/m² have been observed in summer.
- **Mud-Clay Base with Anemones:** This is a common habitat for lobsters on the outer shelf or upper slope. Forests of mud anemones (*Cerianthus borealis*) may reach densities of three or four per square meter. Depressions serve as shelter for relatively small lobsters at minimum densities of 0.001/m².

- **Mud Base with Burrows:** This habitat occurs offshore mainly in the deep basins, in depths up to 250 meters. This environment is extremely common offshore. Lobsters occupy this habitat, but no density estimates are available.

4.2.4 *Impact of Fishing on Essential Fish Habitat*

The environmental impact analysis presented in Chapter 5 of this Final Environmental Impact Statement includes a discussion of how the ALWTRP may affect fishing gear and fishing practices, and subsequently influence marine habitat. Experts believe that fixed fishing gear (e.g. pots/traps) has a more direct impact on benthic habitat than on non-benthic (water column) habitat because it generally comes in contact with the seafloor. Therefore, the sections below review how fishing can affect marine habitat, with a primary focus on benthic habitat and on the potential effects of towed gear (bottom trawls and dredges) which cause more widespread disturbance to seafloor habitats than fixed gear (Stevenson et al. 2004). The potential effects examined include:

- Alteration of physical structure;
- Mortality of benthic organisms;
- Changes to the benthic community and ecosystem;
- Sediment suspension; and
- Chemical modifications.

4.2.4.1 **Alteration of Physical Structure**

Any type of fishing gear that is towed, dragged, or dropped on the seabed will disturb the sediment and the resident community to varying degrees. The intensity of disturbance is dependent on the type of gear, how long the gear is in contact with the bottom, sediment type, sensitivity of habitat features in contact with the gear, and frequency of disturbance. Physical effects of fishing gear, such as ploughing, smoothing of sand ripples, removal of stones, and turning of boulders, can act to reduce the heterogeneity of the sediment surface. For example, boulder piles, crevices, and sand ripples can provide fish and invertebrates hiding areas and a respite from currents and tides. Removal of taxa, such as worm tubes, corals, and gorgonians that provide relief, and the removal or shredding of submerged vegetation, can also occur, thereby reducing the number of structures available to biota as habitat.

Most studies on habitat damage due to fishing gear focus on the effects of bottom trawls and dredges. It has been noted by Rogers et al. (1998) that the reason there are few accounts of static gear (e.g. traps/pots) having measurable effects on benthic biota may be because the area of seabed affected by such gear is almost insignificant when compared to the widespread effects of mobile gear. It is possible that benthic structures (both living and non-living) could be affected as traps/pots are dropped or dragged along the bottom. Most studies investigating small numbers of trap or pots per buoy line (1-3) have found minimal, short-term negative impacts on physical structures (Eno et al. 2001, Chuenpagdee et al. 2003, Stephenson et al. 2017). Similarly, a panel of experts that evaluated the habitat impacts of commercial fishing gears used in the northeast of the U.S. (Maine to North Carolina) found bottom-tending static gear (e.g. traps/pots) to have a minimal effect on benthic habitats when compared to the physical and biological impacts caused

by bottom trawls and dredges (NMFS 2002). The vulnerability of benthic EFH for all managed species in the region to the impacts of pots/traps and bottom gill nets is considered to be low (NMFS 2004). However, less is known about longer trap/pot trawls and there is limited information that trawls with 20 or more pots may have impacts more similar to mobile gear, though at a smaller spatial scale (Schweitzer et al. 2018).

4.2.4.2 Mortality of Benthic Organisms

In addition to effects on physical habitat, fishing gear can cause direct mortality to emergent epifauna. In particular, erect, foliose fauna or fauna that build reef-like structures have the potential to be destroyed by towed gear, longlines, or traps/pots (Hall 1999). Physical structure of the biota sometimes determines their ability to withstand and recover from the physical impacts of fishing gear. For example, thinner shelled bi-valves and sea stars often suffer higher damage than solid shelled bi-valves (Rumohr and Krost 1991). Animals that can retract below the penetration depth of the fishing gear and those that are more elastic and can bend upon contact with the gear also fare much better than those that are hard and inflexible (Eno et al. 2001). Longer trap/pot trawls likely pose a greater threat to benthic organisms than individual trap/pots or short trap/pot trawls (Schweitzer et al. 2018).

4.2.4.3 Changes to Benthic Communities and Ecosystems

The mortality of benthic organisms as a result of interaction with fishing gear can alter the structure of the benthic community, potentially causing a shift in the community from low-productive long-lived species (k-selected species) to highly-productive, short-lived, rapidly-colonizing species (r-selected species). For example, motile species that exhibit high fecundity and rapid generation times will recover more quickly from fishery-induced disturbances than non-mobile, slow-growing organisms, which may lead to a community shift in chronically fished areas (Levin 1984).

Increased fishing pressure in a certain area may also lead to changes in species distribution. Changes (e.g., localized depletion) could be evident in benthic, demersal, and even pelagic species. Scientists have also speculated that mobile fishing may lead to increased populations of opportunistic feeders in chronically fished areas.

4.2.4.4 Sediment Suspension

Resuspension of sediment can occur as fishing gear is pulled or dragged along or immediately above the seafloor (NMFS 2002). Although resuspension of sediment is typically associated with mobile fishing gear, it also can occur with gear such as traps/pots.

Chronic suspension of sediments and resulting turbidity can affect aquatic habitat by reducing available light for photosynthesis, burying benthic biota, smothering spawning areas, and causing negative effects on feeding and metabolic rates. If it occurs over large areas, resuspension can redistribute sediments, which has implications for nutrient budgets (Mayer et al. 1991, Messieh et al. 1991, Black and Parry 1994, Pilskaln et al. 1998).

Species' reaction to turbidity depends on the particular life history characteristics of the organism. Effects are likely to be more significant in waters that are normally clear as compared to areas that typically experience high naturally induced turbidity (Kaiser 2000). Mobile organisms can move out of the affected area and quickly return once the turbidity dissipates (Coen 1995). Even if species experience high mortality within the affected area, those with high levels of recruitment or high mobility can re-populate the affected area rapidly. However, sessile or slow-moving species would likely be buried and could experience high mortality. Furthermore, if effects are protracted and occur over a large area, recovery through recruitment or immigration will be hampered. Additionally, chronic resuspension of sediments may lead to shifts in species composition by favoring those species that are better suited to recover or those that can take advantage of the additional nutrient supply as the nutrients are released from the seafloor to the euphotic zone (Churchill 1989).

4.2.4.5 Chemical Modifications

Disturbances associated with fishing gear also can cause changes in the chemical composition of the water column overlying affected sediments. In shallow water, the impacts may not be noticeable relative to the mixing effects caused by tidal surges, storm surges, and wave action. However, in deeper, calmer areas with more stable waters, the changes in chemistry may be more evident (NMFS 2002). Increases in ammonia content, decreases in oxygen, and pulses of phosphate have been observed in North Sea waters, although it is not clear how these changes affect fish populations. Increased incidence of phytoplankton blooms could occur during seasons when nutrients are typically low. The increase in primary productivity could have a positive effect on zooplankton communities and on organisms up the food chain.

Eutrophication, often considered a negative effect, could also occur. However, it is important to note that these releases of nutrients to the water act to recycle existing nutrients and, thereby, make them available to benthic organisms rather than add new nutrients to the system (ICES 1992). This recycling is thought to be less influential in the eutrophication process than the input of new nutrients from rivers and land runoff.

4.3 Human Communities

The following discussion examines the economic and social environment that would be impacted by modifications to the ALWTRP. The human communities that may be affected are discussed, particularly communities whose social and economic fabric depends in part upon commercial fishing operations that must comply with Plan requirements. The fisheries that may be affected under modifications considered within the scope of this Environmental Impact Statement are the U.S. lobster and Jonah crab trap/pot fisheries in the Northeast Region.

After describing the sources of data used, the sections below provide a baseline socio-economic characterization of these fisheries, discussing fishery management regulations, numbers of permitted vessels, landings, revenue, and key ports. The final section references the communities potentially affected by modifications to the Plan.

4.3.1 *Data Sources*

The analyses presented in this section are based primarily on data collected and maintained by NMFS' Greater Atlantic Regional Fisheries Office (GARFO), NEFSC, and Atlantic Coastal Cooperative Statistics Program (ACCSP). The data represent the best available information on the northeast coast fishing activity. Below, we describe the databases used and highlight key sources of uncertainty in the analyses.

4.3.1.1 NMFS NEFSC/ACCSP Dealer Data

In the Northeast, all seafood dealers handling the catch of federally-permitted vessels are required to hold dealer permits. NMFS requires that dealers to submit reports on the catch that they purchase. Specifically, a dealer must submit a report to NMFS for each fishing trip from which it purchased catch. Each dealer report includes information on:

- date of purchase;
- dealer name and address;
- dealer number;
- vessel name and permit number;
- pounds of each species, by market category, if applicable;
- value of each species, by market category, if applicable; and
- port landed

Field office staff enter data into a coded form and send the data to the NEFSC to be incorporated into NMFS' larger Oracle database.

Analyses based on the dealer data warrant the following caveats:

- The purchase reports that seafood dealers submit to NMFS are not required to provide information on the gear used to land the catch reported. This information is deduced by each individual NMFS Field Office based on personal knowledge of the vessel's primary gear, the predominant species caught on the trip, or firsthand information from the fisherman. Therefore, breakouts of catch by gear type are subject to uncertainty.
- NMFS records only one gear type per dealer report. Thus, if two or more types of gear were used to catch different species during a trip listed on the same dealer report, only the primary gear used on the trip will be noted and gear used to catch secondary species maybe mischaracterized. This creates further uncertainty regarding gear types.

4.3.1.2 Permit Data

Fishermen are required to hold permits to fish for all federally managed species.³ Permit requirements are included as part of the Fishery Management Plans developed by the regional Councils and/or the Atlantic States Marine Fisheries Commission (ASMFC) and implemented by NMFS. Permit data are collected when fishermen apply to renew their fishing permits.

³ Fisheries may be managed by NMFS or by cooperative agreement between NMFS and the individual states

The characterization of affected fisheries relies on permit data to identify the number of vessels that may target a particular species. The analysis distinguishes between commercial and charter/party permits using permit category data. Because fishermen may not actually target all species for which they hold permits, this approach may lead to an overestimate of the number of vessels actively involved in a fishery.

The analysis also relies on permit data to identify the number of vessels likely to fish with gear regulated under the Plan. When applying for permits in the Northeast Region, fishermen are required to indicate what gear they are likely to use, although they are not restricted to the use of this gear (unless stipulated in the American Lobster FMP). As a result, the permit database indicates the gear the permit holder intended to use when the permit application was filed, not necessarily the gear currently used. The degree of inaccuracy that stems from this data limitation is unknown, but is likely minor. In addition to the caveat above, it is important to note that permit applications can designate multiple types of gear (ranked by likelihood of use). For characterizing affected fisheries, the analysis examines the distribution of permits by both primary gear (i.e., the gear that the permit holder is most likely to use) and all gear noted on the permit application. This approach provides a more accurate indication of the number of vessels that may be affected by Plan requirements.

4.3.1.3 Affected Fisheries

The American lobster (*Homarus americanus*) and Jonah crab (*Cancer borealis*) fisheries are the trap/pot fisheries in the Northeast Region that would be affected by the risk reduction measures identified in Alternatives 2 and 3, and are described in detail below. Other trap/pot fisheries would not be regulated by the Plan, and are not analyzed here. The Team will be asked to develop recommendations to reduce risk by 60 to 80 percent for U.S. fisheries along the entire Atlantic coast.

4.3.1.3.1 American Lobster

The American lobster is a bottom-dwelling, marine crustacean characterized by a large shrimp-like body and ten legs, two of which are enlarged to serve as crushing and gripping appendages. American lobster range extends from Newfoundland south to the Mid-Atlantic region. In the U.S. waters, the species is most abundant from the inshore waters of Maine to Cape Cod, Massachusetts, and the abundance declines from north to south (ASMFC 2015). In the Gulf of Maine, the inshore fishery dominates the industry, accounting for the highest percentage of lobster harvest. The offshore fishery dominates in the Georges Bank stock unit; however, in recent years the landings of catch from the inshore portion of Georges Bank (Statistical Area 521) has increased substantially. While historically, the inshore fishery dominated in Southern New England, since the late 1990s the offshore fishery has accounted for the largest portion of the total landed catch (ASMFC 2015).

Lobster growth and reproduction are linked to the molting cycle. Lobsters are encased in a hard external skeleton that provides body support and protection. Periodically, this skeleton is cast off to allow body size to increase and mating to take place. Eggs (7,000 to 80,000) are extruded and

carried under the female's abdomen during a 9 to 11 month incubation period. The eggs hatch during late spring or early summer and the pelagic larvae undergo four molts before attaining adult characteristics and settling to the bottom. Lobsters typically reach legal, commercial size after five to seven growing seasons, or approximately 20 molting cycles.

Several types of gear are used in the American lobster fishery, but the majority of landings are associated with traps/pots. In 2019, 124 million out of 127 million pounds (about 98 percent) of lobsters were landed using traps/pots. Traps/pots may be set singly, each having its own buoy line and buoy, or in multiple-trap/pot "trawls" where the traps/pots are linked together by groundlines, with buoy lines and buoys (or high flyers) at the first and/or last trap/pot. Traps/pots are further divided into general categories: inshore and offshore traps/pots. Inshore fleet is comprised mainly of small vessels (22 to 42 feet/6.7 to 12.8 meters) that make day trips in nearshore waters (< 12 nm/22.2 km), while offshore fishery has larger boats (55+ ft/16.8 m) that make multi-day trips to the edge of the continental shelf (ASMFC 2015).

Harvest levels of American lobster first prompted concern in the 1970s, resulting in the first Fishery Management Plan (FMP) for the American lobster, adopted in 1983. This first FMP called for fishing effort limits, minimum carapace size requirements, a prohibition on the possession of egg-bearing (or "berried") lobsters, and a prohibition on landing lobster parts. Since that time, a number of plan amendments have been developed for both state and federal waters. In December 1999, NMFS issued a Final Rule (64 FR 68228) transferring the federal lobster fishery regulations created under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (50 CFR Part 649) to the state-oriented Atlantic Coastal Fisheries Cooperative Management Act (Atlantic Coastal Act) (50 CFR Part 697). This decision recognized that the federal FMP, which covered only federal waters, was insufficient to address overfishing.

Currently, the American lobster fishery is managed under Amendment 3 of the ASMFC's American Lobster Interstate Fishery Management Plan, as well as Addenda I through XXVI to the plan. Adopted in December 1997, primary regulatory measures under Amendment 3 include carapace size limits, protection of ovigerous females, gear restrictions, and nominal effort control measures. In addition, Amendment 3 created seven lobster management areas (LMAs; Figure 4.4). These include the Inshore Gulf of Maine (LMA 1), Inshore Southern New England (LMA 2), Offshore Waters (LMA 3), Inshore Northern Mid-Atlantic (LMA 4), Inshore Southern Mid-Atlantic (LMA 5), New York and Connecticut State Waters (LMA 6), and Outer Cape Cod (OCC). Lobster Conservation Management Teams (LCMTs), composed of industry representatives, were formed for each management area. They advise the American Lobster Management Board and recommend changes to the management plan within their area.

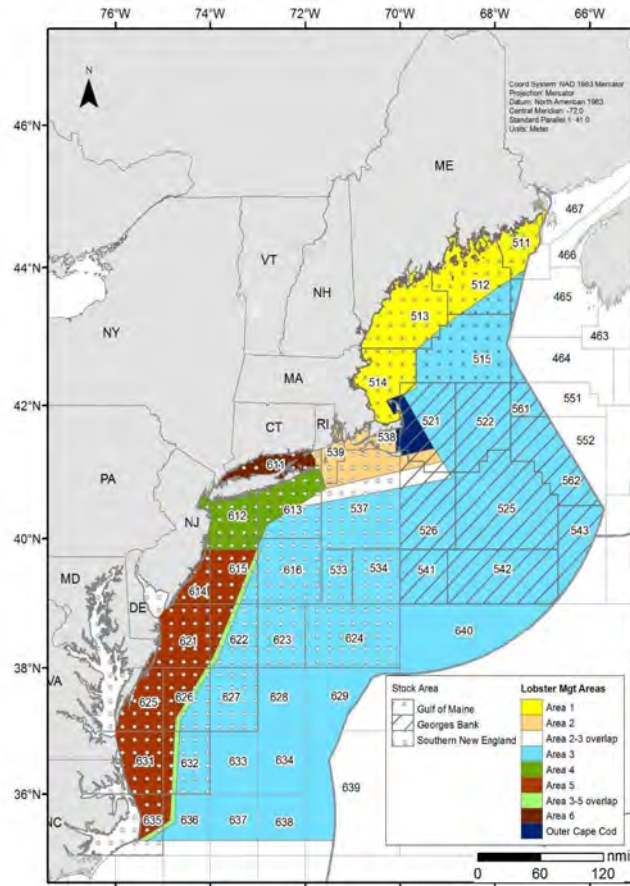


Figure 4.4: American lobster management areas and stock boundaries

Under federal regulations for the American lobster fishery outside of state waters, only limited access federal permits are issued. No new entrants are allowed, although in some LMAs, permits may be bought, sold, and transferred to another vessel. GARFO permit data indicate that 1,926 vessels were issued federal commercial lobster permits in fishing year 2019 (not including for hire boats). The number of commercial trap/pot vessels that hold federal permits for each LMA is presented in Table 4.6. Each state sets its own requirements for trapping/potting lobsters in state waters. State-permitted operators who wish to fish in federal waters must also hold a federal permit and abide by the more restrictive of the two (Federal or state) regulations.

Lobster has consistently ranked among the Atlantic coast's most commercially important species. In 2019, dealer data shows total revenue of more than \$637 million up from approximately \$404 million in 2010. Additional detail on annual lobster landings and average ex-vessel revenue between 2010 and 2019 is presented in Table 4.7.

The greater abundance of lobster in northern waters is reflected in the distribution of landings by state. Maine consistently accounts for the greatest share of the lobster catch, with landings in 2019 of approximately 102 million pounds. Massachusetts, the second leading producer, had landings in 2019 of 17 million pounds. Together, Maine and Massachusetts accounted for about 94 percent of total national landings. Lobster landings by state for 2010 to 2019 are presented in Table 4.8.

Table 4.6: Federal commercial lobster trap/pot permits by LMA in fishing years 2010 – 2019. A single permit could be issued for more than one LMA. Permits that were issued by fishing year 2019 extend from May 1, 2019 to April 30, 2020 (GARFO permit data).

Year	Total	LMA 1	LMA 2	LMA 3	LMA 4	LMA 5	LMA 6	OCC
2010	2,460	1,946	405	106	68	47	60	153
2011	2,455	1,964	382	105	71	44	62	139
2012	2,394	1,900	376	110	67	45	56	136
2013	2,297	1,746	356	105	62	42	52	126
2014	2,313	1,779	343	105	61	41	51	120
2015	2,136	1,758	166	100	56	41	46	20
2016	2,124	1,745	165	98	57	40	43	22
2017	1,932	1,578	150	94	59	38	42	17
2018	1,918	1,569	147	91	60	40	38	16
2019	1,926	1,569	147	91	60	40	35	16

Table 4.7: American lobster landings in the Northeast and Mid-Atlantic United States from 2010 to 2019. All values and prices are nominal (ACCSP Data Warehouse, 2021)

Year	Weight (million lb)	Value (million \$)	Price (\$/lb)
2010	117.6	\$404.1	\$3.4
2011	126.3	\$422.9	\$3.3
2012	150.7	\$431.5	\$2.9
2013	150.5	\$460.8	\$3.1
2014	148.0	\$567.1	\$3.8
2015	147.0	\$622.1	\$4.2
2016	159.5	\$670.5	\$4.2
2017	137.0	\$567.4	\$4.1
2018	148.0	\$631.8	\$4.3
2019	127.2	\$636.7	\$5.0

Table 4.8: Lobster landing weight (million pounds) by state from 2010 to 2019.

	ME	NH	MA	RI	CT-NC	Total
2010	96.2	3.6	12.8	2.9	2.0	117.6
2011	105.0	3.9	13.4	2.8	1.3	126.3
2012	127.5	4.2	14.5	2.7	1.5	150.4
2013	128.0	3.8	15.2	2.2	1.1	150.3
2014	125.0	4.4	15.3	2.4	1.0	148.0

		ME	NH	MA	RI	CT-NC	Total
2015		122.7	4.7	16.5	2.3	0.9	147.0
2016		132.7	5.8	17.8	2.3	0.9	159.4
2017		112.1	5.5	16.5	2.0	0.8	136.9
2018		121.3	6.1	17.7	1.9	0.5	147.5
2019		101.9	6.0	17.0	1.8	0.5	127.2

Table 4.9: The top ten American lobster landing ports in 2019. Ports are listed in descending order based on the weight of total landings (ACCSP Data Warehouse, 2021).

Port	County	State	Weight (million lb)	Value (million \$)
Stonington	Hancock	ME	10.3	\$48.8
Vinalhaven	Knox	ME	7.6	\$39.2
Beals	Washington	ME	6.0	\$21.6
Friendship	Knox	ME	5.0	\$26.6
Newington	Rockingham	NH	4.3	\$26.6
Gloucester	Essex	MA	3.9	\$22.4
Spruce Head	Knox	ME	3.8	\$18.4
Jonesport	Washington	ME	2.9	\$10.3
Portland	Cumberland	ME	2.8	\$15.0
Milbridge	Washington	ME	2.8	\$12.3
Top 10 Total			49.4	\$241.2
Industry Total			127.2	\$636.7
Top 10 ports %			39%	38%

Table 4.9 provides additional data on the distribution of lobstering activity, highlighting the top ten grossing ports for lobster in 2019. As shown, Maine ports account for a significant portion of the total lobster catch. However, most lobster were landed at smaller ports along the New England coast, rather than at a single dominant port. The total landing pounds of the top ten ports was 49.4 million, accounting for 39 percent of the industry total landings in 2019.

4.3.1.3.2 Jonah Crab

Jonah crab is distributed in the waters of the Northwest Atlantic Ocean primarily from Newfoundland, Canada to Florida. The life cycle of Jonah crab is poorly described and what is known is largely compiled from a patchwork of studies. Female crabs are believed to move nearshore during the late spring and summer and then return offshore in the fall and winter. The reasons for this inshore migration are unknown, but maturation, spawning and molting have all been postulated. Due to the lack of a widespread and well-developed aging method for crustaceans, the age and growth of Jonah crab is poorly described. (ASMFC, 2018) Like other cancer crab species, Jonah crab consumes a variety of prey including snails, arthropods, algae, mussels and polychaetes.

Jonah crab is managed under the Interstate Fishery Management Plan (FMP) for Jonah Crab (ASMFC, 2015) and its three addenda. The plan lays out specific management measures in the commercial fishery, including a 4.75 inch (12.07 cm) minimum size with zero tolerance and a prohibition on the retention of egg-bearing females, and requiring harvesters to have a lobster permit. Addendum I (May 2016), establishes a bycatch limit of 1,000 crabs per trip for non-trap gear (e.g., otter trawls, gillnets) and non-lobster trap gear (e.g., fish, crab, and whelk pots). Addendum II (February 2017) establishes a coast-wide standard for claw harvest to respond to concerns regarding the equity of the claw provision established in the FMP. Specifically, the Addendum allows Jonah crab fishermen to detach and harvest claws at sea, with a required minimum claw length of 2.75 inches (6.99 cm) if the volume of claws landed is greater than five gallons. Addendum III (February 2018) addresses concerns regarding deficits in existing lobster and Jonah crab reporting requirements by expanding the mandatory harvester reporting data elements, improving the spatial resolution of harvester data, establishing a 5-year timeline for implementation of 100 percent harvester reporting, and prioritizing the development of electronic harvester reporting. Federal regulations complementing the FMP and Addenda I and II became effective on December 12, 2019.

Jonah crabs are primarily caught in pots and traps and have long been taken as incidental catch in the lobster fishery, or more recently as a secondary target, in the lobster fishery. On average, less than one percent of the catch are identified to come from dredges and trawls (ASMFC 2015). Table 4.10 shows that in 2019, pots and traps are still the primary gears used to harvest Jonah crabs. Other gears include dredge, gill nets, hand line, trawls and long lines.

Table 4.10: 2019 Jonah crab landings in pounds by gear type (ACCSP 2021)

Gear Type	Landing Pounds	Percentage
Pots and Traps	14,381,505	89.94%
Trawls	133,293	0.83%
Dredge	54,027	0.34%
Long Lines	4,179	0.03%
Gill Nets	1,938	0.01%
Other Gears	1402.5	0.01%
Hand Line	151	0%
Not Coded	1,413,151	8.84%
Total	15,989,645	100%

Table 4.11: Jonah crab landings by state from 2010 to 2019 (ACCSP 2021)

Year	MA Weight (million lb)	MA Value (million \$)	RI Weight (million lb)	RI Value (million \$)	Other weight (million lb)	Other Value (million \$)	Total Weight (million lb)	Total Value (million \$)
2010	5.7	\$3.2	3.7	\$1.9	2.3	\$0.9	11.7	\$6.0
2011	5.4	\$3.6	3.2	\$1.8	1.4	\$0.6	9.9	\$6.0
2012	7.5	\$5.6	3.8	\$2.6	1.2	\$0.6	12.6	\$8.8

Year	MA Weight (million lb)	MA Value (million \$)	RI Weight (million lb)	RI Value (million \$)	Other weight (million lb)	Other Value (million \$)	Total Weight (million lb)	Total Value (million \$)
2013	10.1	\$9.1	4.7	\$3.3	1.3	\$0.8	16.1	\$13.3
2014	11.9	\$9.3	4.4	\$3.3	1.1	\$0.9	17.4	\$13.5
2015	9.1	\$6.9	4.3	\$3.0	0.8	\$0.5	14.3	\$10.4
2016	10.7	\$8.2	4.2	\$3.3	1.2	\$0.8	16.1	\$12.3
2017	11.7	\$11.5	4.1	\$3.9	1.8	\$1.3	17.6	\$16.7
2018	13.3	\$12.5	4.6	\$4.3	2.2	\$1.8	20.1	\$18.5
2019	9.7	\$8.1	4.2	\$3.4	2.1	\$1.6	16.0	\$13.1

The value of Jonah crab has increased recently, and along with declining lobster stocks in Southern New England, has resulted in higher landings. Landings fluctuated between approximately two and three million pounds throughout the 1990s (ASMFC 2015). By 2005, landings increased to over seven million pounds and then to over 20 million pounds in 2018, and dropped to 16 million pounds in 2019. Landings in 2019 predominantly came from Massachusetts (61 percent), followed by Rhode Island (26 percent), New Hampshire and Maine (five percent). Connecticut, New Jersey, and Maryland accounted for a combined eight percent of landings. MA and RI together contribute more than 85 percent of Jonah crab landings and value throughout the years (Table 4.11).

Table 4.12 The top landing ports for the Jonah crab fishery in 2019 (ACCSP 2021).

Rank	State	Port	Weight (million lb)	Value (million \$)
1	MA	New Bedford	7.5	6.1
2	RI	Newport	1.9	1.5
3	RI	Point Judith	1.7	1.3
4	MA	Sandwich	1.6	1.5
5	NJ	Point Pleasant	0.8	0.7

Top landing ports of Jonah crab are mostly located in Southern Massachusetts and Rhode Island. Using 2014 Massachusetts and Rhode Island landings data (accounting for approximately 95 percent of all 2014 landings), Jonah crabs are primarily harvested from Statistical Area 537 (71 percent), followed by 526 (10 percent) and 525 (10 percent) (Figure 4.5, ASMFC DEIS 2018). Table 4.12 shows the top five Jonah crab landing ports in 2017. New Bedford and Newport, Rhode Island located in Southern New England have been the leading landing ports for years.

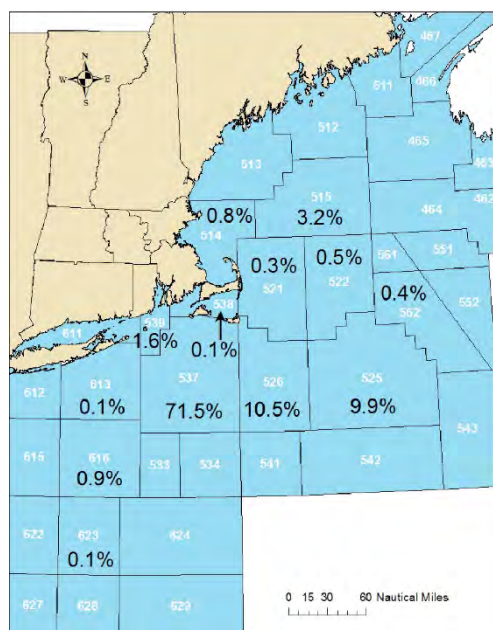


Figure 4.5: 2014 MA and RI Jonah crab landings by statistical area

4.4 Affected Communities

Appendix 4.4 describes the social and cultural setting of the communities potentially affected by the proposed modifications to the ALWTRP.

Although rulemaking is being done under the Marine Mammal Protection Act, communities described are as defined by the Magnuson-Steven Act: “a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community.” Potentially affected communities were identified by looking at the ports of landings, and by the distribution of lobster and Jonah crab harvesters across Maine, New Hampshire, Massachusetts, Rhode Island, and associated fishery management areas, then identifying the towns in which those harvesters reside. Geographically, the vast majority of trap/pot landings from LMAs 1, 2, 3, and Outer Cape Cod are from ports in Maine, New Hampshire, Massachusetts, and Rhode Island. Social and cultural characteristics of the towns with the strongest participation in the affected trap/pot fisheries are described in Appendix 4.2. Social indicators considered here are divided into three categories: Social Vulnerability Indices, Gentrification Pressure Indices and Fishing Engagement and Reliance Indices. The explanation of social indicators used in Appendix 4.2 are listed in Appendix 4.3.

Among all indicators, Commercial Engagement and Commercial Reliance are most relevant to our analysis. Commercial Engagement measures the presence of commercial fishing through fishing activity as shown through permits and vessel landings. A high rank indicates more engagement. Commercial Reliance measures the presence of commercial fishing in relation to the population of a community through fishing activity. A high rank indicates more reliance. Both indicators reveal the significance of fisheries to the community. The most engaged fishing community in Maine is Portland. However, Portland also has the least reliance on commercial

fishing which means it has the most other working opportunities. While Stonington, the biggest lobster landing port in the United States, has both high engagement and reliance on commercial fishing. Other heavily engaged fishing communities in the Northeast Region include Gloucester and New Bedford in Massachusetts, and Point Judith in Rhode Island. Beals in Maine and Newington in New Hampshire have high commercial fishing reliance.

4.5 References

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CHAPTER 5 BIOLOGICAL IMPACTS

The National Environmental Policy Act (NEPA) requires an environmental impact statement (EIS) for a proposed federal action to evaluate the impacts of the action with respect to its biological, economic, and social components. This Final EIS (FEIS) analyzes the impacts of proposed modifications to the Atlantic Large Whale Take Reduction Plan (ALWTRP) on four valued ecosystem components (VECs): large whales, other protected species (i.e. other marine mammals and sea turtles), the physical environment and essential fish habitat, and human communities. As detailed in Chapter 3, the two action alternatives considered in this FEIS both were drawn largely from proposals provided to NMFS by New England states following some of the principles of the Atlantic Large Whale Take Reduction Team's (ALWTRT) April 2019 recommendations. The Alternatives were selected because, using the Decision Support Tool (DST), these suites of measures which include ongoing and anticipated fishery management measures, measures that will be regulated by Maine and Massachusetts, and the benefits of the Massachusetts Restricted Area, achieve or exceed a minimum of 60 percent risk reduction necessary to help reduce impacts to right whales to below the potential biological removal level of 0.8 serious injury or mortality per year.

Of foremost concern to this evaluation is the direct effect of the potential regulations on reducing the likelihood that North Atlantic right whales (hereafter referred to as right whale) will be killed, seriously injured, or experience sub-lethal impacts as a result of entanglement in lobster and Jonah crab trap/pot commercial fishing gear in the Northeast Region Trap/Pot Management Area (Northeast Region). It is also necessary to consider whether new regulations could indirectly affect this species by exposing it to different risks or by altering the habitat upon which it depends. In addition, it is important to examine the potential effect that changes in Plan regulations might have on other aspects of the marine environment.

This chapter analyzes the alternatives' impacts on three of the VECs, evaluating the impact of potential modifications to the Plan on the biological and physical VECs (Human communities are evaluated in Chapter 6) and is organized as follows:

- Section 5.1 discusses the changes to the Alternatives between the Draft Environmental Impact Statement (DEIS) to this FEIS. The discussion that follows presents an evaluation of these impacts using the NMFS DST (See Section 3.1.2 and Appendix 3.1 for model documentation). The DST assesses risk associated with an overlap between whale habitat density and Northeast Region lobster and Jonah crab trap/pot buoy lines to help characterize baseline entanglement risk and the impact of alternative management measures. For this analysis, 2017 represents the baseline for the number of lines and gear configurations because it represents the best available data for comparing the reduction entanglement risk and severity among all alternatives. The right whale habitat density model (right whale density model, version 11) used in this FEIS includes the most recent available data from 2010 to 2018 (Roberts et al. 2020).
- Section 5.2 provides a description of how the DST was used for the biological analysis.
- Section 5.3 evaluates the direct and indirect impacts of risk reduction alternatives. The effects of revised Plan regulations on Atlantic large whales, including right whales, are evaluated by comparing the potential impacts of each of the regulatory alternatives under

consideration, including NMFS' preferred alternative, against the 2017 risk reduction baseline (representing status quo; Section 5.3.1). The chapter also discusses other potential impacts on marine resources – including impacts on other protected species (Section 5.3.2) and essential fish habitat (Section 5.3.3) – and compares the alternatives with respect to these impacts.

- Section 5.4 evaluated the direct and indirect impacts of the gear marking alternatives.
- Section 5.5 provides a summary of impacts.

As described in Chapter 3, the ALWTRT agreed at the April 2019 meeting that there are a few areas where existing regulations or current effort reduction measures since 2017 should contribute toward the overall risk reduction analyzed here. This includes ongoing buoy line reduction that is occurring as a result of fishery management actions (e.g. trap reductions) as well as state measures that will reduce right whale entanglement risk (e.g. state implemented measures). The value of Massachusetts Restricted Area which was implemented in 2015 is also considered. However, the economic analysis in Chapter 6 considers the economic impacts of only those measures that would be implemented to modify the Take Reduction Plan by federal rulemaking.

5.1 Changes from the Draft Environmental Impact Statement

NMFS received numerous comments from a diverse set of interested parties during the public scoping and public comment periods on the DEIS. The comments included both formal written comments as well as oral comments offered at public hearings. Those comments are summarized in Appendices 1.1 and 3.4. These comments were taken into consideration with a new round of analyses described and justified in Chapter 3, Section 3.3. The results of these analyses and the public comment period informed the final alternatives included in this FEIS. Responsive to comments, the modifications to the DEIS for the FEIS prioritized use of an updated right whale density model to estimate risk reduction for right whales; the updated right whale population status including information on unobserved mortalities; feasibility of implementation and safety concerns (particularly for small entities) that could be ameliorated by conservation equivalencies; and consideration of indirect effects of measures that may adversely increase co-occurrence between buoy lines and whales.

Gear marking alternatives analyzed for the FEIS are discussed in Section 3.2.2. Marking gear does not reduce risk but if marked gear is retrieved from entangled whales it can provide information about where entanglement incidents occur. Alternative 2 (Preferred) and the Final Rule would increase the number of marks required in federal water compared to the Proposed Rule but have lesser impacts within the scope of impacts considered for the buoy line replacement analyzed in Alternative 3 in the DEIS and retained as Alternative 3 in this FEIS.

Modifications to the risk reduction measures in Alternative 2 in this FEIS relative to Alternative 2 in the DEIS includes:

- The proposed seasonal restricted area south of Cape Cod in this Alternative is larger than the restricted area analyzed within the DEIS Preferred Alternative, coming instead from DEIS Alternative 3.

- The removal of the requirement for a weak link at the buoy, which was analyzed as part of Alternative 3 in the DEIS.
- Adoption of conservation equivalency recommendations submitted as public comments on the DEIS and Proposed Rule for LMA 2 exchanging new trawl length requirements with more expansive weak insert requirements throughout the LMA
- Adoption of conservation equivalency recommendations submitted as public comments on the DEIS and Proposed Rule for LMA 3 that would require more traps per trawl than in the DEIS within the Georges Basin area that was analyzed as a restricted area in Alternative 3 of the DEIS. This increase in number of traps per trawl was offset by a lower number of traps required within the Northeast Region south of the 50 fathom depth contour on the south end of Georges Bank.
- Adoption of conservation equivalency recommendations submitted as public comments on the DEIS and Proposed Rule for Maine waters in LMA 1, including modification of regulations implementing the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) at 50 CFR 697.21(b)(2) requiring two buoy lines on trawls with more than three pots to accommodate Maine conservation equivalency options. This would allow the use of half the minimum number of traps required with two buoy lines if only one buoy line is used. Other differences in the FEIS Alternative 2 compared to the DEIS are trade-offs in the number of traps on a trawl based on Maine fishery zones and distance from shore between the Maine exemption line and the 12 nautical mile line (22.2 kilometer line, see the description of conservation). See Section 3.3.2 for a more detailed description of the complex trawl length and weak line requirements proposed and implemented in this FEIS.

Changes in Alternative 3 risk reduction elements analyzed in this FEIS relative to the DEIS Alternative 3 include retaining the weak link at the buoy or allowing it to be lowered to the base of the surface system and retaining only one South Island Restricted Area closure. Additionally, Alternative 3 retained only the seasonal weak line option in LMA 3 because the other option is analyzed in the preferred alternative and includes the special expansion of the MRA into state waters as implemented by state Regulations (see Table 3.5).

The only gear marking alternative that changed between the DEIS and FEIS is Alternative 2. The DEIS only required one 6 inch (15.2 centimeters) green mark to be included in state waters within the top two fathoms of the buoy. In the FEIS, gear in federal waters would be required to include at least four 1 foot long (30.5 centimeter) green marks within 6 inches (15.2 centimeters) of each state specific mark. The number of marks in federal waters has increased from the DEIS (four 1 foot/30.5 centimeter marks instead of one 6 inch/15.2 centimeter marks). This change is responsive to concerns about distinguishing state and federal buoy lines, identified during public hearings. Additionally, recently retrieved gear from a right whale included gear marks of 6 and 9 inches long (15.2 and 22.9 centimeters, inconsistent with current U.S. gear marking requirements but consistent with past Canadian gear marks. Use of a minimum of a 12 inch (30.5 centimeter) mark in U.S. commercial fisheries could help distinguish U.S. marks from Canadian gear. The change is within the scope of impacts analyzed within the DEIS, and would increase gear specialists' ability to distinguish state from federal waters than Alternative 2 in the DEIS. For more information on the details of the alternatives, changes from the DEIS, and on the comments received from the public see Chapter 3 and Appendix 1.1 and Volume 3.

5.2 Evaluating Impacts of the Alternatives

The discussion of the biological impacts of new Plan requirements on the biological VECs included in this analysis is largely qualitative. This approach is similar to past analyses of Plan modifications and is necessary because, while the DST was designed to quantitatively analyze changes in entanglement risk as a result of different management actions, uncertainties in the underlying data sources prevent precise risk reduction estimates but provide a comparison of relative risk reduction between options. The DST does not provide a precise analysis of biological effects. The DST is also limited in its capacity to assess the impact of the alternatives on other protected species or marine habitats because it was built specifically for analyzing entanglement risk to right whales and other large whales. Some quantitative criteria from the DST can be applicable to entanglement risk for other species that are not built into the DST, such as sea turtles, including percent reduction in lines but other criteria are species or VEC specific. Therefore the analysis of other protected species and habitats primarily rely upon qualitative data.

The analyses within this FEIS will use the same metrics used for previous analyses of ALWTRP modifications, including changes in line numbers and co-occurrence based on sightings data and vertical buoy line distribution data from the IEC Vertical Line Model. This analysis uses a right whale density model (version 11, Roberts et al. 2020) in lieu of a layer based on whale sightings per unit effort, which differs from the DEIS and previous analyses. The right whale density model is an improvement upon the whale distribution model used in the DEIS because it uses a more recent time frame (2010-2018) and provides better predictions of whale density in areas where there is lower monitoring effort. This also addresses the comments received during the comment period that requested the use of updated data for the analyses included in the FEIS. The DST also includes a humpback density model and a fin whale density model for the period of 1999 through 2017 (Roberts et al. 2017), though the fin whale density model currently does not support the use of a gear threat model and can only be used to examine co-occurrence. As such, the potential biological impacts of the alternatives on large whales were assessed primarily with the DST, described below, generating both qualitative and quantitative measures.

As indicated previously and endorsed by the Team, the Alternatives in this FEIS include line reduction that occurred as a result of fishery management actions (e.g. trap reductions) as well as state measures that will reduce right whale entanglement risk (e.g. state implemented measures). However, the analysis only includes measures implemented since 2017. This does not match the risk reduction estimates within the DEIS for Alternative 2 because it does not include the Massachusetts Restricted Area (MRA) credit. The risk reduction estimates for Alternative 3 already used the 2017 baseline because it did not include the MRA credit and therefore data in Chapter 5 match those presented in Chapter 3. This allows for a comparison between alternatives using the same baseline year, 2017. Additionally, Alternative 3 does not include state implemented measures if they are less conservative than Alternative 3 measures, such as weak rope measures. This alternative analyzed options that offered greater risk reduction for those specific measures and relied largely on new measures, with the exception of the extension of the MRA north into Massachusetts State waters to the New Hampshire border. The economic analysis in Chapter 6 only considers the economic impacts of only those measures that would be

implemented to modify the Take Reduction Plan by federal rulemaking, though it does report the cost of new gear marking in Maine State waters.

Table 5.1: Criteria used to compare the risk reduction impact of the proposed alternatives on large whales.

Type	Measure	Species and/or VEC	Criteria
Entanglement Risk Reduction	Trawl up	Right, humpback, and fin whales	• Change in co-occurrence
		Right and humpback whales	• Relative risk reduction
		All VECs	• Relative reduction in lines
	Planned fishery management trap reductions	Right, humpback, and fin whales	• Change in co-occurrence
		Right and humpback	• Relative risk reduction
		All VECs	• Relative reduction in lines
	Time/area closures to buoy lines	Right, humpback, and fin whales	• Change in co-occurrence
		Right and humpback	• Relative risk reduction
		Right whales	• Recent sightings data
	Line cap	Right, humpback, and fin whales	• Change in co-occurrence
Entanglement Severity Reduction		Right and humpback whales	• Relative risk reduction
		All VECs	• Relative reduction in lines
	Weak insert	Right whales	• Mean line threat
		Right whales	• Total change in gear threat
		All VECs	• Change in overall line strength
		All VECs	• % of line above weak point
		Right and humpback whales	• Relative risk reduction
	Full length weak rope	Right whales	• Mean line threat
		Right whales	• Total change in gear threat
		All VECs	• Change in overall line strength
Gear Marking		All VECs	• % of line above weak point
		Right and humpback whales	• Relative risk reduction
	New marking scheme	All VECs	• % increase in new marks

The following analysis measures the impacts of the action alternatives relative to Alternative 1, the No Action Alternative, against the 2017 baseline conditions and provides the absolute impact of the Alternative (i.e. not in relation to Alternative 1) in the final comparisons of the measures. In some instances, and consistent with past practice, quantitative indicators of the impact of alternative regulations are provided, including percent changes in number of buoy lines, co-occurrence (for right, humpback, and fin whales only), as well as relative risk reduction (for right and humpback whales only) as proxies for indicators of risk of entanglement. Change in mean line strength for all VECs as well as change in mean line threat and total gear threat for the relative risk of mortality and serious injury to right whales. Quantitative measures that were possible for large whales are listed in Table 5.1 and described in more detail in sections 5.2.1 and 5.2.2. These indicators do not measure biological changes in entanglement risks or actual encounter rate, but offer useful information on factors that likely, based on expert opinion, correlate with such risks and allow comparison between alternatives. Percent reduction in buoy line and strength was also used to assess relative impact of the alternatives on other protected species, where no risk or co-occurrence measure was available.

Qualitative analyses were used where quantitative data was not available or sufficient. The impacts of the risk reduction and gear marking alternatives are first examined for each VEC and the summary of impacts on all VECs is discussed in section 5.4.

5.2.1 Use of NMFS Decision Support Tool

The DST was created by NMFS in 2019 to assess the impact of management measures on entanglement risk in northeast waters of the U.S. This model built upon the co-occurrence model originally developed by Industrial Economics, Inc (see Appendix 5.1 for a description of the IEC Vertical Line Model). Improvements to the model were made after an independent peer review was conducted in late 2019 by the Center for Independent Experts. Documentation of the DST can be found in Appendix 3.1 and output from model runs are in Appendix 3.2. The DST addresses the following types of questions related to our biological analysis:

- Where and how do Northeast lobster and Jonah crab fisheries operate?
- Where are concentrations of buoy line the greatest?
- Which areas have the highest predicted overlap between whale density and the high concentrations of buoy lines?
- How much does the strength of buoy line and gear configuration impact the likely severity of an entanglement?
- What is the relative change in entanglement risk expected for different types of management measures?

Through the integration of information on fishing activity and gear configurations, this model characterizes geographic and temporal variations in fishing effort within the lobster and Jonah crab fisheries and the distribution of fishing line in the Northeast Region subject to the Plan. The DST also incorporates information on predicted whale densities (Roberts et al. 2020) and identifies areas and times when whales and commercial fishing gear are likely to co-occur. There are three options for whale layers: one spans from 2003 through 2018, one from 2003 through 2009, and one from 2010 through 2018. The alternatives in this FEIS were all developed using the most recent right whale data, 2010 through 2018. The DST also includes a humpback density model and a fin whale density model for the period of 1999 through 2017 (Roberts et al. 2017). The fin whale density model currently does not support the use of a gear threat model and can only be used to examine co-occurrence. The model has been updated since and analyses in this chapter were run in high resolution with DST model version 3.1.0, line model version 3.0.0, and the 2010 to 2018 right whale density model version 11 (Appendix 3.1, Roberts et al. 2020). See Chapter 3, Section 3.1.2.3 for more information on how the DST was used in this FEIS. The data in this chapter primarily differs from Chapter 3 in that it uses the same baseline line model (the 2017 line model without data within the MRA) in order to compare the impact alternatives with the same baseline.

The DST also contains a gear threat model that takes into account the strength of lines used in the fishery and how that relates to likely severity of entanglement. The DST's final product is a set of indicators that provide information on factors that contribute to the risk of entanglement at various locations and at different points in time. These indicators, in particular the number of

buoy lines in an area, predicted whale density, resultant co-occurrence score, a gear threat score, and an overall risk reduction score for management scenarios, are assumed to represent the relative spatial and temporal risk and severity of entanglement. They provide a basis for comparing the impact of alternative management measures on the potential for entanglements to occur and the likely severity of the entanglement. Readers interested in additional information on the model's structure, data, assumptions, and methods should consult its documentation in Appendix 3.1.

5.2.2 Evaluation of Weak Rope

Alternatives 2 and 3 propose introductions of weak rope or weak inserts for lobster and Jonah crab buoy lines throughout the Northeast Region. This is consistent with ALWTRT recommendations for region-wide measures that would protect right whales while outside of known aggregation areas and would be precautionary as right whale distribution continues to shift.

Proposed measures that modify the strength of rope used for trap/pot fisheries were analyzed quantitatively and/or qualitatively, depending on the VEC. Lowering the strength of rope does not reduce the risk of encounter and interaction between whales and line nor does it change co-occurrence. The intention of these measures is to reduce the potential health impact an entanglement has on some large whale species, particularly right whales, by increasing the chances that an entangled individual can break free of any constricting gear without resulting in a serious injury or mortality. Knowlton et al. (2016) documented the greatest frequency of mortality and serious injury of right whales in lines with a breaking strength greater than 1,700 pounds (771 kilograms) and suggested that large scale introduction of weak rope across fisheries could reduce serious injuries and mortalities by up to 72 percent. This is consistent with estimates of the force that large whales are capable of applying, based on axial locomotor muscle morphology study conducted by Arthur et al. (2015). The authors suggested that the maximum force output for a large, adult right whale is likely sufficient to break line at that breaking strength. That study and others recognized that success in breaking free is also somewhat dependent on the complexity of the entanglement (van der Hoop et al. 2017b).

Alternatives 2 and 3 propose introductions of weak rope or weak inserts for lobster and Jonah crab buoy lines throughout the Northeast Region. This is consistent with ALWTRT recommendations for region-wide measures that would protect right whales while outside of known aggregation areas and would be precautionary as right whale distribution continues to shift.

The DST attempts to quantitatively estimate the benefit of weakened buoy lines by using a gear threat model for right and humpback whales and was developed from the data used in Knowlton et al. (2016). However, a similar model is not available for all species included in the FEIS. Furthermore, although empirical evidence supports the theory that weakened line would reduce mortality and serious injury of right whales, without additional quantitative data to estimate how different forms of weak rope or weak inserts will impact the outcome of an entanglement for different species or age classes, additional analysis of these measures is done qualitatively within the context of the empirical data that are available. Current research on fishing gear strength was

primarily used as the standard against which the measures were evaluated, particularly evaluating how close the proposed measures compare to the types of weakened line recommended by current research (i.e., lines with breaking strength no greater than 1,700 pounds/771 kilograms).

This analysis uses the lower bound estimate calculated for weak rope measures that use inserts that are not considered the equivalent of full weak line, which for this analysis is considered a weak insert every 40 feet (12.2 meters, just below the average length and girth of a right whale). This is because of the uncertainty of the proportion to full weak line used in these calculations and how this approximates full weak line, but it also offers a better evaluation of whether this alternative passes the minimum 60 percent risk reduction target. When possible, relative reduction in mean line threat and total gear threat due to the addition of full weak line or the equivalents is provided to assess the estimated change in risk of severe entanglement. Also included is the average change in line strength in lobster and Jonah crab fisheries with each alternative across the Northeast Region.

5.2.3 Impact Designation Descriptions

Using the criteria outlined above and summarized in Table 5.1, this FEIS analyzes the expected impacts of the proposed alternatives for the biological VECs: large whales, other protected species, and habitat as defined in Chapter 4. The economic VEC (Human Communities) is discussed in Chapter 6 and integrated with the biological analysis in the summary of impacts in Chapter 7. For each alternative, impacts to each VEC will be evaluated against the current condition of the VEC (i.e., resource described in the affected environment), as well as relative to the other alternatives proposed. Impacts are described both in terms of their direction (negative, positive, or no impact) and their magnitude (slight, moderate, or high) based on the guidelines shown in Table 5.2 and Figure 5.1.

Table 5.2: A key of the direction and magnitude of the actions being assessed in the biological effects analysis. MMPA = Marine Mammal Protection Act. PBR = potential biological removal level

<i>General Definitions</i>				
VEC	Resource Condition	Direction of Impact		
		Positive (+)	Negative (-)	No Impact (0)
<i>Large Whales</i>	For ESA listed species: populations at risk of extinction (endangered) or endangerment (threatened). For MMPA protected species: stock health may vary but populations remain impacted	For ESA listed species: alternatives that contain specific measures to ensure no interactions with protected species (i.e., no take). For MMPA protected species: alternatives that will maintain takes below PBR and approaching the Zero Mortality Rate Goal	For ESA listed species: alternatives that result in interactions/take of listed resources, including actions that reduce interactions. For MMPA protected species: alternatives that result in interactions with/take of marine mammals that could result in takes above PBR	For ESA listed species: alternatives that do not impact ESA listed species. For MMPA protected species: alternatives that do not impact marine mammals
	Same as large whales	Same as large whales	Same as large whales	Same as large whales
<i>Other Protected Species Habitat</i>	Many habitats degraded from historical effort	Alternatives that improve the quality or quantity of habitat	Alternatives that degrade the quality, quantity or increase disturbance of habitat	Alternatives that do not impact habitat quality
	Highly variable but generally stable in recent years	Alternatives that increase revenue and social well-being of fishermen and/or communities	Alternatives that decrease revenue and social well-being of fishermen and/or communities	Alternatives that do not impact revenue and social well-being of fishermen and/or communities
<i>Human Communities (Socio-economic)</i>	Magnitude of Impact			
	Negligible	To such a small degree to be indistinguishable from no impact		
	Slight	To a lesser degree / minor	e.g. Slight Negative or Slight Positive	
	Moderate	To an average degree (i.e., more than "slight", but not "high")	e.g. Moderate Negative or Moderate Positive	
	High	To a substantial degree (not significant unless stated)	e.g. High Negative or High Positive	
	Significant	Affecting the resource condition to a great degree, see 40 CFR 1508.27.		
<i>A range of impact qualifiers is used to indicate any existing uncertainty</i>	Likely	Some degree of uncertainty associated with the impact		

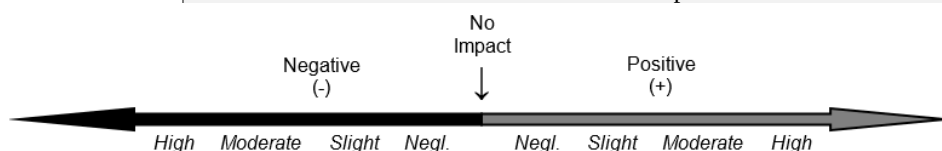


Figure 5.1: A depiction of the relative directional magnitude of impacts on VECs

Large Whales and Other Protected Species

The impacts of the alternatives on protected species take into account impacts to ESA-listed species, as well as impacts to non-ESA listed MMPA protected species in good condition (i.e., marine mammal stocks whose potential biological removal level (PBR) have not been exceeded) or poor condition (i.e., marine mammal stocks that have exceeded or are near exceeding their PBR). These impact descriptors apply to both the Large Whale and Other Protected Species VECs.

ESA-Listed Species

For ESA-listed species, any action that results in interactions or take is expected to have negative impacts, including actions that reduce but do not prevent interactions. Actions expected to result in positive impacts on ESA-listed species include only those that contain specific measures to ensure no interactions (i.e., no take). None of the alternatives considered in this document would ensure no interactions with ESA-listed species. By definition, all ESA-listed species are in poor condition and any take can negatively impact their recovery.

MMPA Protected Species

The stock conditions for marine mammals not listed under the ESA varies by species; however, all are in need of protection. For non-ESA listed marine mammal stocks, negative impacts would be expected from alternatives that result in the potential for interactions between fisheries and those stocks. For species with PBR that have not been exceeded, alternatives not expected to increase fishing behavior or effort may positively benefit the species by maintaining takes below the PBR and approaching the zero mortality rate goal. However, none of the alternatives considered in this document ensure no interactions with MMPA protected species, and therefore would be expected to have negative impacts.

Habitat

Alternatives that improve the quality or quantity of habitat are expected to have positive impacts on habitat. Alternatives that degrade the quality or quantity, increase disturbance of habitat, or allow for continued fishing effort are expected to have negative impacts. A reduction in fishing effort is likely to decrease the time that fishing gear is in the water, thus reducing the potential for interactions between fishing gear and habitat.

Human Communities

Socioeconomic impacts are considered in relation to potential changes in landings, prices, revenues, fishing opportunities. Alternatives which could lead to increased availability of target species and/or an increase in catch per unit effort (CPUE) could lead to increased landings. Increased landings are generally considered to have positive socioeconomic impacts because they could result in increased revenues; however, if an increase in landings leads to a decrease in price or a decrease in future availability for any of the landed species, then negative socioeconomic impacts could also occur. Conservation measures that drastically reduce catch

and revenue may have negative impacts in the short term, but could ensure access to the fishery in the future, potentially with fewer restrictions.

On the other hand, similar conservation measures could have different impacts on communities depending on their vulnerability and resilience. Communities with lower income and higher fishery dependency, like some island fishing villages in Northern Maine, would be more sensitive to stricter restrictions. It takes longer for them to respond to changes than communities with higher business diversity, like those in Southern Maine and Massachusetts.

5.3 Direct and Indirect Impacts of Risk Reduction Alternatives

To determine the biological impacts of all alternatives on all VECs, we used the impact designations outlined in Table 5.11. This section analyzes the impacts of the proposed alternatives for the biological VECs: large whales, other protected species, and habitat as defined in Chapter 4. The economic VEC (Human Communities) is discussed in Chapter 6 and integrated with the biological analysis in the summary of impacts in Chapter 7.

5.3.1 *Large Whales*

As noted in Chapter 2, entanglements are a primary source of anthropogenic mortality and serious injury for the right whale. The primary threat that Northeast Region Lobster and Jonah crab trap/pot commercial fishing poses to Atlantic large whales is the risk of serious injuries and mortalities due to incidental entanglement in buoy lines that mark the location of pots set singly or in trawls along the bottom. According to the NMFS/IEC line model, lobster and Jonah crab buoy lines make up an estimated 93 percent of the buoy lines offshore of the U.S. east coast where right whales occur. Given the above, the regulatory changes under consideration are designed to reduce harm to large whales by reducing the likelihood of entanglement and/or reducing the severity of an entanglement should one occur. NMFS seeks to achieve these objectives primarily through gear modifications that reduce the number of buoy lines and line strength as well as through time/area closures to commercial lobster and Jonah crab fishing with persistent buoy lines.

The discussion below examines the impact of these measures on large whale entanglement risks, beginning with an evaluation of specific line reduction requirements and then turning to an assessment of other restrictions. It is important to note that the No Action Alternative (Alternative 1, status quo) would not achieve the objectives listed above. If Alternative 1 were chosen, there would likely be continued incidents of mortality and serious injury to large whales due to entanglement in commercial fishing gear at rates that exceed PBR, rather than a reduction in these interactions. With no action, we would continue to have similar numbers of lethal and non-lethal takes of right, fin, and humpback whales.

5.3.1.1 Buoy Line and Co-occurrence Reduction

Fixed buoy lines (i.e., line that hangs vertically in the water column, connected from a surface flotation device to trap/pot gear set on the ocean floor) have been identified as an entanglement

threat to Atlantic large whales (Johnson et al. 2005). Reduction in buoy lines, therefore, has the potential to reduce encounter and therefore entanglement risk to these species. As provided below, buoy line reduction can be taken by numerous means (e.g., trawling up, line caps, or seasonal line reductions through restricted areas). In the discussion to follow, the potential direct and indirect effects of buoy line reduction provisions that involve gear modifications (by trawling up or line caps), and those involving seasonal buoy line closure areas are examined.

Alternative 1 would maintain the status quo fishery. Under Alternative 1, high negative impacts are expected because there would be high risk of entanglement as the number of buoy lines in the water would remain the same (i.e. an average of 511,369 lines but a maximum of 925,924 at a given time in the Northeast Region). Relative to Alternative 1, Alternatives 2 and 3 (Preferred and Non-preferred) include several buoy line reduction provisions to reduce the frequency of whale entanglements. Specifically, relative to baseline levels fished in 2017⁴, these provisions would reduce the number of trap/pot buoy lines in areas and seasons where right whales are present. As a result of public input during federal and state scoping as well as the public comment period, in some waters, including the exempt area in coastal Maine, those fishing closer to shore or around islands would not be subject to trawling up requirements and would be able to continue traditional fishing practices. Measures in exempt Maine waters are implemented by the state so, while risk reduction and line reduction includes those areas, the description of buoy line reduction in this FEIS relevant to these alternatives only includes line reduction in areas outside of Maine exempt waters. Alternative 2 (Preferred) within this FEIS analyzes many of the conservation equivalency provisions proposed by Maine during the public comment period. Those were incorporated into Alternative 2 for areas within 12 nautical miles (22.2 kilometers) in Maine LMA 1. This included the use of one or two buoy lines depending on the number of traps on a trawl, where half the maximum number of traps could be included on a trawl with the use of only one buoy line for trawls of up to ten traps. For the purposes of this analysis, these two scenarios were considered to be equivalent and thus discussed interchangeably with all trawl length measures.

Estimated 2017 buoy line numbers are evaluated within the lobster management area (LMA) in which they are fished as well as by distance from shore. Alternatives 2 (Preferred) and Alternative 3 (Non-preferred) reduce the number of buoy lines in the water through measures by: (1) specifying an increase in the minimum number of traps per trawls (“trawling up” requirements) by area and distance from shore, (2) implementing a total line allocation cap that is half the current average of lines fished, or (3) implementing time/area closures to buoy lines. Line reduction through existing or concurrent fishery management measures under the lobster Fisheries Management Plan (FMP) are also considered toward risk reduction, particularly including those measures that reduce latent effort and establish trap caps that reduce buoy lines in LMAs 2 and 3.

All of these provisions would result in a decrease in the number of buoy lines in the water and therefore reduce the likelihood of an entanglement. Alternative 2 (Preferred) line reduction requirements differ slightly from Alternative 3 (Non-preferred). The former relies more on

⁴ The baseline year in which risk reduction is being measured is 2017. Estimated 2017 buoy line numbers are evaluated within the lobster management area in which they are fished as well as by distance from shore.

trawling up measures along with new buoy line closures, and the latter includes a universal line cap and more extensive restricted areas. Line reduction measures, including both trawling up and localized seasonal line reduction through restricted areas, have changed in this FEIS from the DEIS to address public comments but remain within the scope of the DEIS. Changes in Alternative 2 include modifications to Massachusetts State measures and the use of conservation equivalencies in LMA 2, LMA 3, and Maine's LMA 1. Additionally the options considered for the South Island Restricted Area have changed in both action alternatives: the original area included in Alternative 2 in the DEIS was removed and replaced with the larger area in Alternative 3.

5.3.1.1.1 Gear Modifications: Trawl Length and Line Caps

5.3.1.1.1.1 *Direct*

5.3.1.1.1.1.1 Trawling Up

The alternatives analyzed would in several cases institute restrictions designed to reduce the number of buoy lines that are fished in the lobster and Jonah crab fishery. Table 5.3 identifies the estimated monthly line reductions under Alternatives 2 and 3. Alternative 2 would limit the number of lines in the Northeast Region by enacting new minimum trap/trawl requirements based on area and distance to shore, with increasing traps/trawl with increasing distance from shore. Differing from Alternative 2 in the DEIS, trawl length modifications are no longer included in LMA 2 because broader use of weak line offered greater risk reduction in this specific area and was substituted in lieu of minimum trawl requirements as a conservation equivalency.

For LMA 3, both year-round (Alternative 2) and seasonal (Alternative 3) trawling up provisions are analyzed. Relative to the analysis in the DEIS, Alternative 3 in this FEIS analyzes an LMA 3 conservation equivalency that changes the number of traps per trawl required by area, with longer traps on trawls inside the Georges Basin Area (proposed as a seasonal restricted area in Alternative 3), and shorter trawl lengths in the canyons south of Georges Bank deeper than 50 fathoms. The DEIS required a uniform 45 traps per trawl across the Northeast Region LMA 3. This equivalency maintains an average trawl length of 44 traps in LMA 3 but get 1 percent more in risk reduction due to the increased traps per trawl in the higher risk area of Georges Basin; therefore it is considered to have an equivalent impact on entanglement risk reduction, with a greater reduction occurring in an area identified as a hotspot.

Alternative 3 (Non-preferred) would also institute a buoy line allocation in federal waters set at half the average monthly buoy lines in use by fishermen in 2017. This FEIS differs from the DEIS as the analysis better estimates the relative reduction in buoy lines from a line cap only in federal waters, whereas the data within the DEIS estimated line reduction for the entire Northeast Region. While the line reduction estimate in Alternative 3 for this FEIS is lower than the estimate that was in the DEIS, it is closer to the estimated reduction that would likely be observed with these measures.

The Maine Department of Marine Resources (DMR) developed the distance-from-shore trawling up scenarios analyzed in the preferred alternative in the DEIS and proposed in the proposed rule

based on public input and safety concerns, while recognizing that offshore of Maine whale co-occurrence and associated risk increases with distance from shore. They included increases in traps per trawl requirements with increasing distance from shore, primarily in federal and offshore waters where vessels are larger and capable of safely handling larger trawls. Fishermen in Maine identified these configurations as possible with their current vessel characteristics and buoy lines, so that costly and substantial operational changes would not be necessary and mitigating concerns about the introduction of stronger and riskier buoy lines for longer trawl configurations. However, during the public comment period, Maine DMR modified their recommendations informed by numerous stakeholder meetings held during 2020, and offered conservation equivalencies. Alternative 2 (Preferred) analyzed within this FEIS retains the same trawl length requirements in LMA 1 in Maine outside of 12 nautical miles (22.2 kilometers) but has changed within 12 nautical miles (22.2 kilometers) to include trawl length configurations based on Maine lobster management zone and distance from shore. Greater trawl lengths are included in the areas farthest east and west within Maine waters. Although not obvious from the DST results, reducing lines in these two areas may reduce more risk in the western Gulf of Maine and waters closest to the Bay of Fundy than the trawling up configurations analyzed in the DEIS. However, some areas within 12 nautical miles (22.2 kilometers), outside of Maine exempt waters, will maintain status quo or shorter required trawl lengths than was analyzed in the DEIS and proposed in the proposed rule. Overall, the analysis suggests that the risk reduction of Maine DMR's proposed conservation equivalencies in federal waters within 12 nautical miles (22.2 kilometers) offers the same risk reduction and is therefore considered equivalent to what was analyzed in the DEIS. The modifications Maine DMR has identified demonstrates less risk reduction within the sliver of non-exempt Maine State waters in the FEIS Alternative 2, but right whale aggregations are far less likely this close to shore in Maine and weak insertions maintained in all buoy lines within state waters continue to provide precautionary benefits (see section 5.3.1.3 for a discussion of weak line).

Table 5.3: Monthly percent buoy line reduction of Alternatives 2 and 3 compared to Alternative 1 (i.e. status quo). Note that the percentages are relative to the number of lines within that month and therefore not additive. All changes in line numbers include the combined changes due to gear configurations and areas closed to persistent buoy lines. Buoy line closures were assumed to relocate lines outside of the restricted area boundaries unless they were in state waters. MRA "credit" for seasonal line reduction is not included.

Month	Alternative 2	Alternative 3
January	-9%	-16%
February	-6%	-5%
March	-6%	-6%
April	-7%	-10%
May	-12%	-19%
June	-13%	-20%
July	-12%	-15%
August	-15%	-15%
September	-7%	-6%
October	-6%	-4%
November	-6%	-4%
December	-6%	-4%
Total	-7%	-7%

Associated with the LMA 3 trawling up requirement, NMFS would extend the allowable distance between buoy lines in LMA 3 to 1.75 miles (3.24 kilometers). Currently, lobster fishermen are restricted to fishing ground lines of no more than 1.5 miles (2.78 kilometers). While trawls with more than 45 traps are currently fished within this constraint, fishermen in some areas might want to increase groundline between end traps to reduce the number of pots hanging in the water upon hauling if weak line or weak inserts are implemented in buoy lines, or they may want to increase their total trawl length to hold fishing ground. To allow LMA 3 vessels to optimize distance between traps, under both Alternative 2 and 3, the maximum length between the buoy lines would be extended from 1.5 miles (2.78 kilometers) to 1.75 miles (3.24 kilometers).

Cumulatively, all line reductions estimated for Alternatives 2 and 3 through trawling up and line caps, in addition to seasonal buoy line closure areas, will reduce the number of trap/pot buoy lines in the Northeast Region by approximately 7 percent compared to the 2017 annual baseline (Table 5.3). This does not include the estimated seasonal line reduction “credit” of the MRA, and is substantially lower than the line reduction estimated in the DEIS because the line reduction reported in the DEIS did not include Maine exempt waters and the change in the Alternative 3 line cap analysis to more accurately reflect that it occurs only in federal waters. The goal of these different buoy line reduction approaches is to reduce the number of lines, co-occurrence, and associated encounter rates of large whales with vertical trap/pot buoy lines (e.g., North Atlantic right, humpback, and fin whales; see Table 5.5 for changes in co-occurrence). Alternative 2, which includes the most trawling up measures, two new restricted areas and a spatial extension of the MRA, would have a similar overall reduction in the number of buoy lines compared to the aggressive line cap in federal waters that would be set under Alternative 3, though this varies by month. Greater reductions are observed during the summer months in both alternatives, with a monthly reduction from 6 to 15 percent under Alternative 2 and 4 to 20 percent under Alternative 3. Alternative 3 gets higher line reduction in summer because it retains seasonal trawling up measures in LMA 3 in addition to line relocation through the seasonal closure in Georges Basin from May through August. Alternative 2 gets marginally higher line and risk reduction in September through December and in February, though the difference is relatively small.

Trawling up substantially will likely result in some areas with longer, heavier trawls than baseline conditions. Heavier trawls, especially if buoy line strength also goes up (discussed in indirect effects), could increase potential entanglement severity to all whales, including adults but particularly calves and juveniles that may be more likely to survive an interaction with a single trap than with a trawl made up of multiple traps. This concern, that trawling up could create more severe interactions with right whales of all ages, was voiced by Team members as well as at stakeholder meetings by fishermen and members of the public. Small neonate calves are weak swimmers and lack the physical and behavioral developments that increase buoyancy (Thomas 1984) – all traits that likely contribute to a whale’s ability to survive an interaction with fishery gear. Similarly, minke whales are more likely to be impacted negatively by an interaction with a long, heavy trap trawl compared to larger whale species. However, the decrease in the number of buoy lines decreases overall risk of becoming entangled specifically in areas of high co-occurrence, likely mitigating some of the possible increased risk from serious injury or death if entangled. Additionally, in combination with weak rope or weak inserts, longer trawls are

more likely to allow a whale to break free of a trawl that is anchoring it in place. DeCew et al. (2017) found that, in simulations of weak inserts with different weak points, longer trawls more consistently broke free during an entanglement within a shorter period of time compared to shorter trawls. This requires that there is a weak insert below the point where a whale becomes entangled in the line given this is the area that would be most likely to break in the case of an entanglement. This means that the location of the lowest weak insert is an important factor in reducing the severity of an entanglement and is discussed further in Section 5.2.1.3. Finally, input from fishermen at stakeholder meetings suggested that the trawling up requirements included in the FEIS are less economically egregious because they can use their existing buoy lines, suggesting that wholesale replacement of buoy lines for stronger rope is not necessary and unlikely. Trawling up measures are likely to reduce entanglements and overall risk assuming weak inserts reduce line strength and entanglement severity, as predicted.

5.3.1.1.1.2 Potential for trawling up not impacting buoy line numbers

As noted above, trawling up was required as a line reduction measure in the 2014 buoy line modifications to the Plan, effective June 2015. Hayes et al. (2018) reviewed data that indicated that draft buoy line estimates for 2016 prepared by IEC using the Co-occurrence Model were higher than the pre-regulation baseline line estimates provided in the FEIS developed for the 2014 rulemaking (NMFS 2014). Hayes et al. (2018) suggested that the line reductions anticipated in the rule, effective in June 2015, were not achieved. However, the line estimate in the 2014 FEIS was based on fishery data from 2009 through 2011. Beginning in 2010, there was a steady increase in abundance in the Gulf of Maine and Georges Bank lobster stock. This is the stock fished in LMA 1 where the vast majority of buoy lines are fished. The values and landings of American lobster also rose steadily after 2010, peaking in 2016. Catch per unit effort was also higher during this time, so without line estimates it is difficult to draw conclusions about relative buoy line numbers, but it is likely that participation by permitted fishermen rose to near-capacity during these lucrative years.

However, without a constraint on the total number of lines that can be fished, such as that suggested in Alternative 3, there is no mechanism to prohibit latent effort from being activated. Many fishermen who hold lobster licenses do not actively fish at all, and many active fishermen do not fish all of the traps that have been allocated to them. Additionally, as discussed above, fishermen fish different numbers of pots and trawls in different months. This results in varying amounts of “latent effort”; permitted allocations that are not actively fished but are theoretically available to be deployed at any time. For the following reasons, we believe that trawling up under the present day fishery conditions would result in line reductions close to those calculated in our analysis (see Table 5.3).

1. Relative to 2017 effort in LMA 2 and LMA 3, there is a low likelihood of future significant latent effort reactivation. Fishery management measures to reduce latent effort and consolidated trap allocations have been implemented in LMA 2 and LMA 3, effective May, 2016, under Addendum XVII to Amendment Three to the Interstate Fishery Management Plan for American Lobster (Lobster Plan). These changes were intended to match the size of the fishery to the size of the resource, including the declining southern New England lobster stock. As described in Chapter 3 section 3.1.4.3, and in the proposals submitted by Massachusetts and Rhode Island, (Appendix 3.3),

latency in these two LMAs does appear to be greatly reduced. In their proposal, Massachusetts documents a reduction in fishermen actively fishing across their states, which includes LMA 1 and the Outer Cape LMA (MADMF 2020, Appendix 3.3).

2. The Gulf of Maine and Georges Bank lobster stock is at high abundance and recruitment, making direct management of latent effort less of a fishery management priority for LMA 1. As indicated above, positive market and lobster stock conditions incentivize fishermen to increase fishing effort and may encourage inactive fishermen to reenter the fishery. For that reason, it is likely that fishermen in the Gulf of Maine have been fishing at a high capacity in recent years. Figure 1 in the proposal submitted by Maine DMR) demonstrates the relative stability of latent licenses (Maine DMR proposal, 2019; Appendix 3.3. As discussed in Maine's proposal and above, these latent permits are unlikely to be activated if they were not used during recent lucrative fishing years (see Appendix 3.3).
3. The average age of New England lobster and Jonah crab fishermen is increasing. Massachusetts Department of Marine Fisheries (DMF; 2020) provides documentation of their aging fisherman population. Similar demographics have been noted in the Maine fishery. A study conducted by the Gulf of Maine Research Institute (2014) showed the age of Maine lobster license holders increasing steadily from 1999 through 2013 (GMRI 2014) and suggested that at some point given the grueling nature of the work, fishermen reduce their fishing effort as they age.

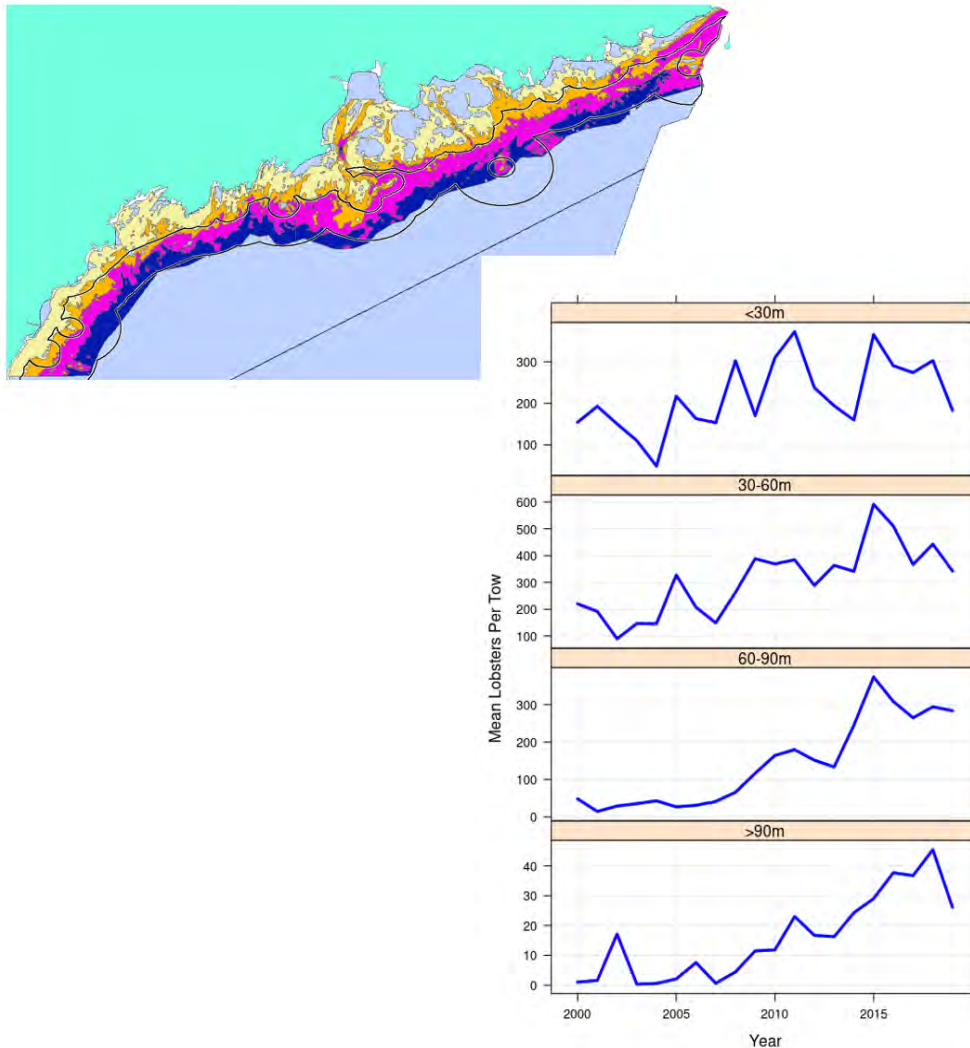


Figure 5.2: Mean lobster abundance in the Maine/New Hampshire trawl survey. Top left panel: map of coastal Maine with sampling strata with reference lines for 3 and 12 miles from shore and the LMA 1/3 boundary. Bottom right panel: survey indices by depth strata for the Fall survey.

For these reasons, we concur with Maine's, Massachusetts', and Rhode Island's conclusions that an increase in fishing effort from allowed, but inactive latent traps, above that documented in a strong fishing year like 2017, is unlikely to occur. Under these conditions, trawling up under Alternative 2 would, as estimated, reduce the percent of buoy lines fished relative to 2017 estimates, as detailed in Table 5.3.

Offshore of the Maine coast within LMA 1, the likelihood of encountering a right whale increases with distance from shore (Roberts et al. 2016), as Maine DMR observed in their proposal (ME DMR, 2019, Appendix 3.3). For this reason, reducing buoy line numbers more substantially with increasing distance from shore provides better risk reduction for right whales.

Table 5.4: Trends in landings and fishing effort with distance from shore from Maine DMR.

Distance from shore (nm)	2008	2009	2010	2011	2012	2013	2014	2015	2016
Proportion of landings	by	distance	from	shore					
0-3	81.5%	69.8%	77.8%	75.5%	67.0%	72.8%	69.1%	64.1%	68.2%
3-12	14.9%	25.0%	19.3%	17.3%	25.8%	20.3%	24.7%	26.3%	23.3%
12+	3.6%	5.2%	2.9%	7.2%	7.2%	6.9%	6.2%	9.6%	8.6%
Proportion of trips	by	distance	from	shore					
0-3	87.7%	80.9%	84.2%	83.8%	77.5%	80.9%	80.3%	77.3%	80.8%
3-12	10.4%	16.3%	14.1%	12.4%	18.6%	15.5%	15.7%	17.7%	14.6%
12+	1.9%	2.8%	1.7%	3.8%	3.9%	3.7%	4.0%	5.0%	4.5%
Average catch (lb)	Per trap								
0-3	1.17	1.31	1.46	1.62	1.86	1.96	1.87	1.82	1.81
3-12	1.45	1.77	1.74	2.05	2.33	2.24	2.67	2.27	2.43
12+	1.61	1.84	1.88	2.1	2.27	2.51	2.72	2.41	2.49
Total Average	1.41	1.64	1.69	1.93	2.15	2.24	2.42	2.17	2.24

The lobster resource is growing in federal nearshore waters, though lobster density is still highest in waters less than 98 yards (90 meters) deep, which is mostly inshore of about 6 nautical miles (12.2 kilometers; Figure 5.2). The proportions of landings and trips in the lobster fishery have increased in federal waters and industry catch-per-unit-effort has increased across the resource in the Maine portion of LMA 1 (Table 5.4). However, the potential for fishing effort to shift from state to federal waters is restricted by limited entry to the federal fishery. Additionally, spatial data is generally lacking on how fishing effort is distributed in federal waters either inside of 12 nautical miles (24.3 kilometers) or outside of 12 nautical miles (24.3 kilometers) within LMA 1. Thus, it is unclear if changes in the distribution of lobsters or relative proportions of landings and trips are indicative of increased density of fishing gear further from shore. However, if current trends in lobster density continue, commercial lobstering may become more viable in deeper waters and further from shore in the future, a possibility that would be somewhat ameliorated by the proposed seasonal restricted area for offshore LMA 1. This uncertainty in the current and changing spatial distribution of fishing effort complicates the assessment of entanglement risk in this region. Thus, going forward, there is a need for adequate characterization of the spatial distribution of fishing effort in this region, both through improved trip reporting and implementing vessel monitoring, to monitor how the lobster fishery responds to the changing distribution of lobsters and how this impacts risk of entanglements.

NMFS will monitor line numbers annually and associated co-occurrence with right whales to evaluate whether predicted line reduction occurs. This will be facilitated by improved data once NMFS and the state of Maine require 100 percent harvester reporting in the lobster fishery and even more so once vessel tracking systems are deployed in federal waters (Maine proposal 2019, see Appendix 3.3). While measures to implement vessel tracking have not yet been developed, Addendum XXVI to Amendment Three to the Lobster Plan (2018) identified vessel monitoring as a long-term recommendation to improve lobster reporting. Results from a lobster fishery vessel tracking pilot program were presented to the ASMFC in Fall 2020 and Spring 2021 and

the ASFMC has formed a working group to expedite implementation of this technology, perhaps within the next two years.

5.3.1.1.1.3 Buoy Line Cap in Federal Waters

As mentioned previously, this FEIS differs from the DEIS because the analysis of the line cap included here better estimates the relative reduction in buoy lines from a line cap only in federal waters, whereas the DEIS only had line cap reduction estimates for the entire Northeast Region. As such, the line reduction estimates in Alternative 3 in the FEIS are lower than the DEIS estimates but likely closer to the reduction that would likely be achieved with these measures. This results in a far lower line reduction than Alternative 3 as it was included in the DEIS. The majority of lines in the Northeast Region are fished in state waters and therefore a line cap in only federal waters has a limited impact on the overall line numbers being fished in the lobster and Jonah crab trap/pot fishery.

Because this is not the preferred alternative and therefore not in the proposed rule, the exact regulatory mechanism for implementing a line cap has not been identified. Given the complexity of interstate fishery management, this measure would be restricted to lobster and Jonah crab fishermen when fishing in federal waters. State waters would still achieve risk reduction in both alternatives due to targeted buoy line closures. Additionally, Maine DMR (2019) considered a 50 percent line reduction for Maine permitted fishermen but it did not move forward with this consideration given that, although the large majority of Maine lobster buoy lines are fished in state waters, it is the area of least risk to whales causing an inverse relationship between fishermen impacted and risk reduction.

Allocation of 50 percent of the lines fished in 2017 to fishermen fishing in federal waters through a line cap in a way that results in an actual reduction in the number of buoy lines requires data that are not currently collected by the lobster fishery. Fair distribution of line allocations requires documentation of vessel fishing histories or other commonly used metrics and detailed knowledge of the amount of fishing effort by sector or individual vessel. Allocation decisions in effort control management of capped resources (lines or traps) are also usually informed by iterative public fishery management processes and include appeal options that are administratively burdensome. Because the lobster fishery has variable reporting requirements across states, only about 10 percent of Maine fishermen have been required to report in any year and federal reporting is variable, there are no data to easily determine effective trap and line cap measures. It was assumed that a trap cap would require work with the Commission and New England states to qualify the number of buoy lines, and to this end the Commission instituted an April 29, 2019 control date (84 FR 43785, August 22, 2019). That control date put American lobster permit holders and new entrants on notice that future participation and eligibility could be affected by past participation data (84 FR 43785, August 22, 2019). A new control date would be established for Jonah crab permit holders. However that control date does not reduce the time- and labor-intensive workarounds for the data gaps caused by inconsistent reporting requirements. The [Commission process](#), including soliciting public feedback, requires, at a minimum, approximately 6 months to develop an adaptive management action. Larger, more controversial actions can take eight to 18 months. Once approved by the Commission, additional time would be required for NMFS to develop a rulemaking and associated analysis to implement measures to distribute allocations of line tags to fishermen; envisioned as one tag to be affixed to buoy, one to

the end trap attached to each buoy line. States and fishermen could use allocations according to their unique fishing operations and capacity, through trap reductions, trawling-up scenarios, single buoy line trawls, or through other options that allow them to fish with half the lines that they have historically used. Allocation and histories would be based on vessel trip reports or, for Maine, other data sources such as dealer records for fishing prior to April 29, 2019. The ASMFC and NMFS established a control date of April 29, 2019, at the April 2019 ASMFC meeting.

Chapter 3 goes into greater detail regarding how a 50 percent line cap would reduce buoy lines based on the average number of buoy lines currently being used in federal waters across the Northeast Region. In sum, to estimate the likely reduction in line numbers with a buoy line cap, NMFS used the 2017 baseline buoy line data to test how different approaches might shift buoy line numbers and selected likely scenarios. A cap in federal waters to 50 percent of the average lines fished would likely result in a buoy line reduction closer to a 45 percent average reduction given the current level of fluctuation in buoy lines used throughout a fishing year. Our estimate of a 45 percent reduction in buoy lines in federal waters under a 50 percent line cap is the result of regional variation and our anticipation of a complex response by fishermen to a line cap. The line cap would likely be implemented at a regional scale as well as across all federal fisheries in the Northeast Region. Implementing a line cap without accounting for variation across all fisheries achieves a near 50 percent reduction in line in federal waters. However, given variation between regions and months, if this was implemented on a regional level (a likely scenario) the actual average monthly line reduction is closer to 45 percent due to areas with higher variation in monthly line numbers. For LMA 2 in particular, where February and March had lower line numbers than half of the monthly average, we considered three scenarios (see Chapter 3 for the calculations) to capture a range in responses. Depending on how vessels respond to this line cap, during months where 2017 line numbers fall below the line cap, vessels could either:

1. Continue fishing at 2017 levels during months where line numbers typically fall below the line cap and only fish at their full halved line allocation level during months they previously fished at high effort.
2. Fish their entire line allocation each month even if they did not previously fish or fished fewer lines in some months. This could make up lost wages in other months.
3. Fish an average number of lines between the line cap and their 2017 line number in months where 2017 effort fell below the line cap, and fish their full allotment of lines.

Since line caps result in a very large reduction of lines during high effort months, particularly in the summer, we anticipate the most likely scenario falls somewhere between scenarios two and three, with an increase in use of buoy lines during months that previously had lower fishing effort. This could increase risk in LMA 2 when right whales are likely to be in the area.

However, the line cap would only be implemented with a restricted area in LMA 2 during peak right whale occurrence and during months where line numbers fall below the average monthly number of lines in LMA 2. The implementation of a closure in this area during this time would likely mitigate this potential risk. Though the Outer Cape also has a low number of lines during these months, this area is largely closed during months of high right whale density and likely will not be impacted by a line cap during spring. Complementing restricted areas in areas of predictable whale aggregations, this line reduction would generally be in areas of greater risk to right whales. Furthermore, the most conservative scenario is analyzed in the risk reduction

estimate provided from the DST (Chapter 3) with an estimated 44 to 49 percent reduction in lines depending on the LMA. Using this conservative estimate of actual line reduction from a line cap in federal waters, Alternative 2 still achieved well over the 60 percent risk reduction target.

Although a 50 percent line cap does not explicitly include any trawling up restrictions, it is expected this measure would result in broad scale trawling up so fishermen could fish as many traps of their allocated traps as their individual operations would safely allow under a line allocation. Where trawling up occurs, the effects are expected to be similar to those described above where heavier gear could be more likely to cause serious injury or mortality if an entanglement occurs but is likely offset somewhat given the overall decrease in risk of entanglement and full weak line or weak inserts are implemented.

Though overall co-occurrence, and associated entanglement risk, is expected to decrease substantially with the implementation of a line cap (Table 5.4), there is additional uncertainty over how the spatial and temporal entanglement risk will change as buoy line use adjusts to the new measures. Monitoring would be essential for tracking these changes. It is possible certain seasons and areas could experience an increase in co-occurrence, but that analysis is currently unavailable. Any increase in risk is expected to be offset somewhat in combination with seasonal buoy line closures.

5.3.1.1.1.2 Indirect

The indirect effects of the requirements described above depend upon whether they would result in an increase in unintended changes in gear lethality, gear conflict, or loss of trawls, with a resulting cost to fishermen and an increase in the risk that whales may become entangled in ghost gear.

Trawling up was required as a line reduction measure in the 2014 buoy line modifications to the Plan and some suggest that the trawling up requirements, effective in June 2015, caused fishermen to replace buoy lines with stronger line at strengths that have been associated more often with serious injuries and mortalities of all age classes (Knowlton et al. 2016, Hayes et al. 2018). If this occurred with these alternatives, it would reduce the benefit of trawling up measures. It is possible that trawling up poses a higher risk of mortality and serious injury to calves and juveniles, if entangled compared to adults, if one were to become entangled, but a reduction in the number of lines reduces the chances of an interaction occurring, mitigating some of this risk. However, Maine developed the proposed trawling up measures first, through extensive outreach with Maine fishermen to discuss what they could do with existing vessels and gear, including their existing buoy lines. For that reason, NMFS believes that these trawling up measures are not likely to result in changes in fishers using stronger buoy lines that would potentially reduce the effectiveness of line reduction. Note also that weak buoy line toppers and weak insertions, discussed in section 5.2.1.2, would mitigate some of the possible risk of heavier trawls as well.

Fishermen also voiced concerns that longer trawls make it more likely that lobster fishermen operating in close proximity will lay gear across each other's trawls by mistake, or that mobile bottom trawl net fishermen will trawl their net through a lobster set, both resulting in safety hazards for fishermen. In 2010 and 2011, the Massachusetts DMF completed a comprehensive

study of gear loss and “ghost” fishing (i.e., impacts from lost or derelict gear) (NMFS 2014). Their data indicate that rather than exacerbating gear loss, increased trawling requirements may reduce the amount of gear lost and thereby yield an economic benefit to affected fishermen. Furthermore, as mentioned above, the new trawling up measures were designed with input from fishermen regarding how many traps could be accommodated on one trawl using existing lines without overwhelming concern for additional gear loss. Available data assessing how trawling up requirements including increasing the distance between buoy lines in LMA 3 could affect gear loss are inconclusive but suggest it is unlikely to increase substantially with the proposed measures.

LMA 3 fishermen requested an extension of the distance between buoy lines from 1.5 nautical miles (2.78 kilometers) to 1.75 miles (3.24 kilometers) to allow them options to trawl up to 35 to 50 pots, including an option to increase distance between traps near the ends of the trawl so that if fishing with a weakened buoy line, they will not have additional pots hanging in the water column and requiring more force for hauling. The 1.5 mile (2.78 kilometers) distance between buoy lines was originally instituted in 1986 gear marking requirements in Amendment One to the New England Fishery Management Council’s Lobster Fishery Management Plan to “allow for visual identification of entire sets, under optimum sea conditions, by mobile gear operators” (NEFMC 1986). In making this request, offshore lobster fishermen did not identify any concerns about increased gear conflicts or gear loss. Radar technology has advanced since 1986. A recent report on gear marking best practices (FAO 2016) does not identify a standard for the distance between radar reflectors on lobster. However, it suggests that spar buoys can be seen by eye from three nautical miles (5.56 kilometers) and further if fitted with a radar reflector. The report recommends that other line of sight position indicators are detectable from a distance of two nautical miles (3.7 kilometers). Detection requires active searches and relies on factors such as sea conditions and the quality and settings of radar detectors. However, modifying the distance between radar reflectors from 1.5 (2.78 kilometers) to 1.75 miles (3.24 kilometers) appears to be within standards acceptable with current technology and this measure is not anticipated to increase incidents of gear conflict or gear loss.

It is possible that other areas may also observe an increase of groundline length with the combination of increased trawl lengths and the use of full weak rope or inserts. Fishers may increase the distance between the first and second traps in order to reduce the amount of force being placed on the line during hauling and the likelihood of the line breaking. This could increase entanglement risk to right whales that use the entire water column and interact with the seafloor (Baumgartner et al. 2017, Hamilton et al. 2019). Right whales have not been observed entangled in groundlines since the Plan restricted the use of floating groundline, effective in 2009, so this regulation may minimize the risk of entanglement in groundlines. Buoy lines are found on right whales more frequently than groundlines (Johnson et al. 2005). The reduction in the number of vertical buoy lines is likely greater than the risk of any potential addition of groundlines under Alternative 2.

5.3.1.1.2 Seasonal Restricted Areas Changed To Buoy Line Closures

Currently, under Alternative 1, two new areas in the Northeast Region are seasonally closed to trap/pot fishing: the Massachusetts Restricted Area and the Great South Channel Restricted Area. Alternative 2 and Alternative 3 would modify these management areas to allow ropeless fishing

by changing the definition from a closure to fishing, to a closure to persistent trap/pot buoy lines. The Outer Cape LMA would remain closed for lobster management purposes.

NMFS proposed and accepted comments on this change to the management areas through an Advanced Notice of Proposed Rulemaking (ANPR) published in September 2018 (83 FR 49046, September 28, 2018). This definition change would open up the potential use of these areas for ropeless fishing, and would incentivize fishermen that are currently unable to harvest lobster to participate in the development of methods to remotely retrieve buoys or buoy lines stored on the bottom in a manner feasible during commercial fishing operations. The ability to fish without buoy lines to retrieve gear and allow co-occurring fishermen to detect gear on the bottom to avoid gear conflicts requires testing and development under commercial conditions as well as solutions regarding limited manufacture and high production costs that keep the technology out of the reach of most lobster and Jonah crab fishermen. Testing and adaptation under commercial fishing conditions is necessary to accelerate development of ropeless solutions so that it becomes an alternative to broad seasonal area closures should additional risk reduction be needed. While the risk of ropeless fishing in areas of whale aggregations may be higher than the risk of closures in the short-term, there are long-term benefits to the accelerated development of gear that protects right whales and supports healthy lobster and Jonah crab fisheries.

To reduce potential risks in the short term, conditions can be placed on fishing. Interested fishermen would have to obtain authorization to fish without surface buoys and other surface gear. The federal lobster regulations promulgated pursuant to the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA), at 50 CFR Part 697.21 requires buoys (with identification marking) and for larger trawls, radar reflections on each end of trawls of lobster pots to insure other fishermen and mariners know that there is fishing gear on the bottom between the surface systems. Similar regulations for bottom tending fixed gear have been implemented for New England and Mid-Atlantic fisheries managed pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSA), at 50 CFR 648.84. Until remote surface detection technology is available and required on all fisheries that occur on the same fishing grounds, allowing revision of those regulations, they remain necessary to prevent gear conflicts and so ropeless fishing will require authorization or exempted fishing permission from states or NMFS (See Section 3.3.3). While surface marking is required, applicants for an exemption to those requirements will be required to provide details on their operations, including objectives, reporting and monitoring plans, and a description of possible environmental impacts including anticipated impacts on marine mammals or endangered species.

A few fishermen from the South Shore of Massachusetts that have experimented with ropeless gear outside of the seasonal closure have continued to express interest in fishing with ropeless gear in the Massachusetts Restricted Area under an exemption to the surface marking requirements. Other fishermen currently experimenting with ropeless fishing technology in offshore fisheries areas have not expressed interest in fishing within current seasonal restricted areas. We anticipate that this modification to the closed areas would likely result in very low level of lobster fishing during the seasonal restricted periods, although the using ropeless retrieval or other ropeless systems under an exempted fishing permit or state authorization that includes risk reduction conditions.

Based on outreach by the NMFS gear team, interest does not appear to be substantial among the commercial fishery in the Northeast Region, and participation within any restricted area can be limited through the authorization process. We anticipate that at least through 2025, ropeless fishing in these restricted areas is likely to be done primarily by collaborators borrowing gear from the NMFS gear cache, with up to an additional 10 percent of effort by other researchers and fishermen coast wide. The Northeast Fisheries Science Center gear team projects that by 2025 they expect to have about 300 ropeless units and enough deck controllers for about 30 vessels, as well as technology to support adjacent mobile fishing vessels. That is, at the most, coast-wide, there would be up to 33 vessels fishing ten ropeless trawls. If congressionally appropriated and private funding remains available, NMFS will continue to reimburse fishermen for some of their time and will provide the onboard and in-water technology so that costs to fishermen will be minimal. To incentivize participation, the alternatives consider modifying current seasonal restricted areas and defining new restricted areas as seasonal closures to trap/pot fishing that use persistent vertical buoy lines.

5.3.1.1.2.1 Direct

5.3.1.1.2.1.1 Decrease in Co-Occurrence of Whales and Buoy Lines

Both Alternatives 2 and 3 propose additional seasonal management areas which would allow ropeless fishing but be closed to lobster and Jonah crab trap/pot fishing with persistent buoy lines; allowing fishing with ropeless gear under an exempted fishing permit and significantly minimizing the risk of entanglement from buoy lines by large whales. These closures to buoy lines would further reduce the amount of buoy line in the water during seasons that have been used by aggregations of right whales.

Table 5.5: Right, humpback, and fin whale co-occurrence scores by month for each alternative scenario, including Alternative 1 (i.e. status quo). All changes in co-occurrence include the combined changes due to gear configurations and areas closed to persistent buoy lines.

Month	Right Whale Alternative 2	Right Whale Alternative 3	Humpback Whale Alternative 2	Humpback Whale Alternative 3	Fin Whale Alternative 2	Fin Whale Alternative 3
January	-37%	-39%	-11%	-23%	-15%	-30%
February	-30%	-45%	-14%	-25%	-17%	-33%
March	-36%	-51%	-17%	-29%	-19%	-34%
April	-55%	-67%	-18%	-29%	-20%	-29%
May	-92%	-95%	-18%	-27%	-19%	-24%
June	-30%	-62%	-13%	-21%	-13%	-16%
July	-32%	-70%	-13%	-19%	-13%	-14%
August	-15%	-22%	-11%	-18%	-12%	-13%
September	-17%	-23%	-10%	-16%	-13%	-14%
October	-39%	-44%	-10%	-15%	-13%	-13%
November	-47%	-46%	-11%	-19%	-13%	-15%
December	-23%	-23%	-11%	-13%	-13%	-21%
Total	-54%	-60%	-12%	-19%	-14%	-17%

The seasonal buoy line closure areas proposed in Alternative 2 are more extensive in space than Alternative 3, though a few areas in Alternative 3 are closed for a longer period of time. As indicated in Table 5.5, the spatial and temporal risk reduction measures considered in the alternatives achieve co-occurrence reduction scores with right whales of greater than approximately 54 percent. Although co-occurrence reduction scores are higher in Alternative 3 (approximately 60 percent), both Alternatives appear to reduce co-occurrence significantly in the months and areas where right whales and lines are most likely to overlap. These estimates are lower than those in the DEIS because the line cap analysis in this FEIS is updated to only include federal waters, as was intended, and because co-occurrence was estimated with the right whale density model from 2010 to 2018 instead of the DEIS use of sightings per unit effort. The use of the right whale density model includes more recent data and was modified to smooth issues related survey gaps and inter-annual variability. Closures where buoy lines are fully removed offer slightly higher co-occurrence reduction, most notably in areas where right whales are likely to be aggregating. Humpback and fin whale co-occurrence reduction scores are also provided in Table 5.5, demonstrating some co-occurrence reduction and resulting favorable protection, although to a lesser extent than for right whales. These species would likely benefit from co-occurrence reduction in spring when several of the analyzed seasonal restricted areas would reduce the use of buoy lines (Table 5.5).

Alternative 2 and Alternative 3 both propose several new seasonal buoy line restricted areas. Alternative 3 would require more closures to fishing with persistent buoy lines for longer periods of time and therefore, offers the greatest reduction of co-occurrence, assuming lines are not relocated. Alternative 3 would require an additional buoy line closure area in Georges Basin core area (May through August) that is not included in Alternative 2.

Alternative 2 included consideration of state measures proposed by Massachusetts that would seasonally close state waters in LMA 1 and the Outer Cape LMA during the MRA restricted period, from February through April, expanding the MRA north to the New Hampshire border (MRA North). NMFS will be including the addition of the MRA North waters from February through April in the Final Rule. Expansion of the MRA into Massachusetts State waters in both Alternatives is largely assumed to result in lines being removed from the water instead of relocation into federal waters because many state fishermen do not have federal permits. Other Massachusetts State water measures that will not be implemented in the Final Rule have been implemented by the state, including a closure of state waters in LMA 1 and the Outer Cape LMA by monitoring the areas through at least May 15th, potentially extending to the end of May or until no more than three whales remain in those areas. However, Massachusetts and NMFS enforcement personnel are investigating the apparent storage of trap/pot gear in waters remaining open in Massachusetts Bay between the state's new closed waters and the northwest border of the MRA to determine whether the new closure area includes dual permitted fishermen that would move rather than remove gear. However, as seen in Figure 5.3, in spring of 2021 there was gear observed outside of state waters in between the original MRA and MRA North and also in close proximity to right whale aggregations, so there may be unintended consequences of these closures that need further investigation. Future rulemaking would be needed to close that unintended gear storage area, which during 2021 resulted in high observed co-occurrence of right whales and vertical buoy lines.

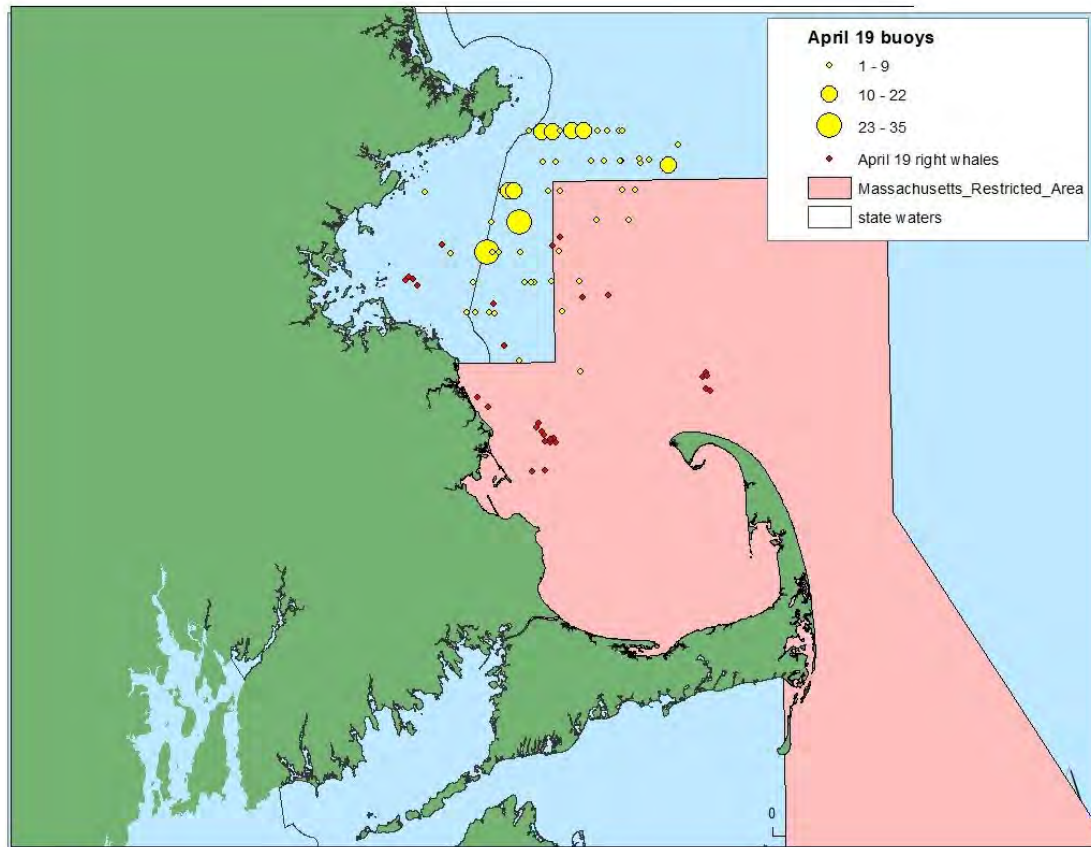


Figure 5.3: April 19, 2021 Aerial survey observations of buoys and whales in closed state and MRA waters and in the area that remained open (Robert Glenn, MA DMF).

Though not included in the baseline for the analysis in this chapter, the risk reduction estimates in Chapter 3 include a credit for the MRA as well because it was implemented relatively recently and maintaining this area is invaluable for reducing co-occurrence between right whales and trap/pot buoy lines, providing an additional 9 to 12 percent risk reduction and 13 percent reduction in co-occurrence with right whales. Since right whales frequently and increasingly (Ganley et al. 2019) aggregate in the MRA during the closure period, and because Massachusetts State will be extending the buoy line restrictions beyond the April 31 end date included in the proposed rule if whales remain in state waters, this restricted area is likely to have a large impact on right whale co-occurrence. Some of the highest reductions of right whale co-occurrence are predicted between February and May, with greater reductions in Alternative 3 due to an extension of the entire MRA. Alternative 3 proposes an extension of the federal closure to buoy lines throughout the MRA through May in addition to the state measures considered in Alternative 2. A soft extension adds an additional 3 percent reduction in co-occurrence beyond the state water closure in Alternative 2, for a 95 percent reduction in risk for the month of May, though this would require a monitoring and enforcement mechanism to be in place for this to be effective.

Both alternatives include an LMA 1 Restricted Area during fall and winter months (October through January) with a month-long extension (through February) in Alternative 3. The LMA 1 Restricted Area was identified as a hotspot in the DEIS, and remained an area of concern with

the updated right whale density model using data from 2010 to 2018. Though this area may have declined in importance since 2010 compared to 2003 through 2009 (Record et al. 2019, Roberts et al. 2020), the right whale density model (version 11) still predicts higher whale densities relative to other regions and higher entanglement risk due to the number of buoy lines used in this area. Additionally, right whales are known to return to areas after years of low use and it may return to pre-2010 frequency in this area in the future. As described in section (5.3.1.1.1), the fishery in Maine may, and has the potential to, be fishing farther offshore than in previous years, with the threat of increased buoy lines in offshore areas increasing entanglement risk for whales that return to that area. An offshore restricted area here would prevent further increase in lines in this offshore area that right whales have been known to use. Similar to the soft opening in the MRA, Alternative 3 would close the LMA 1 Restricted Area for an additional month as a soft restricted area that could be relieved by aerial or acoustic survey confirmation that there were no right whales within the buoy line closure areas.

In this FEIS, there are two options between the two action alternatives for a seasonal buoy line closure from February through April south of Cape Cod, the South Islands Restricted Area. The restricted area proposed in Alternative 2 (Preferred) in this FEIS now includes a larger area south of Cape Cod, which is an area that has seen an increase in right whale aggregations throughout the year with the majority in spring months (black outline, Figure 5.4). This area provides greater risk reduction than the restricted area proposed in the FEIS Alternative 3. A smaller area was previously included in Alternative 2 as proposed by the state of Massachusetts but was ultimately rejected due to public comment and observed (red outline, Figure 5.4) and predicted movement of lines outside of the restricted area into right whale hotspots. Both options analyzed in this FEIS are core areas where whales have frequently been sighted by Northeast Fisheries Science Center surveys between 2017 and 2021 (Figure 5.4). The option offered in Alternative 2 is the larger of the two and was created using sightings and habitat data available to encompass all of the likely hotspots based on whale presence as well as the presence of suitable right whale habitat. This option offers the greatest protection to right whales because it has the potential to close a substantial area known to be used by right whales. Alternative 3 includes a slightly smaller L-shaped restricted area that encompasses the densest area of whales sighted between 2017 through March 3, 2020. However, Figure 5.4 shows this medium sized area in gray also mapped with aerial survey data from early 2021 to check for robustness to annual variation and missed key right whale aggregations. The L-shaped restricted area option likely offers an intermediate to large protection for right whales because, though it is not as large as the Preferred Alternative, it did encompass the areas of high right whale density across several years and is somewhat robust to annual variation.

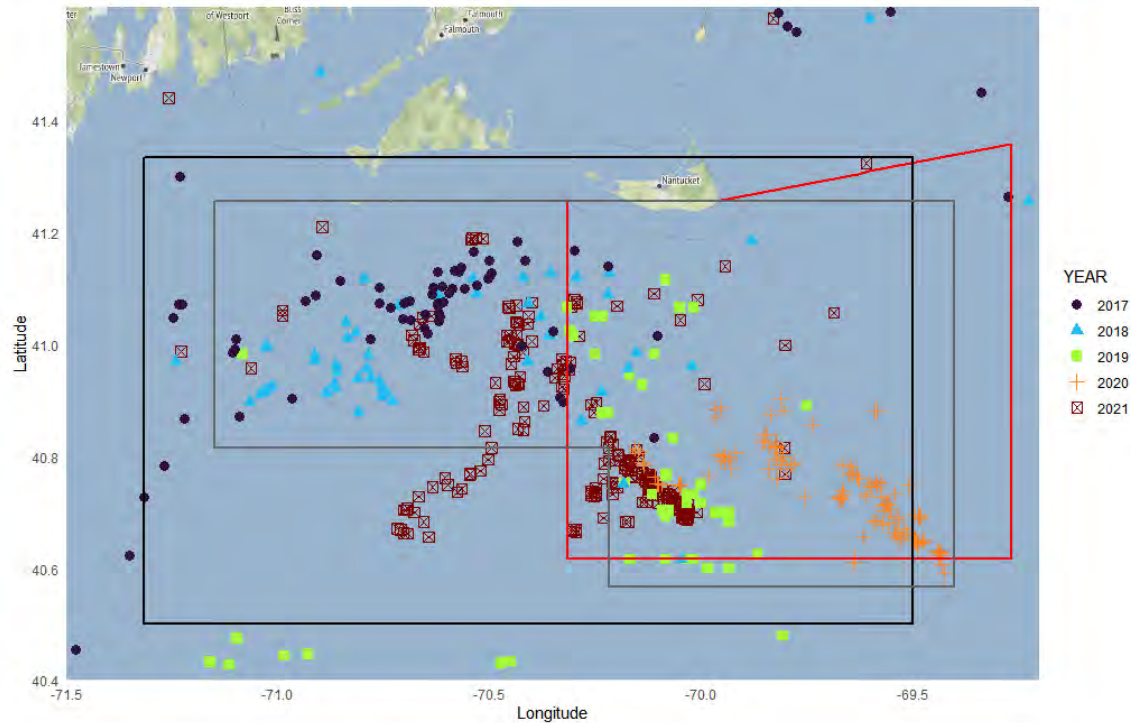


Figure 5.4: Right whale sightings data during February through April from 2017 through 2021 with the restricted areas analyzed in the DEIS. The area in the preferred alternative in the DEIS is in red, the area now in the FEIS preferred alternative is in black, and the grey area is in the non-preferred alternatives in both the DEIS and FEIS. Aerial and shipboard survey data collected by NMFS, the New England Aquarium, and The Center for Coastal Studies and also includes opportunistic sightings data.

The effects of additional seasonal buoy line closure areas in Alternatives 2 and 3 vary. All would benefit right whales but are less likely to benefit fin whales and humpbacks. Restricted areas were analyzed two ways, depending on the location and likely behavior in these areas. First, it was assumed that 100 percent of the vessels would suspend fishing within the Massachusetts Restricted Area and in the state water extensions (although see above for 2021 observations). We know from existing closures that this is more likely for nearshore restricted areas, particularly the MRA, when fishermen would have a long transit to open areas and some fishermen, without federal permits, are restricted in area choices. However, in offshore restricted areas or for fishermen with federal permits, some fishermen would be able to move their lines and could increase risk outside of restricted areas as occurred in 2021. Co-occurrence analysis off restricted areas farther from shore assumed that vessels would continue to fish and would relocate lines to nearby available areas. The effects of each of these two assumptions of response to a restricted area differs slightly depending on how co-occurrence changes whale entanglement risk. When fishing is suspended or ropeless technologies are employed and lines are removed from the water entirely, there is a large decrease in co-occurrence and, as a result, a reduced risk of entanglement. If instead lines are moved to different areas, co-occurrence could decrease or increase depending on where lines are relocated. In some cases, restricted areas could increase risk if the restricted area leads to fencing of buoy lines around the area, such as was predicted for the Georges Basin Restricted area in the DEIS, exacerbated with the use of the newer whale data in the updated DST (version 11). Restricted areas were picked based on scenarios that are more likely to result in a net decrease in right whale co-occurrence. Given recent changes in right

whale distribution, continued monitoring is necessary to confirm how these measures change buoy line density and co-occurrence. A longer trawl option offered risk reduction in Alternative 2 in lieu of a restricted area and likely avoids increasing co-occurrence in areas adjacent to this hotspot.

The multiple restricted areas proposed in Alternatives 2 and 3 could result in local conservation benefits to other large whales, though to a lesser degree than right whales. All large whale species included in this VEC can occur within the proposed restricted areas at times (CETAP 1982), particularly the restricted areas proposed south of Cape Cod (Stone et al. 2017, Davis et al. 2020). As described in Chapter 3, the restricted areas were designed and selected using either estimates of right whale density model based on a long time series of sightings normalized over the area applying oceanographic characteristics (version eight) or using more recent sightings per unit effort data between 2014 and 2018 (NARWC 2019). The current analysis uses a newer version of the right whale density model (version 11) that captures more recent data after the regime shift that started in 2010 (Pace et al. 2017). Despite the direct intention to focus on right whale hotspots, fin, humpback, and minke whales may experience a slight benefit from these restricted areas as they are sometimes present in these areas during the restricted area times (CETAP 1982, Stone et al. 2017), though these areas are not necessarily hotspots for these species so any benefit is likely less beneficial than broad scale line reduction. Co-occurrence of humpback and fin whales is predicted to decrease throughout the year in Alternatives 2 and 3 (Table 5.5), with a larger reduction predicted with Alternative 3. Restricted areas where lines are fully removed would likely have the most beneficial impact on overall entanglement risk, such as those in Massachusetts State waters. However, under the relocation scenarios, certain areas may experience an increase in co-occurrence where gear is expected to move to areas of higher whale density along the border of the restricted area, though the predicted increases are likely to be relatively small. Overall, co-occurrence of large whales with buoy lines and associated entanglement risk will likely decline substantially when paired with the other line reduction measures discussed above.

5.3.1.1.2.1.2 Impacts of Allowing Ropeless Gear in Restricted Areas

Impacts caused by modifying the definition of the existing seasonal restricted areas (Massachusetts and Great South Channel Restricted Areas) to include ropeless fishing are anticipated to be very small because fishing under the new definition would be limited and conditional under exemptions to gear marking requirements. The Outer Cape LMA would not be open to ropeless fishing because it was originally closed for lobster management purposes. Exempted fishing permits would likely also restrict access to Cape Cod Bay where the highest density of right whale aggregations are most common. After the ANPR was published in September 2018, a cost benefit analysis of a short term exempted fishery in the restricted areas was conducted (Black et al. 2019). The analysis considered primarily qualitative information gained from interviews with stakeholders in 2018. Interviewees included a lobster fisherman and representative that were targeted because they had expressed the most interest in developing alternatives to the fishery closures, particularly in Massachusetts Bay. At that time, industry representatives interviewed estimated that approximately eight to twelve fishermen from the South Shore of Massachusetts might consider applying for an authorization or an exempted fishing permit to explore ropeless fishing under commercial conditions in the closure area. In

addition to operational challenges, the high cost of ropeless systems—at that time estimated to range from over \$55,000 to over \$240,000 per vessel—was identified as a constraint although support by ropeless developers, NMFS, and NGOs was considered likely to defray costs during initial efforts. Additional constraints related to time, costs, and logistics associated with permitting, data collect, monitoring, and reporting were also identified.

Ropeless research in the lobster fishery has occurred since that analysis was done. In 2019, the New England Aquarium initiated a study under an exempted fishing permit outside of the Take Reduction Plan closure areas. Additionally, NMFS has begun assembling ropeless gear to loan to fishermen and researchers, and is working with a handful of fishermen, with the support of environmental organizations, to test ropeless fishing under an exempted fishing permit. A few Massachusetts lobster fishermen have conducted trials with ropeless fishing technology outside closure areas and therefore have some understanding of operational issues associated with the technologies. In most of the work done to date, the high costs of the technology has not been borne by the individual fishermen. While these efforts demonstrate a growing interest in developing ropeless fishing, they also suggest that modifying the closure areas would not result in a large influx of fishermen into currently closed areas, especially if they are required to purchase ropeless systems themselves. Any increased testing of ropeless systems, though, could accelerate the timeline for feasibility of ropeless technologies, providing a long-term benefit to right whales and other large whales and to the trap/pot fisheries that operate in close proximity to them. NOAA has invested a substantial amount of funding in the industry's development of ropeless gear, in specific geographic areas and in general. We anticipate that these efforts to facilitate and support the industry's development of ropeless gear will continue, pending appropriations. At this time, we expect the number of individuals testing ropeless fishing to be constrained by the high cost of ropeless technology and to use gear borrowed from other entities, such as the Northeast Fisheries Science Center or NGOs. Given plans for gear caches being developed for this purpose, it is estimated that participants could be expanded from approximately five vessels and 50 trawls in 2021 to about 33 vessels fishing 330 trawls using 330 stored buoy lines (with one system per trawl). Gear would also be available for participating mobile gear fishermen working to ensure affordable methods of detecting gear fished on the bottom and preventing gear conflicts.

By permitting ropeless trap/pot fishing in seasonally Restricted Areas during the period of time they have traditionally been entirely closed to trap/pot fishing (with persistent buoy lines), this Alternative introduces some level of interaction risk to protected species that previously did not exist in both areas during the seasonal closures. Even though participants will not be using persistent buoy lines, they will be using sinking groundlines, and therefore, some level of entanglement risk remains from introducing gear into areas with high densities of feeding whales. As mentioned in Chapter 2, large whales are at risk of becoming entangled not just in buoy lines, but entanglement may also occur in groundlines of trap/pot gear. Bottom foraging increases the risk of whale interaction with groundlines. Evidence of right whale bottom feeding in all feeding habitats and all months indicates that even sinking groundline may pose some risk to right whales, though the frequency of these dives and interactions is uncertain (Hamilton and Kraus 2019) and sinking groundline rules implemented in 2009 reduces groundline threats.

While the groundline of any trap/pot gear may pose some risk (Hamilton and Kraus 2019), conservation measures adopted under Alternative 2 and Alternative 3 would require participants to utilize areas that will minimize their interactions with large whales, especially right whales, the large whale species likely to be present in greatest numbers at the time participants will be permitted to fish ropeless. By assessing the most up-to-date right whale survey data, applicants may avoid the most densely populated areas within the restricted areas (i.e. Cape Cod Bay within the MRA) at any given time. Therefore, the risk of right whale entanglement, even in groundline, has the potential to be minimized. In addition, in alignment with right whale reporting conservation measures, participants may support whale disentanglement efforts by reporting entangled right whale sightings sooner than they would have been reported otherwise, therefore helping to provide some benefit to the health of an entangled whale.

In addition to the entanglement risk posed by sinking groundlines, entanglement risks are also introduced during the deployment of buoy lines during retrieval; however the level of risk differs between ropeless systems. For example, time-released ropeless devices have a higher risk of encountering and incidentally entangling a protected species because it may be released prior to the fisherman's presence due to weather or other factors that would prevent the fishermen from being present at the time that the surface system is released from storage.

By incorporating the full suite of conservation measures addressed in Section 3.3.3 through surface buoy exemption authorization processes, it is expected that entanglement risk will be minimized to the maximum extent practicable. The conservation measure that limits retrieval mechanism to acoustic release allows participants to maintain control over the amount of time any buoy line remains in the water column as a potential entanglement risk. Fishermen must be within a close distance of the gear in order for the signal to be received and the line released, which minimizes the time the line spends in the water column unsupervised. If the gear is released as intended, the risk posed by the released buoy line is minimal. Relative to other release mechanisms (i.e. galvanized time release), acoustic release provides a minimal timeframe where the released buoy line will be left unattended.

Furthermore, failure rates (defined here as premature or failed release of the stored buoy line or retrieval systems) of the technologies are minimized through the use of technology that has been tested elsewhere, and that are set and hauled by crews with experience using these new technologies, as recommended by the conservation measures in Alternative 2 and Alternative 3.

5.3.1.1.2 Indirect

Proposed seasonal restricted areas that are closed to persistent buoy lines could have indirect beneficial effects on large whales by tempering the possible expansion of trap/pot fisheries into areas of whale co-occurrence. Any vessels entering into these fisheries would be subject to the seasonal buoy line closure of the restricted areas or to obtaining conditional experimental fishing permits to allow them to fish with ropeless gear, such as remotely triggered buoys that bring line stored on the bottom to the surface at retrieval time. Further development of operational ropeless fishing systems would have indirect positive effects through the potential future conservation benefits of technology informed and accelerated by experienced commercial fishermen's use under commercial fishing operations.

Testing of ropeless gear, particularly in test phases, could indirectly contribute to ghost gear that pose an entanglement risk. It is assumed that gear loss from ropeless equipment failure would be small given fishermen are more likely to test gear that have lower gear failure rates and gear loss has not yet been reported in testing conducted by the Northeast Fisheries Science Center.

Additionally, most ropeless systems incorporate a transponder or other technology that provide fishermen with location information. Fishermen would be able to reclaim gear through grappling, further reducing the amount of abandoned gear in the environment and a collateral benefit to fishermen who already lose gear due to storms and gear conflicts. A concern that arose during the public comment period was the potential loss of ropeless gear trawled up by mobile fishermen. Given the expected low volume of participants testing ropeless as well as anticipated exemption collaboration recommendations, increased ghost gear and gear conflicts from interactions with mobile gear is not expected to be noticeably higher than what currently occurs in the fishery. Furthermore, fishermen would be required to call in and out of exempted fishing trials and report locations precisely, so that effort can be easily monitored. Additional effort will be made to communicate with the mobile fleet in the area to alert other vessels of locations where ropeless gear is being fished.

The trap/pot buoy line closures could also have negative indirect effects if fishing effort is relocated just outside of the restricted areas adjacent to valuable whale habitats. This relocated effort may result in a wall of fishing gear, which would increase entanglement risk as whales move in and out of these management areas. For this reason, the Georges Basin Restricted Area is not preferred due to the potential to push gear outside the area into equally risky habitat and the originally preferred South of Island closure recommended by Massachusetts has been rejected as a seasonal closure area.

Another potential indirect effect of an increase in ropeless fishing could be increased vessel traffic in areas with high whale densities. Right whales in the Massachusetts Restricted Area are vulnerable to vessel strikes. Vessels 65 feet (19.8 m) and larger operate under seasonal speed reductions of 10 knots or less in Cape Cod Bay from January 1 to May 15th, and along the Outer Cape LMA from March 1 to April 30th. Despite these restrictions, since 2009 there have been eight known vessel strikes in or near Cape Cod Bay: two mortalities, one significant injury, and 5 additional injuries (Caroline Good, Pers. Comm.). It is unclear whether this was due to non-compliance of the speed restrictions or that the current restrictions are insufficient to protect right whales. Based on discussions with fishermen, we do not anticipate more than a few fishermen would operate in the Restricted Area in Massachusetts Bay, outside of Cape Cod Bay, under exempted fishing permits until ropeless fishing gear becomes affordable and effective at marking buoyless gear for fixed and mobile gear fishermen and other mariners. Fishermen operating under an exemption will likely not increase vessel traffic above the current baseline during these months. However, to prevent an increased risk of vessel strikes, any ropeless fishing occurring under an exemption to the surface marking requirements during the seasonal closure to buoy lines and the seasonal speed reduction areas, regardless of vessels size, can be restricted under permit conditions to transit speeds of 10 knots or less, have a designated observer on board looking for whales, and be in contact with the Center for Coastal Studies or other contracted aerial survey teams to ensure knowledge of the most recent information about right whale distribution. Authorization may not be given for areas of particular high right whale abundance.

Both Massachusetts DMF and NMFS may be involved in developing conditions for ropeless fishing in these areas and the Take Reduction Team will be apprised of outcomes at an annual monitoring meeting. Generally, indirect effects of seasonal buoy line closures are expected to be minimal.

5.3.1.2 Changes to Weak Link Requirements

5.3.1.2.1 Direct

As discussed in Chapter 3, ALWTRP measures include incorporation of weak links or weak rope to create breakaway buoy lines on fixed commercial fishing gear. Prescriptive breaking strengths by fishery and area were created after field testing to determine operational feasibility. The use of breakaway buoys or weak buoy lines were required because “. . . this measure would reduce the potential for a whale to become wrapped in the buoy line and sustain serious injury or mortality from either the buoy line itself or from dragging the whole lobster pot trawl (62 FR 16108, April 4, 1997).” This modification recognized the observation that line through the mouth of a baleen whale appeared to be one of the more frequent forms of entanglement (Knowlton & Kraus 2001). Entanglement involving baleen results in more complicated outcomes through persistent entanglements that can reduce feeding efficiency and increase the chance of a serious injury or mortality. Where an entanglement happens near the surface system of a buoy line, weak links may improve the outcome by allowing buoyless line to slip through the baleen in some cases. In gillnet gear, the placement of weak links in multiple places around gillnet panels appears to frequently allow right whales and other large whales to break through without serious injury. The effectiveness of weak links attaching buoys to the trap/pot buoy lines are less clear. As discussed below, weak inserts lower down on the line are more likely to have a risk reduction benefit. Under Alternative 2 (Preferred) and the final rule, all ropes in the Northeast Trap/Pot Management Area would be weak or have weak insertions below the surface system. Knowlton et al. (2020) models whale interactions with weak ropes and weak insertions, and the model suggests that rope parts below where a whale’s movement applies force on the rope. This model suggests the weak insertion at the buoy would not necessarily part the buoy from the rope quickly, and may not have much effect on entanglement severity. Some commenters indicated a preference for retaining the buoy on the rope so that in the event of an entanglement some additional information about the location of the incident could be obtained from the buoy. Additionally at Team meetings some Team members suggested that drag caused by the buoy could pull rope away from the whale and facilitate the shedding of gear, and suggested that the buoy could provide a disentanglement team with improved access to entangling rope. While retention of the buoy may be beneficial for some large whales, given right whale behavior in surface aggregations, buoys may be rubbed off of gear whether or not a weak link is present. Given the lack of confidence that a weak link in a surface system is effectively reducing risk to right whales and the potential benefit of buoy retention for some entangled large whales, Alternative 2 of this FEIS and the final rule would remove this requirement. Fishermen however, would not be prohibited from retaining a weak link in the surface system.

For all large whale entanglement cases between 2010 and 2018 where a whale was entangled but the gear was not recovered, 38 percent had buoys still attached, suggesting a weak link was not present or the whale was not always able to break the weak link (Moise pers. comm., April 9,

2020). There are a small number of cases including one observed in 2020 that demonstrate that buoys may complicate entanglements that involve the mouth or baleen. However, even where no buoys are involved, right whales and other large whales entangled at the mouth are often still left with constricting rope that can seriously impact their health and ability to feed. Disentanglement team members suggest that trailing gear that includes a buoy could aid disentanglement teams in grappling and pulling gear away from a whale or attaching a tracking buoy to facilitate tracking and further disentanglement attempts. Additionally, buoys could help whales shed gear by providing resistance against the water, pulling line away from a whale. Additionally, commercial fishing buoys are marked with identifying information that can help pinpoint the location of entanglement events if retrieved.

For these reasons, the measure included in Alternative 2 that would remove the weak link requirement for lobster/crab trap buoy lines that use weak rope or weak insertions further down on the buoy line likely has a negligible impact on entanglement risk and a potential positive impact on future determinations of gear type and set location. Discussed further below, a weak buoy line would likely do more than a weak link at the buoy to allow a whale to break away from a crab or lobster trawl and minimize entanglement severity and reduce serious injuries and mortalities. Additionally, Alternative 3 would make the use of weak links optional. Surface systems sometimes include two or more lines connecting buoys and radar reflector to the buoy line used to haul gear aboard. Public comments on these two alternatives would provide valuable insights on the disentanglement and fishing operational benefits to these potential modifications to the Plan.

5.3.1.2.2 Indirect

Weak link requirements have been implemented under previous ALWTRP initiatives, and the NMFS Gear Research Team reports that they have received few comments regarding problems with the failure of any of these devices. The NMFS Gear Research Team has conducted a series of research projects that measured the loads exerted on buoy systems when used in typical conditions at different locations (NMFS 2002a, 2003). Allowing an option to remove the weak link at the buoy if weak rope or weak inserts are introduced to the buoy line lower down (Alternative 2), or make the use of a weak link optional (Alternative 3) are not likely to indirectly affect large whales through gear loss but could provide fishermen with operational improvements. Input from fishermen and disentanglement responders from public comments would be useful on this element. Providing an option to move the weak link should minimize the amount of gear loss but it will be important to follow up after regulations are implemented to see whether gear loss rates have changed.

5.3.1.3 Weak Rope

Weak rope requirements are designed to increase the chance that a whale will quickly break free of gear, and reduce the number of interactions between whales and commercial fishing gear that result in a serious entanglement (i.e., results in serious injury or mortality). As previously noted, buoy lines have been identified as a source of entanglement risk (Knowlton et al. 2016, Sharp et al. 2019). The requirement to weaken the strength of buoy lines is specifically designed to reduce serious injury or mortality as a result of interactions with buoy lines and surface systems. The theory is that the combination of the whale's momentum and the force it exerts against the weight

of the gear, or the force exerted across a line entangled around the whale in particular entanglement scenarios (e.g. if the whale is entangled through its mouth and tail stock or attached to a long, heavy trawl), will cause the force to increase until the rope or weak insertions break the line, allowing whales to break free of some gear. Replacing buoy lines with rope that breaks at less than 1,700 pounds (771 kilograms), a weak rope topper of 20 to 75 percent of the length of the buoy line, a weak buoy line or topper with weak inserts at 40 foot (12.2 m) intervals, or fewer weak inserts into full strength line all, to varying degrees, increase the likelihood that a whale will break away from a buoy line before sustaining more serious injuries or dying from the impacts of entanglement.

Alternatives 2 and 3 take different approaches to reducing line strength and our analysis considers how these differ in how they relate to research on the likely effectiveness of full weak rope. The theory behind weak rope is based on the observed strength of lines taken off of entangled whales associated with serious injuries and mortalities. Rope remaining on right and humpback whales included disproportionately (relative to availability in the environment) higher rope strengths, suggesting these species could break free from lighter line (Knowlton et al. 2016). During ALWTRT presentations and Team discussions, researchers suggested that, in lieu of fully manufactured weak rope, inserts of the same breaking strength at 40 foot (12.2 meters) intervals would ensure sufficient breaking points to allow a whale to break free. The proposed distance of every 40 feet (12.2 meters) is just less than the average length of an adult right whale, increasing the likelihood that a whale interacting with a line would encounter a weak spot. In the hope of being able to re-enter the Mass Bay Restricted Area, fishermen that belong to the South Shore Lobster Fishermen's Association developed a hollow braided sleeve that breaks at less than 1,700 pounds (771 kilograms) that they can rapidly splice into a buoy line, and proposed inserts at every 40 feet (12.2 meters). A comparison of these lines to other buoy lines used by Massachusetts fishermen showed comparable performance during commercial fishing operations (Knowlton et al. 2018). Insertions every 40 feet (12.2 meters) would be somewhat labor intensive for fishermen in deep waters, prompting New England states to propose fewer weak insertions. However, the broad regional use of weak rope in buoy lines, or frequent weak inserts increases the likelihood that an entanglement would include a point where a whale can exert sufficient force needed to break the line and potentially avoid more severe injuries.

Alternatives 2 (Preferred) and 3 (Non-preferred) would require the use of weak line or weak inserts with breaking strengths of 1,700 pounds (771 kilograms) or less. Engineered weak line that breaks at 1,700 pounds (771 kilograms) or less are available in commercial quantities at line diameters of 3/8ths (0.95 centimeters) and 5/16ths inches (2.1 centimeters), commonly used in lobster and Jonah crab trap/pot fisheries in nearshore waters. NMFS is working with gear manufacturers to determine if these lines can be produced with one strand of alternating color included to assist in the detection and enforcement of engineered weak line since much stronger line is also available at these diameters. NMFS has also been collaborating with Maine DMR and Massachusetts DMF to determine what weak insertions, gear configurations, or full weak options reliably break at 1,700 pounds (771 kilograms, within a 10 percent range). Weak insertions can be as simple as splicing in the South Shore Sleeve, or splicing in a length of manufactured weak rope. Additional weak insertions are being proposed by lobster fishermen and tested, primarily by Maine DMR through a NMFS grant. Interim results show some solutions that use relatively inexpensive commercially available materials (MEDMR 2020). The state of Massachusetts is requiring the use of full weak line or weak inserts every 60 feet (18.3 meters) in the top 75

percent of the line as of May 2021 and has approved a few options that use a manufactured red rope spliced into 3/8ths inch line (0.95 centimeter line; see Chapter 3 and Appendix 3.6). Offshore vessels are configured to use lines of larger diameters. The Atlantic Offshore Lobstermen's Association is working with NMFS and gear manufacturers to find engineered line of 5/8ths inch (1.6 centimeters) or other larger diameters that breaks at 1,700 pounds (771 kilograms) and can work with their hauling block. Offshore fishermen are testing acquired line as weak inserts and toppers. NMFS will continue to work with gear manufacturers and distributors as well as the states and commercial fishermen to ensure that weak rope and insertion is available at commercial quantities well before the effective date of final regulations.

Compared to Alternative 1 (No Action), Alternatives 2 and 3 would reduce the average maximum breaking strength of buoy lines in the Northeast Region from an estimated 2,162 pounds to an estimated 1,976 pounds (896 kilograms) in Alternative 2 and 1,753 pounds (795 kilogram) in Alternative 3 (Table 5.6). This relies on the estimated proportion of the weak insert configurations in Alternative 2 to full weak line. The analysis in this Chapter relies on the lower bound estimate of risk reduction, which assumes that the equivalent to full weak line is an insert at least every 40 feet (12.2 meters) and relies upon the depth data and scope ratio used to estimate line length in Chapter 3. The depth data used a weighted mean depth according to the number of lines fished at depths in a particular area and scope ratio was estimated from McCarron and Tetrault (2021), both of which represent the best available data at the time of this FEIS. Scope ratio ranged from 1.1 to two times the depth of the area being fished.

Chapter 3 also included an upper bound estimate that only considered the proportion of line above the lowest weak insert, which takes into account the depth of an insert but without considering the number or frequency of inserts as with the lower bound estimate. Weak insert simulations found that entanglements were more likely to part a line when a weak insert was below where a whale interacted with the line and when the trawl was longer (e.g. greater than five traps per trawl; DeCew et al. 2017, Knowlton et al. 2020). Thus, the lower down an insert, the more likely it would break when on a longer trawl in the event of an entanglement, though this may differ if there is only one insert and it may vary with distance from the entanglement point. The use of weak inserts at regular intervals on a buoy line or a full length of weak rope to reduce the likelihood that interactions between whales and commercial fishing gear will likely result in entanglements that cause serious injury or mortality. Alternative 1 would maintain the status quo, and the potential for entanglements to result in mortality and serious injury would not be decreased. The primary difference between weak rope requirements in Alternative 2 (Preferred) and Alternative 3 (Non-preferred) is that Alternative 2 relies primarily on weak inserts and at intervals that do not simulate full weak rope (except in shallow waters where inserts would be placed every 40 feet/12.2 meters) and therefore does not quite achieve an average line strength of 1,700 pounds (771 kilograms) across the northeast; whereas Alternative 3 requires more weak insertions or the use of lengths of engineered weak rope and the average line strength achieved with these measures is estimated at 1,753 pounds (795 kilograms). The weak line measures included in Alternative 2 in this FEIS provide greater conservation benefits than those analyzed in the DEIS, with broader use of weak line through state measures in Massachusetts and throughout LMA 2.

Table 5.6: A comparison of mean line strength and change in gear threat under each alternative.

<i>Alternative:</i>	<i>1 (No Action)</i>	<i>2 (Preferred)</i>	<i>3</i>
<i>Mean Line Strength</i>	2,162 lb/ 981 kg.	1,976 lb/ 896 kg.	1,753 lb/ 795 kg.
<i>Change in Line Strength</i>		8.6%	18.9%
<i>Change in Gear Threat</i>		17.2%	28.6%

5.3.1.3.1 Direct

The alternatives included in this analysis were selected based on the approximate risk reduction estimated for weak line in the DST, which used an empirically-based gear threat model that compares an individual whales' likelihood of retaining gear of different strengths (see Appendix 3.1). The model predicts that whales are significantly more likely to be observed with gear attached as the breaking strength increases (Appendix 3.1). The probability of lethality also increases with breaking strength given the available data (Appendix 3.1). These findings are in line with similar analyses showing no entangled adult right whales found in line that break at 1,700 pounds (771 kilograms) or below (Knowlton et al. 2016). Thus, broader use of line with a maximum breaking strength of 1,700 pounds (771 kilograms) should reduce the number of observed adult right whales entangled in heavy gear and the overall lethality of the gear in the Northeast Region trap/pot areas. Knowlton et al. (2016) found stronger average rope strength on entangled adults than juveniles, suggesting adults are better able to break out of weaker gear under a certain breaking strength. Given this, calves and juveniles may not experience the same benefit given they may be less able to break line of the same breaking strength as adult whales.

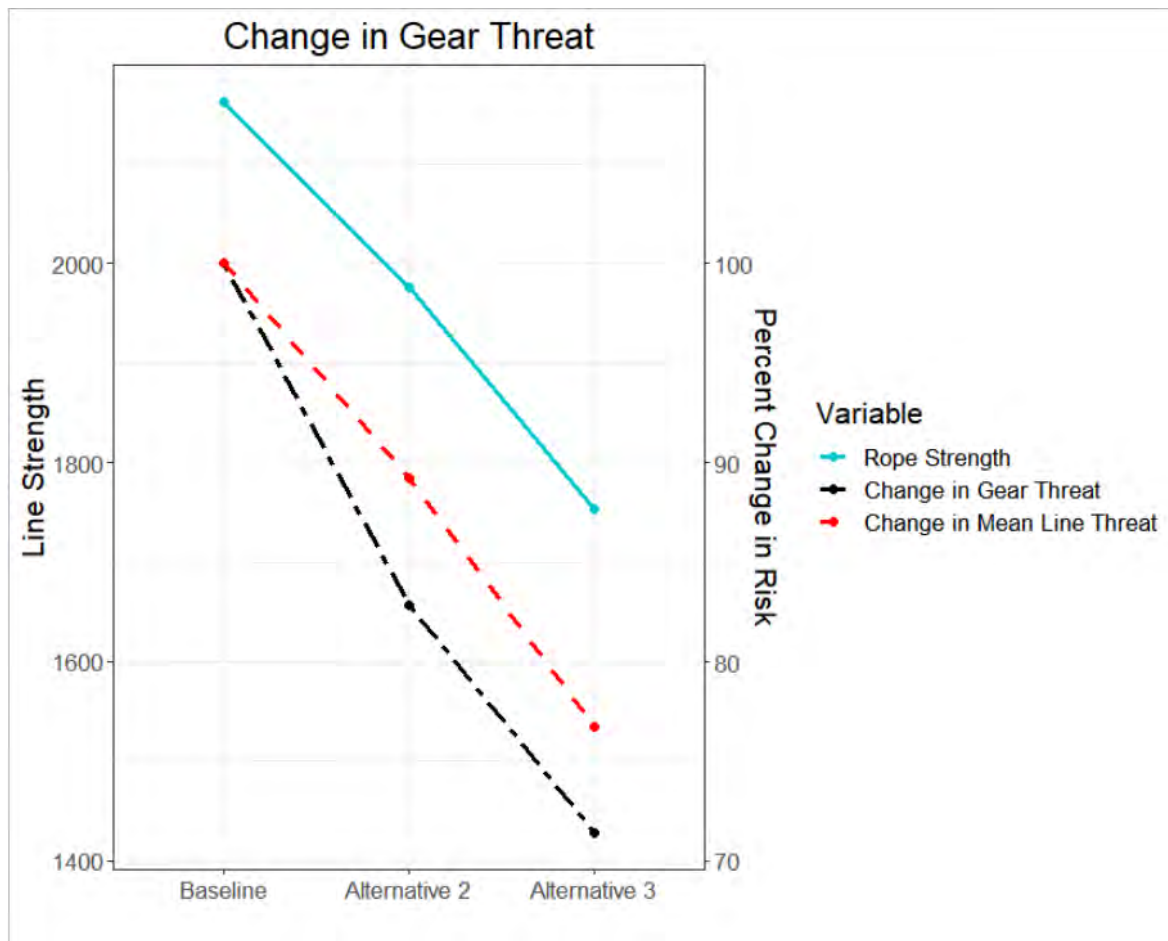


Figure 5.5: The relative mean rope strength, relative gear threat, and mean line threat for each alternative, including the baseline (baseline represents Alternative 1).

Figure 5.5 shows the change in average breaking strength of buoy lines between the baseline and Alternatives 2 and 3 as well as the associated change in mean line threat (i.e. threat of a single line) and total combined gear threat for the entire northeast. The weak line measures in Alternatives 3, which would require greater use of full weak rope or the equivalent (weak insertions every 40 feet/12.2 meters), offers the most direct benefit to whales by reducing likely entanglement severity compared to Alternative 2.

Weak buoy lines, particularly in areas with deep waters, waters with high currents, storm waves, large tidal ranges, or high chance of gear conflicts, have a high likelihood of breaking upon retrieval or snapping due to other conditions. Thus, requiring all buoy lines to be completely weak would result in increased lost gear and potential safety risks to fishermen.

Therefore, the alternatives, taken from proposals from New England state fishery management agencies, include other strategies that provide a few weak points. Generally, these requirements are for nearly all rope and would be required in areas or seasons of relatively low whale abundance. Such universal requirements would provide a precautionary measure to right whales outside of their predictable aggregation areas and would protect large whales across the Northeast Region.

However, whales that encounter buoy lines below weak rope or weak inserts are not likely to benefit from these modifications. Where the number of proposed inserts decreases as water depth increases (e.g. in Alternative 2 in areas outside of 12 nautical miles/22.2 kilometers), there is more risk reduction benefit than for a full-strength rope as whales encountering line above the break should be able to break free and would have an increased chance of shedding gear without serious injury/mortality, but the risk reduction benefit is not the equivalent of a full weak line. Although telemetry data are not available for right whales over deep waters off the continental shelf edge, current evidence suggests right whales use the entire water column to search for food and that they frequently interact with the seafloor (Baumgartner et al. 2017, Hamilton and Kraus 2019). That is, right whales can encounter buoy lines at all depths. The amount of protection a few inserts near the upper 33 to 50 percent of the buoy line offers is far less risk reduction than that of a full weak line or line with continuous 40 foot (12.2 m) interval inserts to the sea floor. A right whale or other large whale encountering rope above a weak point has a greater likelihood of breaking free from bottom gear as the whale exerts force against the weight of the trap/pots and anchor below. Depending on the length of time it takes for a whale to break free and the associated complexity of the entanglement, these weak inserts would reduce the risk of serious injury or mortality. However, if the whale encounters the rope below the lowest weak point, there would likely be no benefit given the lack of a weak point between a whale and the heaviest gear component. This scenario would still likely result in a whale dragging heavy gear or drowning below the surface. Drag can result in mortality and serious injury (van der Hoop et al. 2016, van der Hoop et al. 2017a, van der Hoop et al. 2017b).

Serious entanglements can cause death in up to 6 months (Moore and van der Hoop 2012). Chronic entanglements with gear retained and dragging can also contribute to lower birth rates (Moore and Browman 2019). For some areas where fewer weak points are proposed or where weak inserts are not far down the buoy line (e.g. beyond 12 nautical miles/22.2 kilometers), co-occurrence is higher between buoy lines and right whales relative to nearshore Maine waters, further reducing the risk reduction benefit in these areas.

The depth of the lowest weak point in Alternative 2 ranges from 33 percent to 75 percent. There is an option for full manufactured weak line only in Massachusetts State waters, though it is anticipated that most fishermen will choose the use of weak inserts every 60 feet (18.3 meters) in the top 75 percent of the buoy line. Under Alternative 2, LMA 3 would only have one weak buoy line topper in the top 75 percent of the line. Conversely, Alternative 3 includes broader use of full weak line or the equivalent in the top 75 percent of all buoy lines outside of LMA 3, which is more extensive than the nearshore options in Alternative 3. However, weak line measures are less extensive in LMA 3, which includes only a 20 percent weak rope topper year round with one end weakened in the top 75 percent only from May through June. This configuration may have more risk than the LMA 3 option in Alternative 2, particularly during summer months when right whales are more likely to be found in offshore waters.

There also may be reduced benefit depending on how weak insertions are configured and how a whale interacts with the line. The greater the number of weak points the greater the likelihood that a weak point will be located outside of the mouth, where the whale has a better chance of breaking free from the buoy line. Line through the mouth of a baleen whale is thought to be one of the more frequent forms of entanglement (Knowlton and Kraus. 2001) and involvement with baleen results in more complicated and persistent entanglements that can reduce feeding

efficiency and increase the chance of a serious injury or mortality. Configurations that are knot-free may also pose less risk. Currently, the Plan recommends the use of gear that is knot-free, and/or free of attachments due to the belief that smooth line may be more likely to slide through the whale's baleen without becoming lodged in the mouth or elsewhere and increasing the possibility of serious injury or mortality risk. Weak insertions that depend on large knots could potentially get caught in baleen if an entanglement occurs. Note, however, that there is evidence that splices and knots introduce weaknesses into buoy lines. Lines undergoing breaking strength testing broke on the smaller side of knots and splices (MEDMR 2020). Configurations for weak insertions currently being developed by fishermen are likely to include some with knots. Further evaluation is needed before adding knotted configurations to a list of approved weak insertions. NMFS is currently seeking input through an expert elicitation from scientists investigating Large Whale Unusual Mortality Events to determine the safety of approving knots as weak inserts and, if so, if there are particular knots that are less likely to complicate an entanglement.

Both Alternatives 2 and 3 aim to reduce the severity (i.e. serious injury or mortality) of future entanglements while maintaining safe conditions for fishermen without increasing gear loss. The alternatives offer different approaches that are expected to reduce the risk of serious entanglement for large whales relative to the status quo (Alternative 1), particularly for right whales and humpback whales (Knowlton et al. 2016) but also potentially for fin whales (Arthur et al. 2015). Knowlton et al. (2016) reported that age plays a role in a right whale's ability to break free of rope and that adults may be better able to break free from ropes of lower breaking strength than ropes of greater breaking strength so these measures may benefit adults more than calves or juveniles. Smaller species like minke whales and leatherback turtles are not expected to benefit from weak rope given they are frequently found entangled in rope of lower strengths and likely do not exert forces strong enough to allow disentanglement (Arthur et al. 2015, Knowlton et al. 2016). While Alternative 3 may offer higher risk reduction from weak rope than Alternative 2 (Table 5.6), they both offer some precautionary benefit to some large whales in some life stages in the event of an entanglement. Alternative 2 likely reduces the strength of more line in offshore waters in LMA 3 where gear is also stronger and more likely to cause serious injury or mortality if they were to become involved in an entanglement.

5.3.1.3.2 Indirect

The installation of weak rope could increase the rate of gear loss that could increase the risk that whales could become entangled in ghost gear. This may depend on which weak rope or weak insertion solution fishermen elect to use, although over time they would be expected to select for the solutions that cause the least gear loss. In a study of weak inserts conducted by New England Aquarium for the Massachusetts Office of Energy and Environmental Affairs, Knowlton et al. (2018) documented sleeves designed with reduced breaking strength breaking in only 11.8 percent of hauls relative to 8.5 percent of control buoy lines, which they did not find statistically significant. Information from Maine DMR studies of measured forces during gear hauling indicates that the proposed scenarios are appropriate for the areas and conditions where they are to be used (MEDMR 2020). While forces greater than 1,700 pounds (771 kilograms) breaking strength were required for some configurations, particularly for trawls of 35 traps and more in waters greater than 50 fathoms (91.4 meters, MEDMR 2020), timed haul data indicated those higher forces were not detected on the line until well past the halfway time during a haul (for example, Figure 7 in ME 2019 Proposal, Appendix 3.3). Both Alternatives propose a broader use

of weak line or inserts in more shallow waters. In deeper offshore waters where there are increased forces needed for hauling, as well as added safety concerns and conditions that can inadvertently break a weak rope, the alternatives allow at least one buoy line either fully strong (LMA 3 Alternative 2), a weak insert at 33 percent down (12 nautical miles /22.2 kilometers to LMA 3 border), or a weak topper at 20 percent down on one end on trap/pot trawls set in deeper waters (LMA 3 Alternative 3). Alternative 2, with limited weak inserts half way or 33 percent of the way down the line, a smaller proportion of line is considered to be the equivalent of weak line and could have lower likelihood of contributing to gear loss, if weak rope is found to contribute to gear loss. Overall, weak rope elements considered in the Alternatives should minimize the amount of gear loss caused by reduced rope strength but it will be important to follow up after regulations are implemented to see whether gear loss rates have changed.

The broad requirement to use weak lines or inserts may make disentanglement more difficult. Disentanglement teams rely upon added floatation or drag to slow the whale down and provide an opportunity to safely release the whale from the lines. Weak inserts or line may prevent this additional drag from being applied thus potentially making the effort more dangerous and difficult. Colorful or contrasting weak inserts that are easily recognized would help disentanglement responders recognize these potential obstacles and adjust accordingly. Chapter 2 includes the number of whales for which serious injury or mortality was averted because they were disentangled, demonstrating disentanglement's positive impacts on entanglement outcomes. However, disentanglement is not always possible or feasible so prevention of serious entanglements is likely to be more beneficial to the population in the long term.

5.3.1.4 Enforceability

The measures described above for Alternatives 2 and 3 would only provide a conservation benefit if they are broadly adhered to and result in a measurable change in entanglement risk and severity. This requires the measures to be enforceable by NOAA's Office of Law Enforcement (OLE) as well as the U.S. Coast Guard and especially state enforcement agencies. The impact of trawling up measures was discussed briefly in 5.3.1.1.1. Agencies already do their best to enforce current measures, including restricted areas and minimum trawl lengths as well as other gear configurations. Enforcement has been a particular challenge in LMA 3 offshore waters, where fishing operations are largely unobserved and deep sets of long trawls are beyond the haul capabilities of prevent enforcement vessels. OLE has successfully tested the use of remotely operated vehicles to aid in enforcement in offshore waters when hauling gear is not possible. This technology has the capabilities of improving enforcement of the current and FEIS measures in offshore waters.

The conversion of seasonal closures to buoy line closures where ropeless fishing is allowed with an EFP provides an additional enforcement challenge. Enforcement boats will need to have access to the locations of all ropeless gear in order to properly enforce their use and ensure they are not within areas where ropeless fishing is not allowed (e.g. in Cape Cod Bay during spring). Currently, the testing of ropeless fishing with an EFP is limited and conducted in close collaboration with NOAA or other entities with strict adherence to conditions including location reporting (outlined in Chapter 3). NOAA has been developing standards for the technology used to locate and retrieve gear to ensure the development of industry standards and the ability of law

enforcement to have access to gear locations and configurations. Testing of ropeless gear in restricted areas will allow testing of these technologies and collaboration with enforcement officials to develop protocols for enforcement of ropeless fishing. This testing phase allowed under both Alternatives 2 and 3 will prepare enforcement agencies for broader use of ropeless fishing.

Weak inserts are also an area where enforcement may be a challenge. Comments on the DEIS expressed a concern with the ability of agencies to enforce the use of weak rope or inserts. Enforcement of weak rope or weak inserts requires the gear to be configured such that they are detectable by enforcement agencies. This is a challenge given it requires fully manufactured rope to look distinct from other fishing line and for weak insert configurations to be identifiable. Furthermore, areas where regular weak inserts are required in lieu of full manufactured weak line will be difficult to detect and enforce without the capability to measure length between inserts. NMFS is working with OLE and other fishery enforcement agencies to ensure the approved weak inserts are identifiable and enforceable. In this FEIS, the line cap in Alternative 3 would be particularly challenging to enforce, even if a mechanism for implementation was identified. The use of gear configurations and restricted areas that rely on enforcement are not expected to differ between Alternatives 2 and 3. For more information on enforcement plans see Appendix 3.5.

5.3.1.5 Analysis of Direct and Indirect Impacts of the Alternatives on Large Whales

The biological impacts described in the previous section focus on impacts to the right whale and vary across the regulatory alternatives. This section compares the direct and indirect biological impacts of each alternative. Where sufficient information is available, the alternatives are compared using quantitative criteria.

Table 5.7 compares the annual impacts of the alternatives using a variety of indicators that are likely to correlate with reduced large whale entanglement risk and severity. The change in line numbers, co-occurrence, and gear threat for the impact alternatives, compared to Alternative One, were summed to provide an annual total for the purpose of comparing the alternatives. This analysis evaluates the impact of alternatives to modify the ALWTRP requirements relative to the status quo Alternative 1 (the No Action baseline that assumes no change in existing Plan requirements). As previously stated, it is important to note that the No Action Alternative (Alternative 1) would not achieve the objective of reducing mortality and serious injury of right whales below PBR. If Alternative 1 were chosen, the current rate of mortality and serious injury to large whales due to U.S. entanglements in commercial fishing gear would continue to exceed PBR, rather than be reduced.

The risk of an interaction is associated with the quantity of gear in the water (e.g., number of buoy lines), gear soak duration, and the temporal and spatial overlap of the gear and protected species. Increases in any of these factors equates to elevated interaction risk to protected species, while decreases in these factors equates to a lower interaction risk. As the lobster and Jonah crab fisheries use trap/pot gear, and the distribution of protected species of large whales (North Atlantic right, humpback, minke, fin) overlaps with the fisheries, interactions with protected species are possible and some level of negative impacts to protected species is likely.

Table 5.7: The annual summary of all quantitative measures for each alternative, including the change in annual buoy line numbers (summed across months), co-occurrence, and total annual conversion to weak line. The risk reduction and co-occurrence estimates from Chapter 3 are also shown, which include the credit for the implementation of the MRA with the upper and lower bound estimates provided for weak inserts)

Alternative:	1 (status quo)	2 (Preferred)	3 (Non-preferred)
Line Reduction		% Reduction	% Reduction
Risk Reduction		60%	72%
Risk Reduction (with MRA Credit)		69% – 73%	
Line Reduction		7%	7%
Co-Occurrence		% Reduction	% Reduction
Right Whale		54%	60%
Right Whale (with MRA Credit)		65%	
Humpback Whale		12%	19%
Fin Whale		14%	17%
Weak Line			
Mean Line Strength	2,162 lb/ 981 kg.	1,976 lb/ 896 kg.	1,753 lb/ 795 kg.
Change in Line Strength		9%	19%
Change in Gear Threat		17%	29%

Alternatives 2 and 3 are similar in geographic range and requirements. As such, each alternative reduces co-occurrence and, by proxy, predicted entanglement risk within the 60 to 80 percent target (Figure 5.6). Each alternative also proposed gear modifications that would increase the likelihood that a whale could break free of gear before becoming seriously injured or killed. The substantial differences among the alternatives is the number of restricted areas and the different approaches taken to reduce the number and breaking strength of vertical buoy lines. Alternative 2 (Preferred) would reduce co-occurrence with less impact on total fishing effort (e.g. the number of trap/pots fished or the number of restricted areas) than Alternative 3 and with less of an impact on line strength. Alternative 2 additionally considers the risk reduction credit offered by the maintenance of the MRA, which results in equal re Broad scale implementation of weak inserts or toppers with full weak line are also included in areas of lower co-occurrence and represent risk reduction that is also precautionary for right whales in the Northeast Region outside of high use areas and seasons. The highest degree of protection results from Alternative 3 (Non-preferred) due to the combination of the most proposed closures to persistent buoy lines and the broadest requirement for full weak rope.

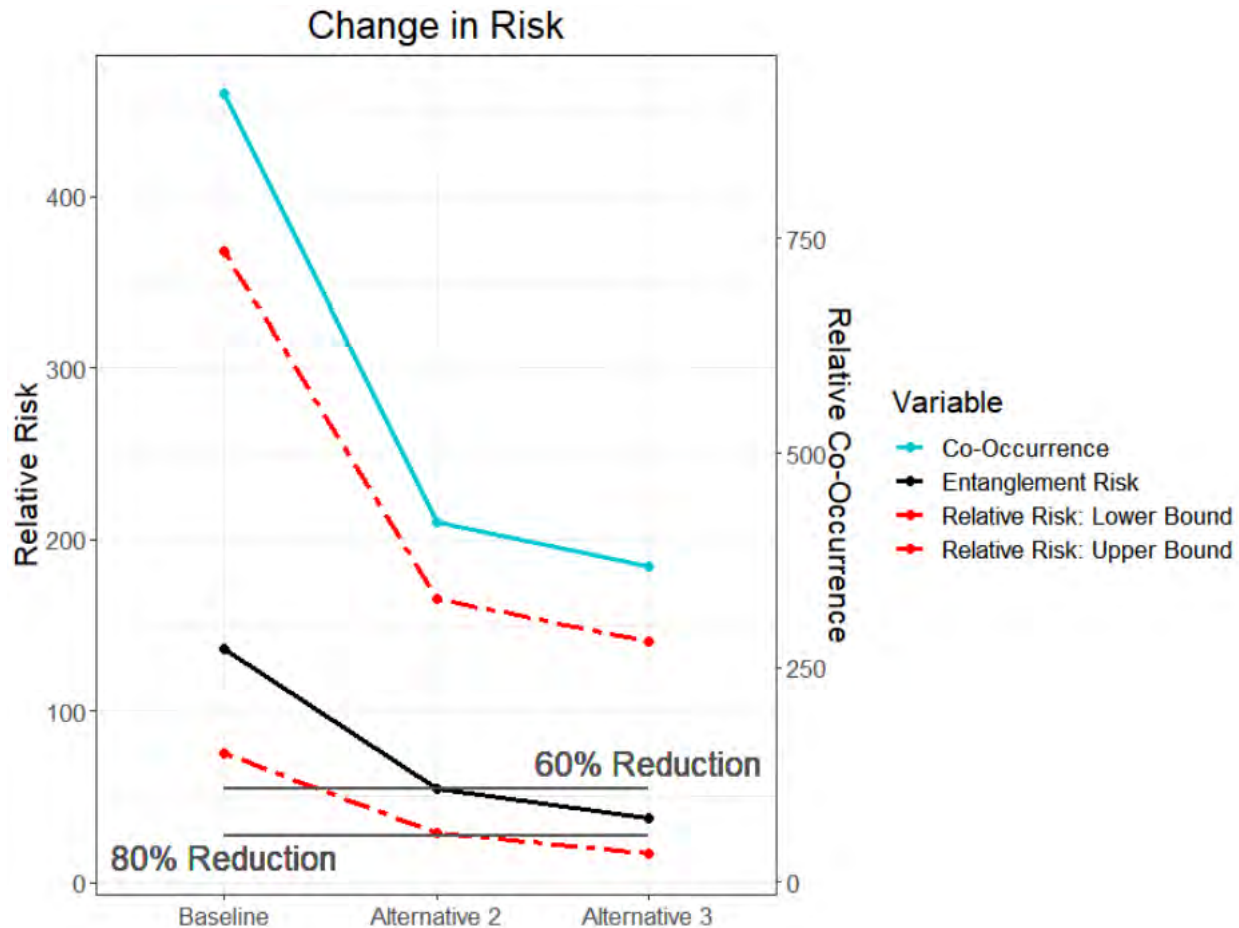


Figure 5.6: The relative change in right whale risk and co-occurrence from Alternative 1 (represented by baseline, i.e. status quo) to Alternative 2 (Preferred) and 3, relative to the risk reduction targets.

An average of 511,369 lines are fished monthly, with a maximum of 925,924, in the Northeast Region. The restrictions on the number of buoy lines in the Northeast Region considered in the alternatives include minimum trap trawl requirements, line caps, and seasonal buoy line closures. Alternatives 2 and 3 reduce the number of lines by roughly the same proportion across the entire Northeast Region (7 percent, Table 5.8). This includes Maine Exempt Waters where there will be no line reduction, which generally have lower levels of co-occurrence so this area is largely reducing risk via precautionary measures rather than line reduction. All of the risk reduction options analyzed here within Maine Exempt Waters will be implemented and regulated by Maine DMR but considered here for their precautionary risk reduction benefit. The reduction in buoy lines in these alternatives will likely result in an equivalent reduction of the potential risk of entanglement by reducing the likelihood that whales and gear would co-occur in the same area at the same time.

Table 5.8: Monthly percent risk reduction for right and humpback whales compared to Alternative 1 (i.e. status quo). Since a gear threat model is not currently available for fin whales, there are no risk reduction estimates for this species. Relative risk includes the combined changes due to gear configurations, areas closed to persistent buoy lines, and maximum line strength.

Month	Line Reduction		Relative Risk			
	Alternative 2	Alternative 3	Right Whale Alternative 2	Right Whale Alternative 3	Humpback Whale Alternative 2	Humpback Whale Alternative 3
January	-9%	-16%	-46%	-61%	-18%	-45%
February	-6%	-5%	-53%	-66%	-22%	-48%
March	-6%	-6%	-60%	-69%	-25%	-51%
April	-7%	-10%	-65%	-79%	-27%	-52%
May	-12%	-19%	-89%	-96%	-25%	-48%
June	-13%	-20%	-49%	-80%	-22%	-44%
July	-12%	-15%	-50%	-83%	-22%	-42%
August	-15%	-15%	-23%	-43%	-21%	-41%
September	-7%	-6%	-24%	-43%	-19%	-38%
October	-6%	-4%	-42%	-64%	-18%	-37%
November	-6%	-4%	-50%	-65%	-20%	-44%
December	-6%	-4%	-40%	-48%	-19%	-36%
Total	-7%	-7%	-60%	-72%	-21%	-41%

Alternative 3 predicts greater reduction in large whale co-occurrence compared to Alternative 2 (Table 5.8). This is because of the more extensive reduction of lines as well as a greater number of areas that would be closed to vertical buoy lines. Buoy line closures that relocate lines outside of the restricted area can increase risk near the restricted area, as is the case near Georges Basin in Alternative 3. Alternative 3 could also have unintended consequences for all large whales if the line cap restriction results in increased effort in months where effort has been relatively low and potentially increase co-occurrence to a greater degree than is reflected in this analysis but this is less likely in combination with a restricted area in LMA 2. The line reduction and co-occurrence measures proposed in Alternative 2 (Preferred) and Alternative 3 both substantially reduce right whale co-occurrence. Though Alternative 3 will likely reduce co-occurrence between large whales and buoy lines to a larger degree than Alternative 2, significantly decreasing entanglement risk for large whales, Alternative 2 will be less likely to increase co-occurrence in the Northeast Region, better accommodates small scale fishing operations and traditional practices, considers fishing safety concerns, and is more enforceable.

The addition of weak line throughout the proposed area will not reduce co-occurrence but is predicted to reduce the likelihood that an entanglement will result in serious injury or mortality. Alternative 3 proposes a larger percentage of full weak rope to be required on vertical buoy lines across the proposed areas. While Alternative 2 similarly proposes broad scale use of weak rope, this alternative differs in that it relies upon weak inserts. Weak insertions may, in some ways, be optimal to full weak rope because insets provide a focused low breaking strength location when compared to a full weak line where breaking strengths often vary more widely across a line. However, the fewer insertions that are required in a full line and the deeper the water column, the less protection an insertion requirement will offer compared to full weak line or the equivalent. In Alternative 2, the proposed insertions within nearshore shallow waters are very close to a full

weak line equivalent (an insertion every 40 feet/12.2 meters). In deeper waters within nearshore trap/pot management waters, where fewer insertions are proposed within the top proportions of the buoy line, the risk reduction benefit of the weak insert is reduced. This may result in fewer weak rope benefits in offshore areas where right whales are more likely to occur but these areas would be subject to greater line reduction. The weak insertions in Alternative 2 would provide some risk reduction benefit across the entire Northeast Region, providing a precautionary measure resilient to changes in right whale distribution.

The combination of line reduction, co-occurrence reduction, and line weakening measures are estimated to reduce the overall risk of severe entanglement by approximately 60 percent in Alternative 2 and 72 percent in Alternative 3. This estimate does not take into account additional risk reduction achieved by maintaining the Massachusetts Restricted Area (MRA) in Alternative 2. Because of the increasing value of the MRA over time (Ganley et al. 2019), the Take Reduction Team recommended including the MRA risk reduction in the overall risk reduction score. Including the risk reduction value of the MRA results in an estimated 69 to 73 percent risk reduction to right whales under Alternative 2 (Preferred) and the associated Final Rule.

Likewise, Alternative 3 does not take into account estimated line reduction through state or fisheries management actions not being implemented by NMFS. The effectiveness of Alternative 2 and 3 both depend on the past effectiveness of these measures on line and risk reduction. Expected line reduction measures in these alternatives would be far more effective at reducing overall entanglement risk than weak rope. Including weak inserts in areas with no line reduction and low right whale co-occurrence, such as exempt areas in Maine, or in areas with longer trawl lengths, such as in LMA 3, provides an additional important precautionary measure to reduce entanglement severity.

Based on the information above, Alternative 1 is expected to have high negative to moderate negative impacts to large whales. Current ALWTRP regulations will be maintained, providing no incentive for vessels to change effort or fishing behavior, new or elevated entanglement risks to protected species are not expected. For ESA-listed species of large whales, the risk of interactions with trap/pot gear remains, and the current rate of mortality and serious injury will likely continue and U.S. entanglements in commercial fishing gear would continue to exceed PBR, resulting in moderate negative to high negative impacts. Moderate negative impacts are expected for other MMPA protected species of large whales because, while the PBR for these species has not been exceeded while the fishery has operated and the ALWTRP regulations have been in place, interactions may still occur. Because observed mortality and serious injury only represents a fraction of observed cases, some of these species may be experiencing human caused injuries at a rate above PBR once unobserved mortality is taken into account (see Chapter 2).

Considered independently, the fishery under Alternative 2 and Alternative 3 are expected to result in moderate negative to slight negative impacts for ESA-listed and MMPA-protected species of large whales. While entanglement risk for large whales will likely be lessened by reducing co-occurrence (i.e., additional seasonal restricted areas restricting buoy lines) and introducing gear modifications that would increase the likelihood that a whale could break free of gear before becoming seriously injured or killed (i.e., trawling up, end line restrictions, and weak link requirements), the risk of entanglement remains (i.e., entanglement in groundlines and

the continued presence of buoy lines), albeit less so than under Alternative 1. Therefore, ESA-listed and MMPA-protected species of large whales are expected to have slight negative to moderate negative impacts. Relative to Alternative 1, Alternative 2 and Alternative 3 both substantially reduce right whale co-occurrence due to line reduction and co-occurrence measures proposed, therefore are expected to have slight positive to moderate positive impacts to ESA-listed and MMPA-protected species of large whales, depending on the species.

Relative to Alternative 2, Alternative 3 impacts are expected to be negligible to slight positive (i.e, a larger percentage of full weak rope to be required on vertical buoy lines across the proposed areas and predicts greater reduction in large whale co-occurrence). Alternative 3 likely reduces entanglement risk to a slightly greater degree than Alternative 2 with a slightly higher decrease in co-occurrence and the strength of lines. A larger decrease in co-occurrence and strength will likely offer more benefits, particularly to right whales. Though this analysis does not take into account the MRA risk reduction credit, which achieved a higher co-occurrence reduction than Alternative 3 and Alternative 2 likely contains fewer regulations that would lead to uncertain outcomes that could potentially increase line in some areas. Minke whales are less likely to benefit from line strength reduction and are more likely to be negatively impacted by long trawl lengths. Therefore, compared to Alternative 2, Alternative 3 is likely to have negligible to slight positive impacts in large whales. Meanwhile, relative to Alternative 3, Alternative 2 impacts will be slight negative to moderate negative, because it will be less likely to increase co-occurrence in the Northeast Region.

5.3.2 *Other Protected Species*

In addition to impacts on large whale species, other protected species occur in the Northeast Region that can be entangled in commercial fishing gear. This section assesses the potential impact of modifications in Alternatives 2 and 3 to the ALWTRP on other ESA-listed species of marine mammals, including sei and sperm whales as well as ESA-listed sea turtles, including loggerhead and leatherback (see Chapter 4 for more information). The alternatives differ with respect to the ancillary benefits they would afford other protected species. As the following discussion explains, these differences stem from differences in the extent to which the alternatives would mandate gear modification requirements that could prove beneficial to other potentially affected ESA-listed species of large whales and sea turtles.

5.3.2.1 Buoy Line and Co-occurrence Reduction

Similar to large whales, it is anticipated that proposed line reduction strategies will reduce overall risk of entanglement for other protected species, including other large whales and leatherback and to a lesser extent loggerhead sea turtles. The proposed changes would reduce the number of buoy lines in the water through measures specifying the minimum number of traps fished along lobster trawls by area and distance from shore, and/or through a buoy line allocation cap in federal waters. Alternative 2 (Preferred) requirements differ slightly from Alternative 3 (Non-preferred) where the former relies more on trawling up measures and the later includes a universal line cap and a greater number of restricted areas. The potential direct or indirect impacts are discussed below in two sections: gear modifications and seasonal area management.

5.3.2.1.1 Gear Modifications: Trawl Length and Line Caps

In addition to the large whales discussed in Section 5.2.1, other protected species in the waters subject to regulation under the Plan are known to become entangled in lobster and other trap/pot lines (NMFS 2001c, a, b, d, STDN, 85 FR 21079, April 16, 2020, Henry et al. 2016, Henry et al. 2021). Alternative 1 (No Action) would not result in additional conservation gain for other ESA-listed protected species of large whales and sea turtles and this VEC would continue to sustain current levels of entanglement in trap/pot gear. Proposed gear modifications that aim to reduce buoy line are discussed in additional detail in section 5.2.1.1.1. As described previously, the regulatory changes proposed under Alternatives 2 (Preferred) and 3 include several provisions that reduce buoy line that could reduce protected species entanglement risks. The alternatives analyzed would impose restrictions on the number of buoy lines that trap/pot fishermen employ in the Northeast Region. In Alternative 2, fishermen would be required to use trawls of from two to 50 trap per trawl, depending on area and season, contributing to an estimated 7 percent reduction of line. Alternative 3 cuts the number of buoy lines nearly in half using a line cap in federal waters also contributing to a similar estimated 7 percent reduction of line with added flexibility with how vessels implemented the line cap.

5.3.2.1.1.1 *Direct*

Absolute line reduction across the proposed area should benefit all protected species that use the areas where and when line is reduced. This comprehensive line reduction would likely benefit other protected species identified in Chapter 4, specifically ESA-listed large whales (i.e., sei and sperm) and sea turtles, by also reducing the likelihood that individuals would encounter and become entangled in line.

Sea turtles would be best protected by line reductions that occur when waters are warm enough to support sea turtles in the Northeast Region (i.e., approximately May through the end of November; see Chapter 4). Thus, the implementation of a line cap that reduces line numbers more significantly in summer months, when effort is typically high, likely provides the most significant reduction in sea turtle entanglement risk. Changes in buoy line numbers during winter are not likely to impact sea turtle entanglement rates, given that they are typically only present in the Northeast Region when the water is sufficiently warm.

As provided in Chapter 4, sei and sperm whales have the potential to be impacted by the proposed regulations. Although the commercial fisheries regulated under the Plan may affect sperm whales, there seems to be significant separation between the known feeding/or breeding range of this species and primary fishing areas. Therefore, the gear modifications in the commercial fisheries regulated under the Plan may be less beneficial for this species. Due to similarities in distribution, feeding behavior, and other characteristics, sei whales are believed to benefit from ALWTRP measures in much the same manner as the large whale species the Plan is designed to protect.

5.3.2.1.1.2 *Indirect*

The indirect effects of reducing buoy lines are similar to those for large whales described above depend upon predicted changes in gear loss, enforceability, and gear movement. Increased gear

loss, which generally appears unlikely across the alternatives, could cause an increase in the risk that whales and sea turtles may become entangled in ghost gear.

5.3.2.1.2 Seasonal Restricted Areas Closed to Persistent Buoy Lines

Alternatives 2 and 3 consider line reduction via seasonal closure of trap/pot fisheries to persistent buoy lines and are described in section 5.2.1.1.2. Under the No Action Alternative, the number of closures currently in place would remain the same but they would be closed to persistent buoy lines rather than to lobster fishing. Under exempted fishing permits, a low level of fishing with ropeless technology could occur that would have minimal impact on protected species in the short term and that could result in an acceleration of the development of commercial ropeless fishing technology that reduce impacts to protected species in the future. There would be no additional conservation benefit to other protected species as a result of Alternative 1.

5.3.2.1.2.1 *Direct*

Several of the proposed seasonal buoy line closures could have a beneficial impact on other protected species, but such benefits are likely to be limited. Leatherback and loggerhead sea turtles generally do not appear in the Cape Cod Bay Restricted Area or Gulf of Maine until June, when there are no current or proposed restricted areas. One restricted area is proposed during summer months in Georges Basin in the non-preferred alternative and is likely the only restricted area to potentially have any small positive effect, if any, on leatherbacks and loggerheads (James et al. 2006, Dodge et al. 2014, AMAPPS 2015, Dodge et al. 2015). Displacement of effort could negate benefits of the closed areas. The benefits of these restricted areas are likely to be minor but could potentially prevent the future expansion of trap/pot fisheries into this area.

Given that the majority of known entanglements for these species in trap/pot gear occur in the buoy line and surface systems, entanglement risk to sea turtles in ropeless trap/pot gear is considered negligible because the potential for new unattended buoy line into the water column would be limited if the recommended conservation measures, or their equivalent, are implemented.

The restricted areas described above could have a beneficial impact on sei and sperm whales, but such benefits are likely to be limited and may be negated by relocation of fishing lines. Given their offshore distribution, the only restricted area that is most likely to have a positive effect on sperm whales is the Georges Basin Restricted Area. The distribution of sperm whales in the U.S. Atlantic EEZ also typically occurs farther on the edge of the continental shelf, over the continental slope, and into mid-ocean (Waring et al., 2007), though have been spotted south of Massachusetts near proposed South Island Restricted Areas in spring (Stone et al. 2017) and near Georges Bank in summer (CETAP 1982). Given the distinct offshore distribution of this species, sperm whales are also less likely to benefit from inshore fishery restricted areas particularly not the proposed LMA 1 Restricted Area.

Sei whales may also benefit from fishery restricted areas proposed closer to shore (Davis et al. 2020). Although sei whales are often found in the deeper waters that characterize the edge of the continental shelf (Hain et al. 1985), NMFS aerial surveys found substantial numbers of sei whales south of Nantucket in spring (when a restricted area is proposed in Alternative 3) and

summer (Stone et al. 2017), and Georges Bank in the spring and summer (CETAP 1982). Sei whales (like right whales) are largely planktivorous, primarily feeding on euphausiids and copepods, which has resulted in reports of sei whales in more inshore locations. Therefore, sei whales may benefit from the restricted area extensions in Cape Cod Bay, a restricted area south of Nantucket, and potentially a restricted area in Georges Basin.

5.3.2.1.2 Indirect

The indirect effects of proposed restricted areas are similar to that of large whales and could have indirect beneficial effects on protected by tempering the possible expansion of trap/pot fisheries or negative indirect benefits if effort is relocated just outside the restricted area into more sensitive areas. This relocated effort may result in a wall of fishing gear, which would increase risk of entanglement in the area directly adjacent to the closed areas.

5.3.2.2 Changes to Weak Link Requirements

5.3.2.2.1 Direct

Changes in weak link requirements are not likely to have a significant direct impact on other protected species. Similar to large whales, sperm or sei whales could potentially have a greater likelihood of breaking free if the weak link was in a different position on the line. However, the requirement to switch to some form of weakened line likely accomplishes this objective on a broader scale. Sea turtles will likely not be impacted from changes to current weak link requirements given they are unlikely to break line in an entanglement.

5.3.2.2.2 Indirect

Different weak link requirements could potentially increase the amount of ghost gear but, as discussed above, this is an unlikely outcome and this measure is not anticipated to have any substantial indirect effects on other protected species.

5.3.2.3 Weak Rope

Both proposed alternatives, would require conversion of a certain proportion of line to weak rope or the equivalent (see section 5.3.1.3 for more details).

5.3.2.3.1 Direct

Regulations reducing the breaking strength of rope, or requiring weak inserts in rope, are more likely to benefit other ESA listed species of large whales. Data from Arthur et al. (2015) suggest larger whale species, such as sperm and sei whales could be able to exert a high enough force to exceed 1,700 pounds (771 kilograms) line. Protected marine mammal species (e.g. sperm and sei whales) are estimated to exert lower maximum forces than right whales (Arthur et al. 2015) and therefore the likelihood of these species breaking out of weak rope may be slightly lower. However, reduced breaking strength could benefit most other protected marine mammals analyzed here by reducing the likelihood of serious entanglements when an individual is able to exert enough force to break free. The use of weak inserts lower down on the line may allow other

large whales to avoid getting anchored if the entangled whale could generate sufficient force. Similar to large whales, Alternative 3 may provide slightly greater reduction in potential entanglement severity to other protected whale species compared to Alternative 2 given the proposed use of more full weak line.

Sea turtles are unlikely to be able to free themselves at the proposed breaking strength of 1,700 pounds (771 kilograms). Given this, sea turtles are not expected to benefit from reduced rope strength proposed under Alternative 2 or Alternative 3 given their size and physiology limits their ability to break free of any entanglement regardless of rope strength.

5.3.2.3.2 Indirect

Indirect effects of the use of weak rope or inserts on other protected species are similar to that of large whales. There could be potential indirect effects from gear loss that could increase the risk of entanglement. However, the proposed measures aim to minimize the amount of gear that is potentially lost as a result of changes in rope strength and so the indirect effects are expected to be minimal.

5.3.2.4 Comparison of Alternatives

There were few quantitative criteria available to compare the biological effect of the alternatives on other protected species. As noted above, the No Action (Alternative 1) maintains current ALWTRP regulations, and therefore, provides no incentive for vessels to change effort or fishing behavior, new or elevated entanglement risks to protected species are not expected. Under Alternative 1, impacts are expected to be moderately negative. As discussed in Chapter 4, ESA-listed species of large whales and sea turtles are at risk of interacting with trap/pot gear, specifically via the entanglement in buoy lines or groundlines associated with this gear type.

Alternative 2 and Alternative 3 are expected to have a slight negative impacts to other ESA-listed species. Other ESA-listed species of large whales (i.e., sei and sperm whales) may not benefit from the closed areas due to limited co-occurrence and may have increased elevated entanglement risks outside closure areas due to relocation of fishing lines, though these impacts would occur close to the restricted area where these species are not commonly sighted. . Other ESA-listed species of large whales (e.g. sperm and sei whales) are less likely to break out of weak rope, and therefore not able to benefit. ESA-listed species of sea turtles are not expected to benefit from reduced rope strength proposed under Alternative 2 or Alternative 3 given their size and physiology limits their ability to break free of any entanglement regardless of rope strength. Relative to Alternative 2, Alternative 3 is expected to have negligible to slight positive impacts to sea turtles due to closures in areas of possible co-occurrence.

Based on the information above, relative to Alternative 1, Alternative 2 and Alternative 3 impacts are expected to be negligible (i.e. little change in line where these species are commonly sighted) to slight positive (i.e., reducing co-occurrence of buoy lines protected species, weak links requirements, and line reduction provisions) for ESA-listed protected species. Therefore, compared to Alternative 2 and Alternative 3, Alternative 1 is expected to have slight negative to negligible impacts to ESA-listed species.

Relative to Alternative 2, Alternative 3 is expected to have negligible to slight positive impacts to ESA-listed species (i.e., reduced co-occurrence of buoy lines and sea turtles, use of more full weak line to lessen entanglement severity for large whales, weak line requirements, and line reduction provisions). However these provisions will likely not benefit whales that spend more time in deeper waters, such as sperm whales, and there is a greater risk of an increase in lines outside of Georges Basin Restricted Area into important habitat. Therefore, compared to Alternative 3, Alternative 2 is expected to have negligible to slight negative impacts to ESA-listed species.

5.3.3 *Habitat*

As noted in Chapter 4, traps/pots regulated under the ALWTRP can affect fish habitat primarily through the gear's impacts on the benthic environment. Such impacts generally arise as a result of contact between fishing gear and the sea floor, especially during the setting and retrieval of the gear. In some cases, bottom contact can alter the physical structure of the seabed, injure or kill benthic organisms, alter the structure and productivity of the benthic community, contribute to the suspension of sediments, and cause changes in the chemical composition of the water column overlying affected sediments. The habitat impacts attributed to fixed, bottom-tending gear are less severe than the impacts of mobile, bottom-tending gear. The regulatory alternatives under consideration are likely to have a temporary or minimally adverse impact on the benthic environment. The regulatory provisions with the greatest potential to affect benthic habitat are those that may influence contact between ALWTRP-regulated gear and the sea floor. As discussed below, the provisions of interest are those pertaining to trawling up measures and restricted areas.

5.3.3.1 **Buoy Line and Co-occurrence Reduction**

5.3.3.1.1 Gear Modifications: Trawl Length and Line Caps

With the exception of Alternative 1 (No Action, i.e. status quo), all of the regulatory alternatives under consideration would require increasing the minimum number of traps per trawl fished in the Northeast Region. This increase in trawl length under Alternatives 2 and 3 (Preferred and Non-Preferred) may in turn increase the use of sinking groundline (see section 5.2.1.1.3 for more details on proposed changes). Alternative 1 would maintain the current levels of biological impact of trap/pot fishing on benthic habitats.

5.3.3.1.1.1 *Direct*

It is likely that in total, the amount of sinking groundline that may be used will not be substantially different from Alternative 1. Fewer trawls will be fished with an increase to the minimum number of traps per trawl. Those trawls with more traps, however, may be longer so a reduction would not be equivalent to removing all groundline from the reduced trawls. A provision to allow trawls to be lengthened in LMA 3 from 1.5 miles (2.78 kilometers) between buoy lines to 1.75 miles (3.24 kilometers) is included that may result in some fishermen fishing disproportionately longer trawls if they think it will increase catch per unit effort by providing more space between traps on 35 to 50 trap trawls. Fishermen choose to add additional traps to

their trawls to ensure that LMA 3 fishermen can achieve an average of 45 trap trawls, compensating for vessels that cannot be configured to accommodate longer trap trawls, or lengthen groundlines near the buoy line to reduce the number of pots hanging in the water column during haul-up so the forces do not break a weakened buoy line.

If these measures in Alternative 2 and 3 result in increased amount of sinking groundline along the bottom, there will be increased line contact with the seafloor, creating the potential for adverse impacts on benthic habitat. The expected impacts of sinking groundline on benthic habitat would occur primarily when the trawl lines of pots are hauled to the surface. During this process, the line may snag on bottom features and organisms as it is dragged across the bottom. Such impacts are not expected to be more than minimally greater than current impacts for shorter trawls and are likely temporary in nature. Most studies investigating small numbers of traps or pots per buoy line (one to three) have found minimal, short-term impacts on physical structures (Eno et al. 2001, Chuenpagdee et al. 2003, Stephenson et al. 2017). Similarly, a panel of experts that evaluated the habitat impacts of commercial fishing gears used in the Northeast Region of the U.S. (Maine to North Carolina) found bottom-tending static gear (e.g. traps/pots) to have a minimal effect on benthic habitats when compared to the physical and biological impacts caused by bottom trawls and dredges (NMFS 2002b). The vulnerability of benthic essential fish habitat for all managed species in the region to the impacts of trap/pots is considered to be low (NMFS 2004). However, less is known about longer trap/pot trawls and there is limited information that trawls with 20 or more pots may have impacts more similar to mobile gear, though at a smaller spatial scale (Schweitzer et al. 2018). Areas where trawl lengths reach 20 pots per trawl or more may have a greater impact of benthic habitats than areas with shorter trawls. In Alternative 2, longer trawls will primarily occur beyond 12 nautical miles (22.2 kilometers) in deeper waters. In Alternative 3, this could impact inshore waters if longer trawls are used closer to the shore in response to the line cap.

Current knowledge suggests that trap/pot fishermen minimize the distance at which gear is drawn across the sea floor when hauling in their gear, as this contact causes abrasion of the protective coating on the traps themselves. Hence, fishermen try to position their vessels above their gear, pulling sets up through the water column instead of across the sea floor. This practice minimizes the adverse impact of long trap trawls and sinking groundline on benthic habitat. Furthermore, the amount of bottom area that would be disturbed by sinking groundline on long trap trawls, and the frequency of disturbance in the exact same area from repeated contact with sinking groundline, would be very small, allowing enough time for recovery of benthic communities that would potentially be affected. Therefore, any adverse impacts associated with longer trap trawls or the increased use of sinking groundline in Alternative 2 and Alternative 3 would be temporary but slightly higher offshore where longer trawls are being fished.

5.3.3.1.2 Indirect

As with other VECs, an increase in ghost gear is possible if trawling up led to the loss of more gear, but this is not expected to occur in higher numbers than the baseline given the trawl configurations proposed in Alternative 2. There is some uncertainty regarding the impact of a line cap on trawl configurations in Alternative 3, but it is expected that fishers will continue configuring gear such that the risk of gear loss is minimized. Thus, indirect impacts from gear configurations Alternative 2 and Alternative 3 are expected to have a negligible impact on

habitat, and expected to have negligible impacts in comparison to Alternative 1 and to each other.

5.3.3.1.2 Seasonal Restricted Areas Closed to Persistent Buoy Lines

Both proposed alternatives, with the exception of Alternative 1 (No Action), include seasonal restricted areas that would further reduce the use of persistent buoy lines during times when right whales are more likely to aggregate (see section 5.2.1.1.2 for more details).

5.3.3.1.2.1 *Direct*

The seasonal restricted areas proposed in Alternatives 2 and 3 could lead to additional habitat protections where fewer lines and traps are coming into contact with the bottom, leading to less structural damage or mortality of benthic organisms. However, there will be little benefit to the habitat if ropeless fishing expands in use within these areas, particularly with longer trawls that increase the amount of sinking groundline comes into contact with benthic habitats. If ropeless fishing expands widely in closed areas, habitat is expected to experience similar levels of disturbance as described in section 5.2.3.1.1 where longer trawls could potentially have an impact on benthic habitats. Although the implementation of seasonal restrictions would limit bottom contact to certain times of year, the overall impacts to biological communities would be the same since most affected organisms would require more than a few months to recover from disturbance.

5.3.3.1.2.2 *Indirect*

Seasonal restricted areas where no lobster or Jonah crab trap/pot trawls are fished are not likely to have many indirect impacts other than any potential beneficial effects that result from protection of benthic habitats from bottom tending gear, though these are expected to be minimal given the scale of the restricted areas. If ropeless equipment is broadly used in seasonal management areas, it could indirectly impact the habitat in the event of equipment failure that could increase the presence of ghost gear. Using transponders to help fishermen locate their gear on the bottom in ropeless systems could reduce the likelihood of gear lost compared with current gear losses after storm events or other incidents. Alternatively, expansion of ropeless gear in restricted areas could reduce bottom trawling in the region, preventing more invasive practices from harming benthic habitats and possibly leading to a positive impact on habitats. The loss of gear is not expected to be significantly higher than with traditional trap/trawl fishing practices so any impact is likely minimal. It is possible that an increase in grappling for lost gear could impact habitat quality given its known effect on the sea floor.

5.3.3.2 Changes to Weak Link Requirements

5.3.3.2.1 *Direct*

Changes in weak link requirements are not likely to have any impact on habitat quality because it will not come into direct contact with the benthic environment.

5.3.3.2.2 *Indirect*

Different weak link requirements could potentially increase the amount of ghost gear but, as discussed above, this is an unlikely outcome and this measure is not anticipated to have any substantial indirect effects on habitat.

5.3.3.3 Weak Rope

Both proposed alternatives, with the exception of Alternative 1 (No Action), would require conversion of a certain proportion of line to weak rope or the equivalent (see section 5.2.1.2 for more details).

5.3.3.3.1 Direct

The use of weak rope, as required by regulatory Alternatives 2 and 3 (Preferred and Non-preferred), is unlikely to have a significant direct impact on habitat. It largely will not come in direct contact with the seafloor and should not significantly result in any changes to the configuration of trap/pot trawls.

5.3.3.3.2 Indirect

Weak rope requirements could have minor indirect impacts on fish habitat or benthic organisms if there is any increase in lost gear. Ghost gear could impact habitat quality and benthic organisms if it comes in contact. It is possible that weak rope could benefit essential fish habitat by reducing the likelihood that an entangled whale would drag heavy gear over sensitive areas if gear is releasing more readily. If this occurs, potential direct damage to the marine environment could be avoided. Overall, weak rope requirements are not expected to create high amounts of ghost gear, as discussed in section 5.2.1.2 and therefore the indirect impacts to habitat are presumed to be minimal.

5.3.3.4 Comparison of Alternatives

No quantitative criteria are available to formally compare the biological effect of the alternatives on habitat. Alternative 1 will maintain baseline levels of biological impacts on benthic habitats, slight direct negative impacts to habitat due to disturbance to benthic habitat to indirect negligible impacts on habitat due to ghost gear.

Alternative 2 and Alternative 3 would result in negligible to slight negative direct impacts on habitat. This possible impact is likely limited to offshore environments with Alternative 2 and could impact offshore and nearshore environments with Alternative 3 in the event that trap/pot trawls are expanded in these areas in response to a large cap in the number of lines allotted to each vessel. However, areas too close to shore (i.e., those within state waters), are unlikely to experience excessively long trap/pot trawls given the nature of the fishery and the vessels operating in these areas. If ropeless fishing is implemented widely in closed areas, it is not expected that Alternative 2 or 3 will significantly change the amount of gear that comes into contact with the seafloor.

Given the information above, in comparison to Alternative 1, Alternative 2 and Alternative 3 are expected to have negligible to slight negative direct impacts on the Northeast Region habitat. Negligible due to the minimal addition of lines for ropeless fishing and unlikely significant biological impacts due to weak rope and slightly negative due to the presence of groundline that is not present under Alternative 1 and the potential increase in risk posed by long trap/pot trawls in contact with the sea floor. Compared to Alternative 2 and Alternative 3, Alternative 1 is expected to have negligible impacts on affected fish habitats. There may be some additional impact on habitat under Alternative 2 compared to 3 because trawl lengths will likely be longer throughout the year under Alternative 2 compared to 3 but these impacts are likely not measurable and thus impacts between the two alternatives is likely negligible.

5.4 Direct and Indirect Impacts of Gear Marking Alternatives

When compared to Alternative 1 (No Action), Alternatives 2 and 3 would both strengthen most of the Plan's current gear marking requirements. Currently the marking system requires buoy lines to be marked three times (top, middle, bottom) with a mark equal to 12 inches (30.5 centimeters in length, with exemptions in inshore waters in some areas.

Both alternatives would modify gear markings to add state-specific colors. Both alternatives include at least one 3 foot (0.9 m) long colored mark within two fathoms of the buoy using the state-specific colors to increase the chance that it can be seen from platforms of opportunity, such as vessels or small planes, to distinguish gear from different states and/or management areas in the Northeast Region waters.

Maine has already added state specific gear marking requirements for state permitted fishermen, including a 3 foot (0.9 meter) mark within two fathoms of the buoy, effective September 2020. ALWTRP modifications will mirror Maine's regulations outside of the exemption area. Massachusetts implemented gear marking regulations in state waters that require frequent state specific red marks, consistent with measures in this FEIS.

The goal of the long mark near the buoy is to increase the marks visibility so that even if gear is not retrieved, it could be identified by state fishery from sighting platforms including boats and aerial survey planes. This color scheme would be continued on at least three marks that are already required, and at least four 1 foot (0.3 meter) long green marks would also be required within 6 inches (15.2 centimeter) of each state specific mark for gear set in federal waters. This is an increase from the one 6 inch (15.2 centimeter) mark required in Alternative 2 in the DEIS, more than doubling the minimum number of marks required on federal lobster and Jonah crab trap/pot gear in the northeast. Additionally, New England waters that are currently exempt from the gear marking requirements would be required to follow the same marking scheme as the principle port with at least one 3 foot (0.9 meter) mark and at least two 1 foot (0.3 meter) marks lower on the buoy line. Alternative 3 would include the same large surface system state-specific color marking to improve detectability, but would require the use of state and fishery specific tape along the entire buoy line, excepting any small weak inserts required in the buoy line, instead of an increase in number of marks on the line. The No Action Alternative 1 would continue a gear marking system that uses marks specific to management areas rather than identifying gear to state level.

The gear marking provisions are designed to improve NMFS' ability to identify the gear involved in an entanglement. As discussed below, these provisions would have no immediate direct impact on entanglement risks. In the long run, however, they may help NMFS to target and improve its efforts to protect large whales.

5.4.1 *Large Whales*

Despite current efforts to mark gear, there is still a high proportion of entanglements that cannot be identified by the fishery or location of origin (as discussed in Chapter 2). No gear is retrieved and/or the fishery of origin or type of fishing gear are not identifiable for a majority of entanglements, including 80 percent of the right whale incidents. In many cases, this is because there was no gear present on right whales with clear signs of entanglement. Of all large whale entanglements between January 1, 2010 and March 16, 2020 where gear was still present, less than half of cases had gear available for analysis and less than 14 percent of all cases had gear marks that could be identified as originating in a U.S. management area (Table 5.9; See Northeast Trap/pot gear guide for details regarding colors: <https://www.fisheries.noaa.gov/webdam/download/94698537>). Between five and 13 percent of all large whale cases with gear present had identifiable U.S. marks and from 69 to 92 percent of all cases did not have U.S. marks and could not be identified as Canadian gear. Only three of 62 right whale cases with gear present had gear with marks from U.S. fisheries and all were red, representative of the large nearshore northeast lobster area. Thus, a large proportion of gear that is recovered does not have identifiable marks using the current marking scheme. These data suggest that the current gear marking scheme does not adequately contribute to our understanding of where entanglement gear is originating. Additionally, regulations that would add a large mark to the surface system will increase the number of cases where gear can be identified even if the gear is not retrievable.

Table 5.9: The number of incidents with retrieved gear analyzed from January 1, 2010 - March 16, 2020 that had marks of those where origin was identified.

Species	Total Cases with Origin ID	Total Analyzed	No marks/ not Canadian	Canadian Gear	Total with U.S. Marks	Red	Red & Yellow	Red & Blue	Red & Blue or Black	Blue
Humpback	214	79	183	14	17	7	7	1	1	1
Fin	13	2	12	0	1	1	-	-	-	1
Minke	59	28	47	4	8	7	-	-	-	-
Right	62	25	43	16	3	3	-	-	-	-

The majority of large whale entanglement cases with gear present had marks that were red, representing a large portion of the nearshore Northeast Region trap/pot fishery. At present, all trap/pot fisheries in federal waters, outside of exempt areas, are required to mark their gear with red for most nearshore fisheries in the Northeast Region, and a separate color (black) for all offshore fisheries. A few management areas have added marks to aid in identification but most regions within the Northeast Region are indistinguishable from each other at the state level. A more fine scale spatial resolution marking scheme will help distinguish which regions are contributing most to large whale entanglements, allowing managers to implement more targeted measures in the future.

5.4.1.1 Direct

While existing gear marking requirements, under Alternative 1, have increased the amount of retrieved gear with marks, it does not provide sufficient entanglement location information. Both Alternatives 2 and 3 include gear marking schemes expected to increase the number of marks present by over 50 percent in federal waters, independent of line numbers. Alternative 2 (Preferred) would allow the use of inexpensive and commonly available materials and would result in the incorporation of two new marks per line in federal waters and three new marks in exempt waters. Alternative 3 would require the addition of fewer new marks but would also require an identification tape throughout the buoy line denoting home state and trap/pot fishery. Alternative 2 shows a higher number of marks than Alternative 3 because a larger number of lines are expected to remain active in the region. However, Alternative 3 further requires tape to be woven through the length of the line that contain state and fishery specific data, which would mean the majority of gear that is retrieved from a commercial trap/pot line would be identifiable to this level of information, though gear is not retrieved in a majority of entanglement incidents. The regulatory provisions described above would have neither direct impact on the probability of whales becoming entangled in commercial fishing gear nor would they affect the severity of an entanglement should one occur. As noted below, however, potential changes in gear marking requirements could have an indirect effect on whale entanglement risks.

5.4.1.2 Indirect

A primary barrier to understanding the nature of large whale entanglements is obtaining information on the type and origin of the gear involved. Gear removal from entangled animals still provides the only reliable information about the nature of entanglements (Johnson et al. 2005). However, it is often difficult to connect the gear in which a whale is entangled with a particular fishery, state, or country because even in those instances where line remains on a whale, entangled whales often carry only a portion of the gear they have encountered and that is not always retrieved. The gear marking requirements under consideration would help to generate more and more geographically specific information on the nature of the gear involved in an entanglement and the fishing vessel's state of origin. In addition, these provisions could increase the number of incidents in which the origin of the gear could be identified, allowing the agency to gather additional information on where, when, and how the gear was set. By increasing scientific understanding of the nature of large whale entanglements, gear marking measures would allow NMFS, over time, to improve the effectiveness of the Atlantic Large Whale Take Reduction Plan. Thus, these measures are expected to contribute indirectly to the preservation

and restoration of whale stocks because bigger, more frequent marks would increase the chances of identifying the source of line that may be visible on whales observed from platforms or recovered from an entangled whale.

5.4.2 *Other Protected Species*

5.4.2.1 Direct

With the exception of Alternative 1 (No Action), all of the regulatory alternatives under consideration would impose new gear marking requirements. Alternative 1 would maintain the current gear marking scheme that is inadequate for identifying the gear related to many entanglements to the ideal specificity. Alternatives 2 and 3 would expand the current gear marking scheme for New England lobster and Jonah crab trap/pot fisheries and include state-specific gear marking. As with large whales, these requirements are intended to improve information about the source of gear seen on or retrieved from entangled whales. But these requirements would not have a direct impact on the probability of other ESA-listed protected species becoming entangled in commercial fishing gear. Nor would these requirements affect the severity of an entanglement if one occurs.

5.4.2.2 Indirect

The gear marking requirements under consideration would help to generate information on the nature of the gear involved in a well-documented entanglements of other ESA-listed protected species. Additional information on the source and type of fishing gear involved in entanglements could indirectly benefit other protected species if it leads to new regulations to mitigate entanglement risk. These provisions could, in some cases, allow NMFS to identify the origin of the gear, and thus, allow the agency to gather additional information on where, when, and how the gear was set. By increasing scientific understanding of the origin of entanglements, the gear marking measures would allow NMFS, over time, to improve the effectiveness of programs designed to reduce the entanglement risks faced by other species that experience high levels of entanglement. Thus, these measures could contribute indirectly to the preservation and restoration of the other potentially-affected ESA-listed protected species of large whales and sea turtles.

5.4.3 *Habitat*

5.4.3.1 Direct

The proposed gear marking requirements are unlikely to have any measurable direct impacts on fish habitat or benthic organisms given the gear markings will not change the amount or type of gear touching the seafloor nor will the markings interact with any characteristics of this VEC.

5.4.3.2 Indirect

The proposed gear marking requirements are unlikely to have significant indirect impacts on fish habitat or benthic organisms unless the gear marking provided added information that informed a

future restricted areas that was free of all buoy and groundlines. The type of marking material could have a small impact on habitat if there was degradation of the materials used, though it this is likely negligible relative the background levels of contamination.

5.4.4 *Comparison of Alternatives*

Alternative 1 would result in no changes to current rates of gear identification and would have negligible (gear marking has no immediate direct impact on reducing entanglement risks to ESA listed or MMPA protected species or habitat) to slight negative (indirectly not providing a mechanism to help NMFS to target and improve its efforts to protect ESA-listed and MMPA protected large whales) impacts.

Alternatives 2 and 3 could potentially result in a larger proportion of retrieved gear being identifiable to country of origin and, potentially, state of origin. Since the number of proposed marks are the same in both alternatives, the chances of visual identification of gear on large whales and other protected species are comparable between Alternatives 2 and 3. It is notable that Alternative 3 would have an additional marker throughout the length of the line, making this line identifiable no matter which portion of the gear was retained on the individual and which portion of the gear was retrieved by the gear team but it would require gear to be retrieved for this to be beneficial, which currently occurs in approximately 20 percent of entanglement cases. Alternative 2 has more external marks and, though this marking scheme would require a marked portion to remain on an entanglement, there are likely to be more marks that are identifiable from a survey platform without retrieval. Given the information above, the impacts of Alternative 2 and 3 are expected to be negligible (gear marking would not impact the direct risk of entanglement or impact habitat) to slight positive (indirectly providing a mechanism to help NMFS to target and improve its efforts to protect ESA-listed and MMPA protected large whales in the long term). Based on the information above, Alternative 2 and 3 have negligible to slight positive impacts compared to Alternative 1, and negligible impacts when compared to each other.

5.5 Summary of Impacts

Alternative 1 (No Action) would maintain the current levels of impact trap/pot fishing currently has on the VECs. Under this alternative, the impact of trap/pot fishing will remain high negative to moderate negative because the rate of mortality and serious injury of right whales is well above PBR and unsustainable for the population. While observed mortality and serious injury of other MMPA protected species (i.e., minke whales and humpback whales) is above PBR, entanglements remain a significant threat to fin whales (an ESA listed species) as well as humpback and minke whales, particularly for humpback whales because undocumented mortality could be occurring above PBR given the current levels of human caused incidents (see Chapter 2). The impact of trap/pot entanglement would remain moderate negative for other ESA listed and protected species as well under this alternative. The impacts to habitat will maintain the status quo as defined in Chapter 4; negligible to slight negative impacts to habitat from the use of trap/pot gear would continue. When assessed individually, Alternative 2 and Alternative 3 would each have a moderate negative to slight negative impact on large whales, slight negative

to negligible impacts on other protected species and a negligible to slight negative impact on the habitat (Table 5.10).

As the discussion above suggests, there are a few significant differences between Alternatives 2 and 3 (preferred and non-preferred, respectively), relative to Alternative 1, with respect to impacts on large whales, other protected species, and habitat. The impacts from Alternatives 2 and 3 are generally expected to be slightly positive to moderately positive when compared to the No Action Alternative (Alternative 1) because the other large whale species likely benefit from these alternatives to a lesser degree than right whales. All of the Alternatives (with the exception of Alternative 1) include some form of gear modifications and some level of increased traps per trawl. The main differences among these alternatives stem from differences in the approach and magnitude of reducing the proportion of buoy lines, size or season of closures to persistent buoy lines, and the extent of the use of weak rope or weak insertions with a maximum breaking strength of 1,700 pounds (771 kilograms). Large whales are expected to positively benefit from the regulations proposed in both Alternatives 2 and 3 since they both effectively reduce co-occurrence between whales and buoy line as well as increase the proportion of lines with maximum breaking strength or weak inserts. Alternative 3 likely reduces entanglement risk to a slightly greater degree than Alternative 2 with a slightly higher decrease in co-occurrence and the strength of lines. Though this analysis does not take into account the MRA risk reduction credit, which achieved a higher co-occurrence reduction than Alternative 3. A larger decrease in co-occurrence and strength will likely offer more benefits, particularly to right whales, but compliance is expected to be greater for Alternative 2, rather than 3, given that it was developed with the states and fishermen and takes into account safety concerns. Furthermore, Alternative 2 likely contains fewer regulations that would lead to uncertain outcomes that could potentially increase line in some areas and is also more implementable and enforceable. Minke whales are less likely to benefit from line strength reduction and are more likely to be negatively impacted by long trawl lengths. Therefore, compared to Alternative 2, Alternative 3 is likely to have negligible to slight positive impacts relating to large whales.

In comparison to Alternative 1, Alternative 2 and 3 will likely have slight indirect positive impacts on other protected species prone to entanglement in trap/pot gear, with Alternative Three offering negligible to slightly greater positive benefits relative to Alternative 2. Any additional indirect impacts of Alternatives 2 and Three on habitat are expected to be negligible compared to Alternative 1 and relative to each other.

Table 5.10: The direct and indirect impacts of the alternatives on the three biological VECs.

Alternatives	Large Whales	Other Protected Species	Habitat
Risk Reduction			
Alternative 1 (No Action)	High Negative to Moderate Negative – Mortality and serious injury would continue to occur and impact ESA listed species’ population health. More so for right whales and other large whales to a lesser degree other ESA listed or MMPA protected species.	Moderate Negative – Injury and mortality due to entanglement would continue to harm ESA listed species.	Negligible to Slight negative – Areas with trawls above 15 traps per trawl may have a short-term impact.
Alternative 2 (Preferred)	Moderate Negative to Slight Negative – Would reduce entanglement risk for ESA listed and MMPA protected species. However risk of interactions will not be entirely eliminated by the proposed action.	Slight Negative – Would reduce entanglement risk for ESA listed species. However risk of interactions will not be entirely eliminated by the proposed action.	Negligible to Slight negative – Trawling up to trawls above 15 traps per trawl may have a short-term impact.
Alternative 3 (Non-preferred)	Moderate Negative to Slight Negative – Would reduce entanglement risk for ESA listed and MMPA protected species. However risk of interactions will not be entirely eliminated by the proposed action.	Slight Negative – Would reduce entanglement risk for ESA listed species. However risk of interactions will not be entirely eliminated by the proposed action.	Negligible to Slight Negative – Areas with trawls above 15 traps per trawl may have a short-term impact.
Gear Marking			
Alternative 1 (No Action)	Negligible	Negligible	Negligible
Alternative 2 (Preferred)	Negligible	Negligible	Negligible
Alternative 3 (Non-preferred)	Negligible	Negligible	Negligible

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CHAPTER 6 ECONOMIC AND SOCIAL IMPACTS

6.1 Introduction

The regulatory alternatives under consideration that would be implemented through proposed modifications to the Atlantic Large Whale Take Reduction Plan (Plan or ALWTRP) would subject commercial fishermen operating in fisheries covered by the ALWTRP to a number of new requirements. These include:

- Reducing buoy lines through minimum trap/rawl or trawl-length standards;
- Requirements to use weak “whale safe” ropes or weak insertions;
- Seasonal designated restricted areas to lobster and Jonah crab trap/pot buoy lines; and
- Gear marking requirements.

These requirements apply to lobster and Jonah crab fisheries in the Northeast Region Trap/Pot Management Area (Northeast Region).⁵ Complying with these requirements is likely to impose additional costs to commercial fishermen and, in some instances, to have an adverse impact on their revenues. If these impacts are large, it is possible that some fishermen may switch their effort to other fisheries if opportunities exist, or cease fishing entirely.

For this analysis, we consider costs of only those measures that would be regulated under the Plan modifications. Costs of ongoing and anticipated lobster fishery management measures, and state regulations, including gear marking and weak insertion regulations within Maine exempted waters and Massachusetts additional weak insertions, gear marking, and the extension of the Massachusetts Restricted Area into May, are considered to be part of the baseline, and are not analyzed here.

Fishermen would incur the costs associated with the change in equipment when new requirements go into effect, and may have additional maintenance and replacement costs on an ongoing basis thereafter. To appropriately reflect the costs associated with such investments, this analysis presents these costs on an accumulated and annualized basis. The model develops a series of potential costs year by year within the effective time of this rulemaking, which is assumed to be 6 years. Six years represents an average replacement cycle for rope in buoy lines, and is also the typical length of time between ALWTRP regulatory changes based on past actions. Then yearly costs are accumulated first and then annualized, which provides an estimate of costs as if they were constant for each year during the effective time of the new rules. We apply both 7 percent and 3 percent discount rates to calculate the annualized value.

All costs in this analysis—except for those in cited literature and documents—are converted into 2020 dollars by using price indexes for Gross Domestic Product (BEA 2021). The year 2020 was selected to follow the Office of Management and Budget (OMB) guidelines to reflect the most

⁵ Existing or anticipated Maine regulations for Maine Exempt Waters and Massachusetts regulations for Massachusetts state waters measures, while considered for risk reduction, are not included in the economic analysis because they are not the result of the proposed rulemaking, rather are the result of the states’ actions. Existing risk reduction measures are treated as part of the economic baseline.

recent available price inflation. Economic impacts described in this chapter represent the difference between the impacts of the proposed rule relative to the regulatory landscape in 2017.

The following discussion describes the methods used to estimate the costs that commercial fishermen would incur in complying with potential modifications to the ALWTRP, and presents the first year cost of each measure. These cost estimates represent the direct impact of new regulations on the commercial fishing industry at the beginning of the rulemaking. They also provide a foundation for subsequent evaluation of the regulations' potential effect on commercial fishing activity, and of the implications of such effects on communities dependent on the commercial fishing industry. At the end, a summary of accumulated values and annualized values of each measure is provided. The discussion is organized as follows:

- Section 6.2 describes the data sources and methodology employed to estimate compliance costs associated with minimum trawl-length and weak rope requirements, including the Vertical Line Model developed by Industrial Economics (IEC);
- Section 6.3 describes the data sources and methodology employed to characterize the economic impact of the seasonal restricted area to trap/pot buoy lines;
- Section 6.4 describes the methods used to estimate the compliance costs associated with gear marking requirements;
- Section 6.5 describes the methods used to estimate the compliance costs associated with buoy line cap reduction;
- Section 6.6 presents the resulting estimates of compliance costs for each regulatory alternative;
- Section 6.7 describes the social impacts of the new requirements of the ALWTRP.

The analysis measures the cost of complying with the regulatory changes to the Plan relative to Alternative 1, the No Action Alternative. The economic analysis is designed to measure costs on an incremental basis, i.e., to measure the change in costs associated with a change in regulatory requirements. If no change in regulatory requirements is imposed—as would be the case under Alternative 1—the costs of complying with the ALWTRP would remain unchanged. Thus, the incremental cost of the No Action Alternative is zero.

Much of the analysis described in this chapter builds on the foundation provided by NMFS' Vertical Line Model created by IEC, which provides an estimate of the number and distribution of lines as they were fished in 2017 (see Vertical Line Model documentation in Appendix 5.1). As discussed earlier in this document, the model integrates information on fishing activity, gear configurations, and large whale movements to provide indicators of the potential for entanglements to occur at various locations and at different points in time because of the co-occurrence of buoy lines and large whales, focusing especially on right whales. The costs of the management measures under consideration depend on the seasons and locations in which a vessel operates; the regulations to which it is already subject; and the current configuration of the vessel's gear. The Vertical Line Model specifies operating assumptions for groups of vessels that hold these key features in common, providing an important starting point for assessing economic impact. The role of the model in the analysis of economic impact is described in detail below.

6.2 Analytic Approach: Gear Configuration Requirements

There are two major risk reduction gear configuration modifications considered in both Alternative 2 (Preferred) and Alternative 3 (Non-preferred). Trawling-up would reduce the number of buoy lines by establishing a the minimum trawl length requirement—i.e., prohibiting trawls of less than a specified number of traps or pots between buoy lines for trap/pot fisheries in Northeast Region (referred as trawling up measure hereafter). The exact nature of this requirement varies by location (primarily distance from shore due to greater vessel capacity) and by Alternative. The other important risk reduction gear configuration component of the alternatives is a requirement for using weakened, whale safe rope/weak rope. Measures analyzed would limit the buoy line breaking strength at the depth of the weak rope or weak insertions to no more than 1,700 lb (771 kg) or introduce a weak insert into buoy line so that an adult right whale can break free after entanglements (Knowlton et al. 2016). The costs that fishermen are likely to incur in complying with such requirements fall into several categories:

Trawling up: Costs of compliance with the trawling up requirements include:

- Gear conversion cost: Vessels fishing shorter trawls (e.g., singles, doubles) would need to reconfigure their gear to comply with trawling up requirements. These changes may require expenditures on new equipment as well as investments of fishermen’s time.
- Catch/landings impact: The “catch” in this analysis refers to the lobster and Jonah crab harvested, brought to land and sold, also known as “landings”. Catch rates may decline for vessels that are required to convert from shorter sets to longer trawls, reducing the revenues of affected operations.

Weak rope cost: To comply with the new weak rope requirement, vessels in different areas need to add one or more weak insertions into their buoy lines, or replace their entire lengths of buoy lines with weak lines no greater than 1,700 lb (771 kg) strength. These changes will cost fishermen extra input in both materials and time.

Other Impacts: Some vessels that shift to longer trawls and/or weak ropes may experience changes in the rate at which gear is lost. In addition, some fishermen may need to modify their vessels or add crew to handle longer trawls.

Given the broad scope of the ALWTRP, a vessel-by-vessel analysis of the costs of complying with these requirements is infeasible. Instead, the analysis is based upon the model vessels defined in the Vertical Line Model. Each model vessel represents a group of vessels that fish in the same area, share other operating characteristics, and would face similar requirements under a given regulatory alternative. As Figure 6.1 illustrates, the analysis estimates regulatory compliance costs for each model vessel. This cost estimate is then applied to the population of active vessels that the model represents, and aggregated across this population to estimate regulatory compliance costs for all vessels in a given category.⁶ The sum of costs across all

⁶ The cohort of active vessels that a model vessel represents is based in part on vessel trip reports that indicate the location of fishing activity. Some vessels report activity in multiple areas in a given month. To avoid double-

vessel categories provides an estimate of regulatory compliance costs for the commercial fishing industry as a whole (see Section 6.2.1 and appendix 5.1).

6.2.1 *Development of Model Vessels*

The first step in analyzing the impacts of trawling up requirements is to define the relevant suite of model vessels, i.e., groups of vessels that operate in a similar fashion and thus are likely to face similar compliance costs. Current regulations under the ALWTRP vary by fishery, location and season. Potential modifications to the ALWTRP, as embodied in the regulatory alternatives under consideration, would follow a similar approach. Thus, compliance costs are likely to vary depending upon the location in which it operates, and the seasons in which it is active. The model vessels employed in the cost analysis are designed to capture these differences.

In addition, the model vessels are designed to take into account differences in compliance costs that would result from the nature, configuration, and quantity of gear that vessels employ. For example, some lobster vessels fishing in a given region may configure their traps/pots in pairs, while others may already use longer trawls; since this difference could have a significant impact on the costs of complying with trawling requirements, it is important that the cost analysis differentiate between such vessels.

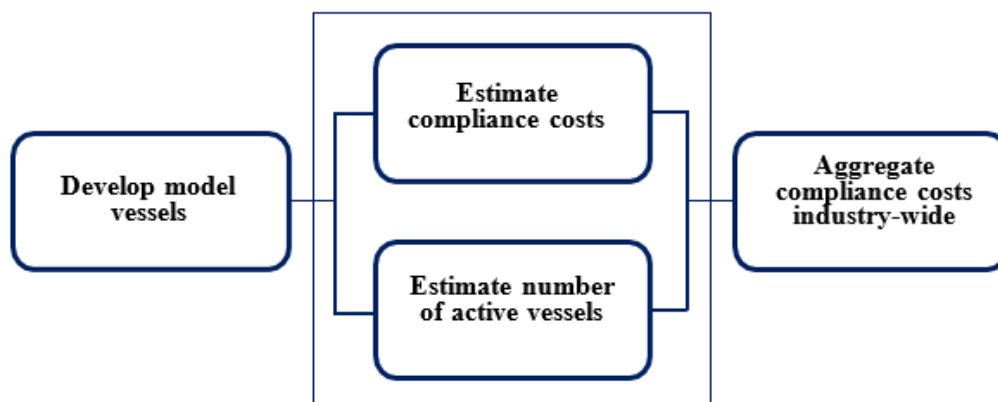


Figure 6.1. Economic impact assessment methodology

Analysis of the economic impact of the trawling up requirements requires comparing the baseline configuration of gear assigned to model vessels in the Vertical Line Model with the new configuration of gear that would be required under each regulatory alternative. This procedure allows assessment of compliance costs for the full suite of possible outcomes. For instance, for the set of lobster vessels fishing in exempt state waters in Maine Lobster Zone B, the Vertical

counting in such cases, the analysis assigns the vessel's activity to each area in proportion to the distribution of trips it reports. For example, if over the course of a month a vessel reports seven trips to Area A and three trips to Area B, the analysis will assign 0.7 active vessels to Area A and 0.3 active vessels to Area B. Thus, all estimates of the number of vessels active in a given area are reported on a full-time equivalent basis; the number of vessels that fish a portion of their gear in the area each month may be higher.

Line Model identifies 35 possible gear configuration options, as defined by a matrix that specifies both the number of traps fished (five categories) and the number of traps per trawl (seven categories). The model relies on survey data to characterize the baseline distribution of gear configurations within this matrix. The cost analysis then identifies the gear configurations that would be prohibited under each regulatory alternative; vessels that currently fish sets shorter than the required minimum would need to reconfigure their gear. The difference between the baseline configuration and the new configuration of gear that each regulatory alternative would require (which varies by area and alternative) drives the analysis of gear conversion costs; thus, estimates of compliance costs for vessels that are subject to identical requirements will vary depending upon the configuration of gear they currently employ. As described below, the cost analysis takes into account a broad range of “with or without” gear configuration options.

6.2.2 *Trawling up Gear Conversion Cost*

When vessels convert from shorter sets to longer trawls, one impact is the direct cost of converting gear to the new configuration. These costs include two major elements:

- **Equipment Cost:** Fishing traps in a new configuration may require the use of new equipment. For instance, the use of longer trawls is likely to require additional groundline. These costs may be offset, at least in part, by a reduction in the use of other types of equipment, such as a reduction in the use of buoy lines, buoys, etc.
- **Labor Cost:** The costs of converting gear include the implicit value of the time that fishermen spend reconfiguring their equipment.

Figure 6.2 illustrates the methodology employed to estimate these costs. As shown, the analysis identifies new gear conversion requirements (i.e., modifications that are not already specified under existing rules), estimates the material and labor required to bring all gear into compliance, and calculates the resulting cost. For each provision, equipment costs are a function of the quantity of gear to be converted and the unit cost of the materials needed to satisfy the trawling requirement. Labor costs are a function of the time required to implement a specific modification, the quantity of gear to be converted, and the implicit labor rate. All costs are calculated on an incremental basis, taking into account any savings in equipment costs that might result from efforts to comply with new ALWTRP regulations. The discussion below further describes how these costs are estimated.

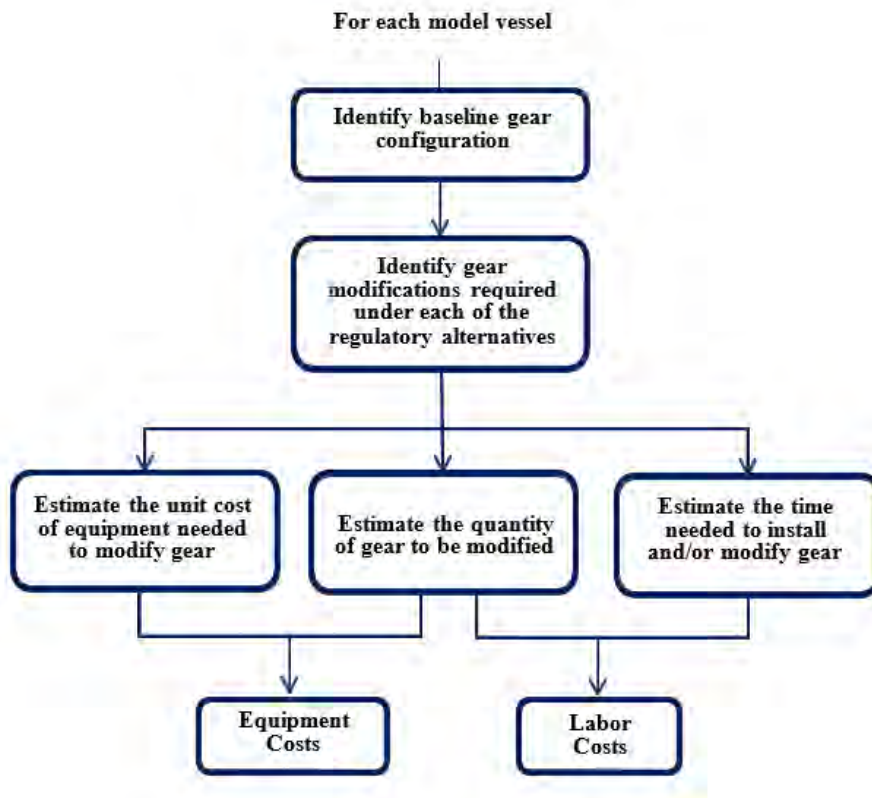


Figure 6.2. Methodology used to calculate gear conversion costs

6.2.2.1 Equipment Costs for Trawling up

Vessels that switch to longer trawls because of new ALWTRP requirements would incur costs for new equipment, but may also realize savings on components of gear that the new configuration would use less extensively or eliminate entirely. For example, under Alternative 2, the use of trawls shorter than five in the 3-6 nautical miles (5.6-11.1 km) portion of Maine Lobster Zone B would be prohibited; trap/pot vessels that currently fish short trawls would need to switch to trawls of no fewer than five traps. The analysis assumes that the affected vessels would fish the same number of pots, and switch to the minimum set length of the new requirements—in this case, five traps per trawl. For vessels that previously fished triples, this implies an increase in the quantity of groundlines and a decrease in the quantity of buoy lines. It also implies a decrease in the number of buoys and other surface marking elements associated with each set (surface systems). To capture this dynamic, the gear cost analysis compares “with” and “without” new requirements for each category of affected vessels, identifying the impact of each regulatory alternative on the gear that vessels in that category would employ. The calculations also take into account regular replacement of surface systems, where an individual could use their cache of surface systems instead of replacement in the future; that credit was applied against the estimated costs.

The equipment cost that vessels would incur is also a function of the total number of traps that must be reconfigured. For each model vessel, the cost model itemizes changes in the quantity of

all gear elements based on the maximum number of traps fished at any point during the year. In this way, the estimate of gear conversion costs for each model vessel reflects the cost of reconfiguring all of its gear, not just the subset of traps it may fish in a particular month.

Gear specifications for each model vessel are customized to the relevant fishing area. The specification of baseline gear use is consistent with typical practices and existing regulatory requirements, while the specification of gear use under each regulatory alternative is based on an assessment of the changes needed to comply with the new requirements. The factors considered in each case include:

- Set configuration (i.e., the number of traps and number of buoy lines per trawl)
- The depth at which gear is typically set, combined with a buoy line slack factor (to define buoy line length);
- Buoy line diameters;
- Buoy system features (buoy size, number, and type);
- The number of anchors (if any) per set;
- The distance between traps on a trawl (to define groundline length); and
- groundline diameters.⁷

Appendix 6.1.1 details how these parameters vary by area. As explained in the appendix, many of these parameters are based on information provided in a lobster gear configuration report for the Gulf of Maine (McCarron & Tetreault 2012). Additional specifications draw on data provided by state fisheries managers to support development of the Vertical Line Model.

To evaluate the net change in equipment cost associated with fishing longer trawls, the analysis incorporates unit cost information gathered from marine supply retailers. The unit cost estimates represent the average of prices quoted by three major marine supply retailers in the Northeast: Friendship Trap, New England Marine, and Brooks Trap Mill. This price information was gathered via searches of online catalogs as well as personal communication with company representatives. Supplementary information from other retailers provides prices for miscellaneous gear elements. Appendix 6.1.2 summarizes the unit prices and useful life estimates compiled for all gear elements.

6.2.2.2 Labor for Gear Conversion and Associated Costs

In addition to equipment costs, converting trap/pot gear to longer trawls would require an investment of fishermen's time. The following discussion summarizes the assumptions the analysis employs to estimate the amount of time fishermen are likely to spend reconfiguring their gear, as well as the method used to estimate the implicit value of their time.

6.2.2.2.1 Labor for Gear Conversion

Numerous factors may influence the amount of time a fisherman is likely to spend on gear conversion, including:

⁷ The analysis assumes that groundlines employed in non-exempt waters is sinking line, consistent with the ALWTRP's current requirements.

- The individual's skill and experience;
- The complexity of the reconfiguration required;
- Whether gear is reconfigured on shore or at sea;
- For reconfiguration at sea, the distance between sets;
- The availability of a sternman to assist with the work; and
- The method (knots, splicing, etc.) used to string traps together into trawls.

In the absence of data to support characterization of all of these factors, the labor cost analysis applies a simplified method. Following the recommendation of National Marine Fisheries Service (NMFS) gear specialists, the analysis assumes 15 minutes of labor for each trap that must be converted to a new configuration, based on the assumption that the reconfiguration will be performed at sea.⁸ To determine the number of traps that must be converted, the analysis first calculates, for each model vessel, the number of sets that the new configuration will accommodate. Using the model vessel's baseline gear configuration as a starting point, it then calculates the number of traps that must be added to each set to reach the target set length. For example, assume as a starting point a model vessel that under baseline conditions fishes 400 sets of doubles (a total of 800 traps), but under a given regulatory alternative would be required to fish trawls of at least five traps. In this case:

- The regulatory alternative will accommodate 160 sets of five-trap trawls ($800/5 = 160$);
- The analysis takes as a starting point 160 sets of doubles (320 traps);
- The remaining 480 traps must be added to these sets to create five-trap trawls;
- At 15 minutes per trap, the analysis estimates that 120 labor-hours would be required to reconfigure the 480 traps (480 traps times 0.25 hours per trap).

The formula for total reconfiguration labor hours is shown as below:

$$\text{Total Labor Hours} = 0.25 * \left(\text{Total traps} - \frac{\text{Total traps}}{\text{New Traps per trawl}} * \text{Old traps per trawl} \right)$$

While this approach is highly simplified, it incorporates the time estimated for the suite of considerations and steps (listed above) required to convert from current to new trawl configurations. In addition, because it is based upon an estimate of the time required to reconfigure gear at sea, it is designed to be more conservative (i.e., to yield a higher cost estimate) than would be the case if the analysis assumed that the reconfiguration of gear occurred on shore.

6.2.2.2.2 Labor Cost

The cost model assigns an implicit value to fishermen's time based on labor rates in professions they would pursue if not involved in fishing. This is the "opportunity cost" of time. To identify alternative professions, the analysis relies on responses provided to a survey administered by the Gulf of Maine Research Institute in 2005 (GMRI 2006). The GMRI survey asked a sample of 1,158 randomly selected lobstermen a variety of questions regarding education, vessel

⁸ Pers. comm. with NMFS gear specialists, September 24, 2012.

characteristics, fishing effort, and other aspects of their work. Compiled and published in 2006, the survey findings guide a number of assumptions in the cost and socioeconomic analysis presented in this document.

When asked about alternative professions, the GMRI survey respondents most commonly indicated that they would be involved in carpentry, other trades, vessel maintenance, merchant marine activity, or another aspect of commercial fishing (i.e., harvesting other species, boat maintenance). Table 6.1 summarizes the responses.

The cost analysis uses the distribution of responses to develop a weighted average wage rate that reflects the opportunity cost of a fisherman's time. First, the analysis normalizes the survey responses, eliminating the indeterminate or non-relevant responses ("other," "don't know," and "retire"). The analysis then matches the alternative occupations with Bureau of Labor Statistics (BLS) occupational categories, developing a simple average wage rate for each occupation (or group of occupations) based on the May 2018 mean hourly wage rate reported by BLS. For instance, the survey response "carpentry/trades/mechanic" is assigned an average wage rate based on the rates that BLS reports for "Carpenters" and for "Automotive Service Technicians and Mechanics." Finally, the analysis weights the wage rates by the distribution of survey responses to estimate an average opportunity cost of \$25.75 per hour (Table 6.1).

6.2.2.3 Caveats and Uncertainties

The discussion above highlights several key assumptions in the analysis of gear conversion costs. Chief among these are (1) the specific baseline configurations and gear elements used in each fishing area; (2) the cost and useful life of various gear elements; (3) the amount of labor needed to convert short sets to longer trawls; and (4) the implicit value of fishermen's time. There are uncertainties associated with each of these assumptions, but the overall direction of any potential bias in the resulting estimates of gear conversion costs is unclear.

It is noteworthy that the analysis of gear conversion costs results in some net cost savings in gear costs for some groups of vessels, as shown in Table 6.3. This occurs when trawling up implies lower expenditures on key gear elements. For instance, vessels fishing in the federal waters of LMA 1 are likely to employ relatively sophisticated and expensive surface systems. If trawling up reduces the number of sets fished and the number of buoys used, the result is reflected as a net cost savings, even after accounting for investments of time needed to reconfigure gear. Table 6.3 also shows savings caused by trawling up for some Maine fishermen that fish singles. Even with some catch losses, these vessels have a net savings due to reduced gear costs when trawling up. While the analysis incorporates these impacts, for most vessels, it also recognizes the potential for other costs—in particular, adverse impacts on catch rates—to offset any savings as a result of changes in gear costs. The following section discusses these impacts in greater detail.

Table 6.1: Calculation of the implicit value of a trap/pot fisherman's time

Alternative Occupation	Percent of Respondents That Identified Alternative	Normalized Distribution of Responses	Average Wage Rate	BLS Occupational Categories Incorporated into Average Wage Rate
Carpentry/Trades/Mechanic	28%	41%	\$23.59	Carpenters; Vehicle and

Alternative Occupation	Percent of Respondents That Identified Alternative	Normalized Distribution of Responses	Average Wage Rate	BLS Occupational Categories Incorporated into Average Wage Rate
				Mobile Equipment Mechanics, Installers, and Repairers; Construction Trades Workers
Other Commercial Fishing/Merchant Marine/Boat Building and Maintenance	26%	38%	\$24.16	Fishers and Related Fishing Workers; Motorboat Mechanics and Service Technicians; Sailors and Marine Oilers; Captains, Mates, and Pilots of Water Vessels
Other Business	8%	12%	\$36.98	Business and Financial Operations Occupations
Truck Driver/Equipment Operator	3%	4%	\$23.71	Heavy and Tractor-Trailer Truck Drivers; Operating Engineers and Other Construction Equipment Operators
Education	2%	3%	\$27.22	Education, Training, and Library Occupations
Police/Firefighter/EMT/Military	1%	1%	\$25.07	Police Officers; Firefighters; Emergency Medical Technicians and Paramedics
Engineering	1%	1%	\$44.62	Mechanical Engineers
Other	10%	N.A.	Weighted	
Retire	2%	N.A.	Average:	
Don't Know	16%	N.A.	\$25.75	

Notes: Because the survey permitted multiple responses, these figures do not sum to 100 percent. Sources:

Alternative occupation choice data from GMRI survey 2006;

Wage rate data from BLS Occupational Employment Statistics, May 2018.

https://www.bls.gov/oes/current/oes_nat.htm#00-0000. Data accessed on March 19, 2020

6.2.3 *Catch Impacts Associated with Trawling Up Requirements*

The analysis of compliance costs associated with trawling requirements recognizes the potential for impacts on landings under certain conditions. Fishermen use singles and other short sets for a variety of reasons. In some cases, short sets may allow fishermen to target especially productive bottom structure where longer trawls may be inefficient or difficult to haul (e.g., because of fouling on bottom structure). This advantage may be most prevalent in rocky habitats, including those around islands. Second, short sets can be distributed more widely than trawled traps. Wide distribution may aid in the search for the target species. Likewise, wide distribution may reduce competition between traps, increasing the catch per unit of effort.

Data to support a quantitative analysis of trawling up effects on catch are extremely limited. Because multiple factors influence catch rates (gear configuration, gear density, the abundance of the target species, bottom structure, soak time, individual skill, etc.), it is difficult to isolate the effect of trawl configuration on catch. The Maine Department of Marine Resources (Maine DMR) developed and implemented a project designed, in part, to assess the impacts of longer

trawls on catch in the lobster fishery (Maine DMR 2012). Participants hauled roughly 2,300 sets of gear in control configurations (singles and doubles) and 835 sets of gear in trawls ranging from triples to tens. The research found no statistically significant reduction in catch per trap when comparing the control configurations to the experimental configurations.

Despite this finding, industry experts believe it is possible, and in some instances likely, that changes in gear configuration could have an adverse impact on catch. Experts from the Massachusetts Division of Marine Fisheries (Massachusetts DMF), for example, have called attention to the potential for catch impacts in the inshore lobster fishery around Cape Cod, where single traps are routinely fished.⁹ Research has demonstrated that the optimal spacing of lobster traps depends upon the abundance of lobster in an area; the greater the density of lobster, the greater the density of traps that can be fished without an adverse impact on catch per trap (Schreiber 2010). The use of singles in the Cape region is partly attributable to this dynamic. The density of lobsters in these waters is lower than it is off the Maine coast; under these conditions, traps that are placed relatively close together—as would be the case when fishing trawls—are more likely to compete with one another in attracting lobsters. As a result, traps fished in trawls around the Cape might be less productive than traps fished as singles.¹⁰

Gear configuration change may lead to change in fishing effectiveness and efforts, causing an initial reduction in landings and associated lower fishing mortality. However, this is a dynamic process: landings would drop in the first year that effort reductions are implemented, and then increase after a few years when fishermen adapt to the new regulations and when lobster not captured in earlier years are caught at larger and more valuable sizes. Baseline landing value would be reached between five and seven years after implementation and baseline value would be exceeded in subsequent years¹¹. Because the ALWTRP regulations are generally revised every five to six years, long-term benefits derived from this measure are not calculated. Lacking any systematic data linking gear configuration and catch rate, the analysis applies a simplified approach to characterize potential impacts. To recognize the potential for catch impacts to be greater when gear configurations change markedly, it first classifies affected vessels into two categories:

Category A – Those subject to relatively large increases in trawl length, defined as an increase of a factor of two or more in the number of traps in each set; and

Category B – Those subject to smaller increases in the number of traps trawled up in each set.

The analysis then incorporates two scenarios designed to provide a reasonable estimate of the range of potential catch impacts:

⁹ Pers. comm. with Massachusetts DMF, November 7, 2012.

¹⁰ Pers. comm. with Massachusetts DMF, November 7, 2012. DMF also noted that several ports on the Outer Cape have sandbars that can only be cleared when the tide is high. Fishermen access and haul their traps in a relatively narrow window of time each day. While trawl fishermen tend to haul more gear to make up for lower catch rates, this may not be an option for those whose ability to exit and return to port is limited by the tides.

¹¹ Pers. comm. with NEFSC lobster stock assessment scientist on May 9, 2020.

Lower Bound – In the lower bound scenario, the analysis assumes that vessels in Category A experience a 5-percent reduction in annual catch. The reduction in catch will also decrease by 20 percent per year, and reach zero at year six. The catch of vessels in Category B is assumed to be unaffected.

Upper Bound – In the upper bound scenario, the analysis assumes that all vessels in Category A experience a 10-percent reduction in annual catch, while those in Category B experience a 5-percent reduction. For both categories, the catch reduction will decrease by 10 percent in year two, then decrease by 20 percent per year, reaching 10 percent of the original reduction at year six.

The impact of the year one catch reduction is calculated as follows:

$$\text{Baseline Catch per Trap (lb/trap)} \times \text{Traps Fished (traps/year)} \times \text{Catch Reduction (\%)} \times \text{Ex-Vessel Price (\$/lb)}$$

Similarly, the reduction in annual landings is converted to a loss in annual revenue using the following equation:

$$\text{Reduction in Catch (lb/year)} \times \text{Ex-Vessel Price (\$/lb)}$$

Table 6.2 summarizes the catch per trap and price data by state and LMA using NMFS Vessel Trip Report (VTR 2010-2017) and dealer data (2015-2017). Vessels fishing in federal waters with any permit requiring VTR reporting are required to report their fishing location, gear configuration and catch amount, while prices are calculated from dealer reports using landed pounds and transaction value. We use more years of VTR data to compensate for the lower VTR reporting rate of 10 percent in Maine waters. The 10 percent sample for VTR reporting in Maine is stratified by state fishing zone (Zones A through G) and license class. More specifically, within each combination of zone and license class, a proportion of harvesters (i.e., 10 percent) is annually selected to complete trip reports. These practices make the multi-year data more likely to be representative for the area.

It is vital to note that the assumptions applied in estimating potential catch impacts are generalized, and the magnitude of such impacts is highly uncertain. A given vessel may experience catch changes greater or less than the impacts assumed in the analysis. These impacts may diminish over time, as fishermen adapt to new gear configurations and learn to fish longer trawls more efficiently. Nonetheless, it is important to recognize that changes in gear configurations could have an overall impact on catch rates. The analysis does so, applying a range of assumptions to illustrate the potential magnitude of this effect.

6.2.4 Summary of Trawling up Cost

Trawling up measures are mainly proposed in Alternative 2 to reduce the number of buoy lines in state and federal waters. Under Alternative 3, the only trawling up proposal is for LMA 3 offshore waters to increase the trap per trawl to 45 from May to August although trawling up is also identified as a likely consequence of a line cap and reduction under Alternative 3. The total economic impact from trawling up consists of three parts: cost savings from surface systems and

buoy lines; extra material and labor cost for groundlines; and lost revenue from catch reduction. Table 6.3 summarizes the savings and costs for different areas.

Under Alternative 2, catch reduction impacts account for the biggest costs, ranging from \$5 million to \$11.8 million. After offsetting the cost saving from buoy lines and surface systems, the total cost is between \$1.5 million and \$8.3 million for the first year. For Alternative 3, the trawling up cost is around \$0.9 million to \$1.9 million. It is much lower than Alternative 2 because the major buoy line reduction measure for Alternative 3 is the buoy line cap reduction, which is described later.

Table 6.2: Parameters for assessing yearly landing value reduction for vessels converting to longer trawls

Fishery	Area	Annual Catch per Trap (lb)	Ex-Vessel Price (\$/lb)	Gross Revenue per Trap (\$)	5% Revenue Reduction per Trap (\$)	10% Revenue Reduction per Trap (\$)
Lobster	ME LMA1	42.5	5.3	225.3	11.3	22.5
	ME LMA3	4.4	5.3	23.4	1.2	2.3
	NH LMA1	32.0	6.0	192.6	9.6	19.3
	NH LMA3	26.4	6.0	158.5	7.9	15.8
	MA LMA1	36.7	5.7	208.8	10.4	20.9
	MA LMA2	18.1	5.7	102.8	5.1	10.3
	MA LMA3	18.5	5.7	105.5	5.3	10.5
	MA OCC	33.0	5.7	187.6	9.4	18.8
	RI LMA2	13.1	6.1	79.3	4.0	7.9
	RI LMA3	43.5	6.1	264.2	13.2	26.4
Jonah Crab	MA LMA2	13.5	0.9	11.9	0.6	1.2
	MA LMA3	146.2	0.9	129.5	6.5	12.9
	RI LMA 2	12.0	0.9	10.5	0.5	1.1
	RI LMA3	123.5	0.9	108.1	5.4	10.8

Notes: 1. Catch per trap data is the average value calculated by state and LMA using 2010-2017 VTR.

2. Ex-vessel price is calculated by state using 2015-2017 dealer reports.

3. All values adjusted to 2020 U.S. dollars

Table 6.3: Savings and costs caused by trawling up measures in the first year of the new rules

Area	Surface System Savings (\$)	Buoy line Savings (\$)	Groundline Line Cost (\$)	Groundline Labor Cost (\$)	Catch Impact Lower Bound (\$)	Catch Impact Upper Bound (\$)	Total Cost Lower Bound (\$)	Total Cost Upper Bound (\$)
ME A	1,671,259	886,847	111,316	409,511	1,171,931	3,229,184	-865,348	1,191,905
ME B	165,350	314,689	54,411	164,217	483,001	1,323,999	221,590	1,062,587
ME C	118,119	567,681	24,282	177,347	704,757	1,521,291	220,586	1,037,120
ME D	98,005	359,989	22,505	152,677	618,008	1,419,169	335,197	1,136,358
ME E	45,151	169,211	8,905	70,592	281,236	641,517	146,371	506,653
ME F	46,749	181,953	9,877	63,205	421,869	919,145	266,250	763,526
ME G	78,311	210,743	23,108	101,696	355,016	939,743	190,766	775,492
MA	179	7,100	457	4,856	25,989	51,977	24,022	50,011
LMA3 (Alt 2)	38,149	157,505	2,135	81,343	1,176,756	2,353,512	1,064,581	2,241,337
LMA3 (Alt 3)	36,993	153,177	2,071	74,976	1,066,603	2,133,205	953,480	2,020,082
Total (Alt 2)	2,261,273	2,855,718	256,996	1,225,445	5,238,564	12,399,537	1,604,015	8,764,988
Total (Alt 3)	36,993	153,177	2,071	74,976	1,066,603	2,133,205	953,480	2,020,082

Notes: 1. All values are adjusted to 2020 U.S. dollars.

2. Fishermen would save some costs in buoy lines and surface system under new gear configurations. The negative numbers are estimated savings.

6.2.5 *Weak Rope Costs*

The use of 1,700 lb (771 kg) test rope would be required under both alternatives to increase the probability of an adult right whale disentangling themselves if they get wrapped up by a buoy line. For the purposes of this document, weak inserts are considered equivalent to weak rope if they are placed in the traditional rope every 40 ft, the average length and girth of an adult North Atlantic right whale. For example, a 90-foot buoy line would need two weak points to be considered equivalent to a fully weak rope.

In Alternative 2 (Preferred), all buoy lines in state waters would be required to have one weak insertion at 50 percent down the rope. Buoy lines in waters between 3 to 12 nm (5.6 to 22.2 km) would be required to have two weak insertions at the top 25 percent and 50 percent of the rope except in Maine Zones A East, F, and G which would have one weak insertion 33 percent of the way down the rope. Buoy lines outside 12 nm (> 22km from shore) to the LMA 1 border are required to have one weak insertion at top 33 percent. For LMA 3, the Preferred Alternative would require fishermen to use fully engineered weak rope or equivalent in one of their buoy lines for the top 75 percent year round.

In Alternative 3 (Non-preferred), buoy lines in all but LMA 3 waters would be required to have a fully engineered weak line or equivalent in the top 75 percent of the buoy lines. There are two options for LMA 3 lines: 1. Have one buoy line with 75 percent weak seasonally (May to August) and one line with 20 percent topper (top 20 percent of the buoy line) year round; 2. Have one buoy line with 75 percent weak year round.

Vessels fishing in inshore (state waters) or nearshore (within 12 nm) waters usually use 3/8 inch (1 cm) diameter ropes. Offshore vessels (beyond 12 nm) use 1/2 (1.3 cm) or 9/16 inch (1.4 cm) ropes. Fully engineered 3/8 inch (1 cm) diameter ropes that break at 1,700 lb (771 kg) or less (weak rope), according to a gear manufacturer,¹² would cost about 15 cents per foot, higher than the 11 cents per foot for traditional 3/8 inch (1 cm) diameter ropes. The price for offshore weak ropes are assumed to be 30 percent more expensive than original ropes at the same diameter. The life span of these ropes are assumed to be 6 years.¹³

There are a few other ways to make a buoy line weak, and the costs vary: The first one is to splice a three ft piece of weaker rope into the original rope. Costs would include five minutes of labor for each insertion and the costs of the piece of weak rope. The life of this weak insertion is assumed to be the same as the original rope, about six years.

Another way is to introduce a 3-ft hollow sleeve, designed by South Shore fishermen, to the original rope. Two cut ends of the original rope meet in the middle of the sleeve, and the two ends of the sleeve are anchored into the original ropes in three tucks or splices. The estimated time to finish the work is around five minutes, and the cost of the sleeve is \$2 with an average life span of four years (Knowlton et. al. 2018).

¹² Pers. comm. with Shippagan Ltd on March 17, 2020.

¹³ Detailed gear price and life span can be found at Appendix.

In this analysis we adopt the costs of the South Shore sleeves as a proxy for weak insertion, and for LMA 3 where fully weak rope will be required, we use 3/4 in. (2 cm) weak rope as a proxy. The sleeves manufactured by Novatec Braid Ltd. have been tested by the South Shore Lobster Fishermen's Association and the New England Aquarium in various locations and weather conditions (Knowlton et. al. 2018). Results indicate that these sleeves are consistent in maintaining integrity and breaking strength over time, so they could be used for multiple seasons. The cost of one sleeve insertion is \$6.10 including labor cost, and the cost of 3/8 weak rope is \$0.15 per foot. The price for 3/4 in. fully engineered weak rope is not available, but with an estimate of 30 percent increase from regular rope, it is around \$0.34 per foot.

The cost estimation for weak ropes is listed in the Table 6.4 below: The investment in weak ropes will generate costs only in the first year, and potentially last for six years without additional input. The total cost would be around \$2.1 million for Alternative 2. For Alternative 3, the total cost would be \$10 million due to the requirement to replace half of the buoy lines with fully weak ropes.

Table 6.4: Affected buoy lines and annual costs of weak lines by alternative in the first year

	Affected Vessels	Affected Buoy Lines	Weak Rope Cost Alternative 2 (\$)	Weak Rope Cost Alternative 3 (\$)
ME A	545	47,247	234,564	1,939,267
ME B	256	25,731	154,779	1,014,326
ME C	439	60,137	306,502	2,076,992
ME D	432	52,503	270,033	1,409,119
ME E	209	17,531	96,780	568,358
ME F	233	16,277	70,299	1,086,206
ME G	187	14,064	60,744	713,151
NH	241	14,814	63,982	147,619
MA	1,216	100,695	465,453	1,145,628
RI	134	6,824	40,572	72,788
LMA 3	81	3,886	479,651	400,055
Total	3,973	359,709	2,243,359	10,573,507

Notes: 1. All dollar values are adjusted to 2020.

2. Weak lines and inserts are assumed to last for six years. Depending on fishing areas, some ropes might last shorter due to weather or bottom condition. Therefore, annual cost could be higher in some areas.

6.2.6 Other Potential Impacts Associated with Gear Configuration Requirements

The analysis does not attempt to quantify several other impacts potentially associated with changes in ALWTRP gear configuration requirements. These include:

- Costs associated with increased gear loss;

- The potential need for a larger crew to handle longer trawls; and
- Vessel modification costs.

The analysis addresses these impacts qualitatively, either because data to develop reasonable estimates are lacking or because available information suggests the impacts will be relatively small. The subsections below address each of these costs in greater detail.

6.2.6.1 Gear Loss Costs

Some gear configuration requirements affecting fixed-gear fisheries have the potential to affect rates of gear loss. Substantial changes in equipment losses can have important cost implications, and should therefore be examined carefully.

The impact of minimum trawl length requirements on gear loss in trap/pot fisheries is difficult to predict with confidence. The uncertainty is largely attributable to the array of underlying factors responsible for gear loss. On the one hand, longer trawls may increase the likelihood that groundline will foul on bottom structure, increasing the potential for line to part while hauling traps. Longer trawls may also increase the potential for gear conflicts, particularly situations in which one fisherman's gear is laid across another's. This could be exacerbated by the Maine conservation equivalencies which will allow fishermen to fish trawls of up to 10 traps with only one buoy line. Overlain gear can cause one party to inadvertently sever another's lines, making it impossible to retrieve all or some of the gear. A longer trawl also increases the consequences of such incidents; i.e., the more gear on a single trawl, the more gear is lost when that trawl is rendered irretrievable.

In other ways, trawling up requirements may reduce the potential for gear loss. The fundamental objective of longer trawls is to limit the number of buoy lines in the water column and reduce encounters with large whales; such encounters are one possible source of gear loss. Likewise, a decrease in the number of buoy lines may reduce the frequency with which gear is entangled in vessel propellers or mobile fishing gear. Furthermore, in areas where trawling up requirements necessitate addition of a second buoy line (e.g., for configurations greater than 20 traps or a vessel going from triples to 10-trap trawls), the second buoy line may make it easier to locate and retrieve gear in case one buoy line is lost. Longer trawls are also heavier and may be less likely to be swept away during extreme storm or tidal events.

Available data assessing how trawling up requirements could affect gear loss are inconclusive. The Maine DMR trawling project (discussed above) asked participants to record whether they lost gear while hauling. An analysis of the raw data provided by Maine DMR shows that of the roughly 3,100 sets of gear, 28 were lost. Of the lost sets, all but six were trawls of three traps or longer (Maine DMR 2012). While this outcome suggests a potential increase in gear loss when trawls are required, nine of the lost sets were 7- and 10-trap trawls fished with a single buoy line (an intentional feature of the project design). This gear configuration was identified as a conservation equivalency in some Maine Zones, although outside of Maine waters it does not occur in normal practice. The conservation equivalency measures were developed by Maine DMR through an iterative collaborative process with the Maine Zone Councils. As fishermen within the Zones provided the measures, there is likely some confidence that gear conflict and

associated loss can be avoided in those areas where more than three traps are fished on a trawl with only one end marked with a buoy. In the Maine DMR (2012) study, participants fished the trawls on an experimental basis; for example, they may have intentionally placed some trawls on bottom structure unsuited to the experimental configuration. Overall, the sample of gear loss incidents in the project is too small to draw reliable conclusions about how trawling up or single end lines influences gear loss.

In 2010 and 2011, the Massachusetts DMF completed a comprehensive study of gear loss and “ghost” fishing (i.e., impacts from lost or derelict gear). Roughly 520 Massachusetts lobstermen responded to the survey (about 59 percent of all the lobstermen permitted in the Commonwealth); the responses were distributed across LMA 1, 2, 3 and the Outer Cape in approximate proportion to lobstering activity. Respondents characterized the extent of their gear loss in different seasons and discussed the perceived causes of gear loss. Table 6.5 summarizes key information gathered in the survey. The findings demonstrate that gear loss is common and represents a significant cost for many lobstermen (Massachusetts DMF 2011).

Table 6.5: Summary of findings from Massachusetts DMF gear loss and ghost gear survey

LMA	Average Number of Traps Lost per Vessel	Primary Causes of Gear Loss	Average Value of Gear Lost per Vessel
1	10 to 23	Storm events and vessel traffic	\$640 to \$1,570
Outer Cape	14 to 34	Storm events and vessel traffic	\$1,410 to \$2,950
2	8 to 21	Vessel traffic and bottom hang ups	\$570 to \$1,500
3	19 to 46	Gear conflicts, line wear, storm events	\$3,860 to \$7,140

Source: Massachusetts DMF, 2011

The survey also included questions about typical gear configurations, allowing DMF to examine how gear loss varies with trawl length. Table 6.6 summarizes the findings. The minimum gear loss rates reported for each configuration show slightly higher losses associated with singles. The maximum rates more strongly suggest that gear loss is greater when fishing singles and doubles than when trawls of three or more traps are used. Overall, these data indicate that rather than exacerbating gear loss, up to a point trawling up requirements may reduce the amount of gear lost and thereby yield an economic benefit to affected fishermen.

Table 6.6: Influence of configuration on gear loss: Massachusetts DMF gear loss and ghost gear survey

Configuration	Trap Loss Rate Minimum	Trap Loss Rate Maximum
Singles	2.70%	21.40%
Doubles	1.60%	19.30%
Trawls (three or more traps)	2.10%	8.70%

Source: Massachusetts DMF 2011

Overall, the effect of trawling up on gear loss is unclear. While data from the Maine trawling project suggest some potential for increased gear loss during fishermen's transition to trawls, the more extensive data from the Massachusetts ghost gear survey suggest that trawls are less subject to gear loss in steady-state conditions. Gear loss is likely a function of numerous variables that extend well beyond the trawl configuration, including bottom structure, shipping traffic, gear density, gear conflicts, tides, currents, experience of adjacent fishermen, and weather events. The net effect of trawling up in the context of all these variables is difficult to characterize or quantify. Hence, the cost estimates discussed in this chapter do not explicitly incorporate the impact of gear loss changes.

6.2.6.2 Addition of Crew

Fishermen operating alone could potentially have difficulty handling the longer trawls required under some of the regulatory alternatives. The physical demands of hauling trawls may be challenging for fishermen who haul by hand rather than with a mechanized hauler. Even with a hauler, older fishermen may find it difficult to manage longer trawls. Addition of a sternman or other crew is one possible response for affected vessels. However, fishing alone is relatively uncommon on most vessels in ALWTRP-regulated waters. In addition, the cost of adding crew is prohibitive for most vessel operators. The subsections below present data suggesting that the addition of crew is unlikely as a response to the trawling requirements.

6.2.6.2.1 Crew on Affected Vessels

Numerous inshore lobstermen choose to fish alone for a number of reasons: limited by permit type, limited by vessel size, or in consideration of vessel profitability. In Maine state waters, permit type LC1 holders are required to be operator only. Adding another crew to the vessel is not allowed. Maine DMR 2017-2019 permit data indicate that 24 percent of applicants hold LC1 permits.

Most other lobster fishermen in the Northeast Region fish with more than one crew onboard. According to the cost survey data collected by NMFS Northeast Fisheries Science Center (NEFSC) for fishing year 2011, 2012 and 2015, only 7 percent of survey respondents from New England states fish without any crew members, and 97 percent vessels longer than 25 feet have at least one crew. Table 6.7 displays the number of crew by vessel size using NMFS survey data.

Table 6.7: Number of crew by vessel size

Crew	25-	26-35	36-45	46-55	55+	Sum
0	5	6	10	0	0	21
1	1	39	64	0	1	105
2	1	42	73	3	1	120
3	1	10	30	1	3	45
4	0	0	1	0	5	6
5	0	0	2	0	2	4
6	0	0	1	0	0	1
Total	8	97	181	4	12	302

6.2.6.2.2 Sternman Costs

Vessel operators choose to work with crew primarily for economic reasons. For instance, a sternman may be cost-effective when lobster abundance is high, harvests are large, and fishing effort is high. Sternmen may also be hired for non-economic reasons, such as safety in offshore waters and for apprenticing purposes.

Sternmen are typically paid a percentage of the vessel's gross (or sometimes net) revenue. Table 6.8 summarizes data from NMFS cost survey for lobster vessels (Zou, Thunberg and Ardini 2021). As the exhibit indicates, payments to sternmen represent a substantial operating cost. A single sternman may be paid roughly 20 percent of gross revenue. On offshore vessels that typically operate with multiple crew members, sternmen may be paid a third of gross revenues.

Table 6.8: Crew payment for lobster vessels by size (in 2018 U.S. Dollars)

Vessel Size	Vessel Number	Crew Payment (\$)	Fishing Revenue (\$)	Percentage
35-	13	20,208	107,793	19%
36-45	277	36,391	168,108	22%
46-55	11	51,986	255,200	20%
55+	15	275,800	752,497	37%

Source: NEFSC Cost Survey (Zou, Thunberg and Ardini 2021)

6.2.6.2.3 Conclusions

As indicated above, the addition of a sternman is a major economic decision for a vessel operator, and is dependent upon many factors. Given the costs, an operator who fishes alone is not likely to alter that practice due to trawling up requirements. The available data suggest that vessel operators who work without a sternman are not necessarily limited to fishing singles. For example, of the Massachusetts lobster vessel operators who work alone, over two-thirds already fish trawls of three or more traps.¹⁴ Anecdotal discussions with fisheries managers also indicate that trawls are routinely fished by vessel operators working alone.¹⁵ Finally, the trawling up configurations proposed in Alternative 2 are based on measures proposed by Maine DMR after extensive scoping with Maine lobstermen and were described as modifications that fishermen can accommodate within their current capacity and fishing practices.

Nonetheless, safety concerns and the physical demands of hauling trawls may prove to be a challenge to some lone operators. In Maine, these vessels may have the option of relocating to exempt waters. Beyond this option, it is possible that the trawling up requirements may force some fishermen to fundamentally reconsider their operations, including crew choices. For instance, an operator fishing alone may choose to hire a sternman, fish more traps, and possibly move to a new location. NMFS does not believe such changes will be widespread, and the analysis does not reflect the cost of such major operational shifts.

6.2.6.3 Vessel Modification

¹⁴ Based on analysis of Massachusetts DMF permit and 2009 Catch Report data.

¹⁵ Pers. comm. with Maine DMR (August 30, 2012) and Massachusetts DMF (November 7, 2012)

For a variety of reasons, operators of smaller vessels may find it difficult to fish trawls. Some small vessels, for example, may lack the deck space to accommodate trawls. Experts with Maine DMR, however, note that in some cases, operators of smaller vessels have made it feasible to use trawls by affixing plywood sheeting to the stern or the rail of their vessels, thus extending the available deck space.¹⁶ The proposed federal regulations would not include trawling up requirements in exempted waters; however, operators of small vessels affected by the proposed trawling up requirements may choose to make similar modifications.

Estimating the number of vessels that would need this type of modification would require data on vessel size and other features that are not readily available; thus, the estimate of compliance costs does not specifically incorporate vessel modification costs. All else equal, the exclusion of these costs biases the estimate downward. In aggregate, however, these costs are likely to be relatively low; thus, the magnitude of any bias is likely to be minor.

6.3 Analytic Approach: Seasonal Restricted Area closed to Trap/Pot Buoy Lines

As described in Chapter 3, seasonal restricted areas that would allow ropeless fishing but be closed to fishing for lobster and Jonah crab with persistent buoy lines are proposed in Alternatives 2 (Preferred) and 3 (Non-preferred): Maine LMA 1 Offshore Restricted Area, across the Maine Lobster Management Zones C, D and E; Massachusetts Restricted Area with the exception of the Outer Cape Cod LMA; South of Islands (Nantucket and Martha's Vineyard) Restricted Area options; and Georges Basin Restricted Area. Figure 6.3 and 6.4 depict the shape of these restricted areas, and Table 6.9 describes the details of the restricted areas and the number of affected vessels. Analysis of available data on vessel activity indicates that the practical impact of these proposals would be limited to the lobster and Jonah crab fishery. How a vessel is likely to respond to a given restricted area depends on the features of the restricted area as well as the type of permit that a vessel holds. In general, vessel operators will likely choose one of the three responses:

Suspend Fishing—If alternative fishing grounds are not readily available, vessel operators may suspend fishing while their regular grounds are closed, and resume fishing when the restricted area ends. For example, if a vessel only holds a state permit, while during the restricted period no other state waters is available, this vessel will be assumed to suspend operation.

Relocate—It may be possible for vessel operators to fish for lobsters in other areas during the restricted period. The potential for relocation depends on many factors, including regulatory restrictions on access to alternative areas, the distance to those grounds, the productivity of the grounds, and the potential for competition with others to limit access to a new area.

Ropeless Retrieval—Use ropeless fishing techniques such as remote retrieval of buoy line that is stored on the bottom. Given the need for an exemption to buoy line requirements and the high costs of ropeless fishing units and deck technology, fishermen interested in using ropeless technology within seasonal restricted areas are likely to be limited to those participating in

¹⁶ Pers. comm. with Maine DMR, August 30, 2012

collaborative gear research and borrowing gear from the NMFS NEFSC gear cache. Given the existing and anticipated ropeless units available, fewer than 35 fishermen across the Northeast Region fishing up to 10 trawls each are likely to be able to participate until the technology is more affordable and operationally feasible under commercial fishing conditions.

These responses have different implications for economic welfare, and affected fishermen may respond differently, depending upon individual circumstances. The following discussion examines this issue, beginning with describing the general approach the analysis employs to analyze the costs associated with restricted areas. Then it examines each of the proposed buoy line restricted areas individually, and estimates the compliance costs.

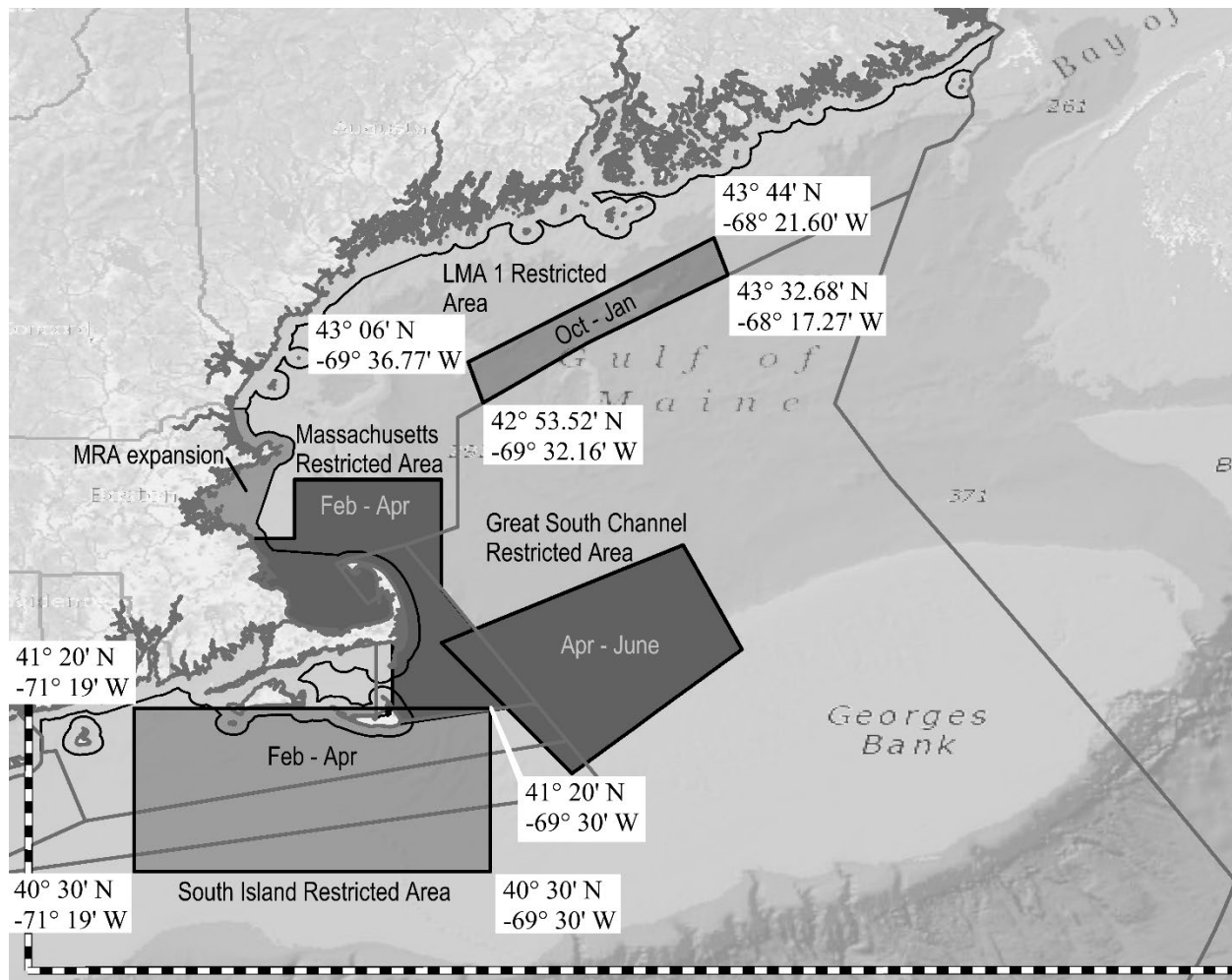


Figure 6.3: The trap/pot buoy line seasonal restricted areas proposed in Alternative 2 (Preferred). LMAs are delineated by the gray lines. The new South Island Restricted Area is proposed as closed to trap/pot buoy lines from February through April and the LMA 1 Restricted area is proposed from October through January. An expansion of the MRA into Massachusetts state waters to the New Hampshire border and under state regulations, extended in state waters in LMA 1 and the Outer Cape through at least May 15, with a potential opening if whales are no longer present, is also included. In dark gray are existing seasonal restricted areas that would become areas with restrictions to fishing with buoy lines, with the exception of the Outer Cape Cod LMA, which would remain closed to lobster harvest from February through March. This change is intended to encourage ropeless gear testing and accelerate the development of commercially feasible ropeless fishing and associated long-term benefits to right whales. The area north and east of the checked line and west of the EEZ encompasses the Northeast Region.

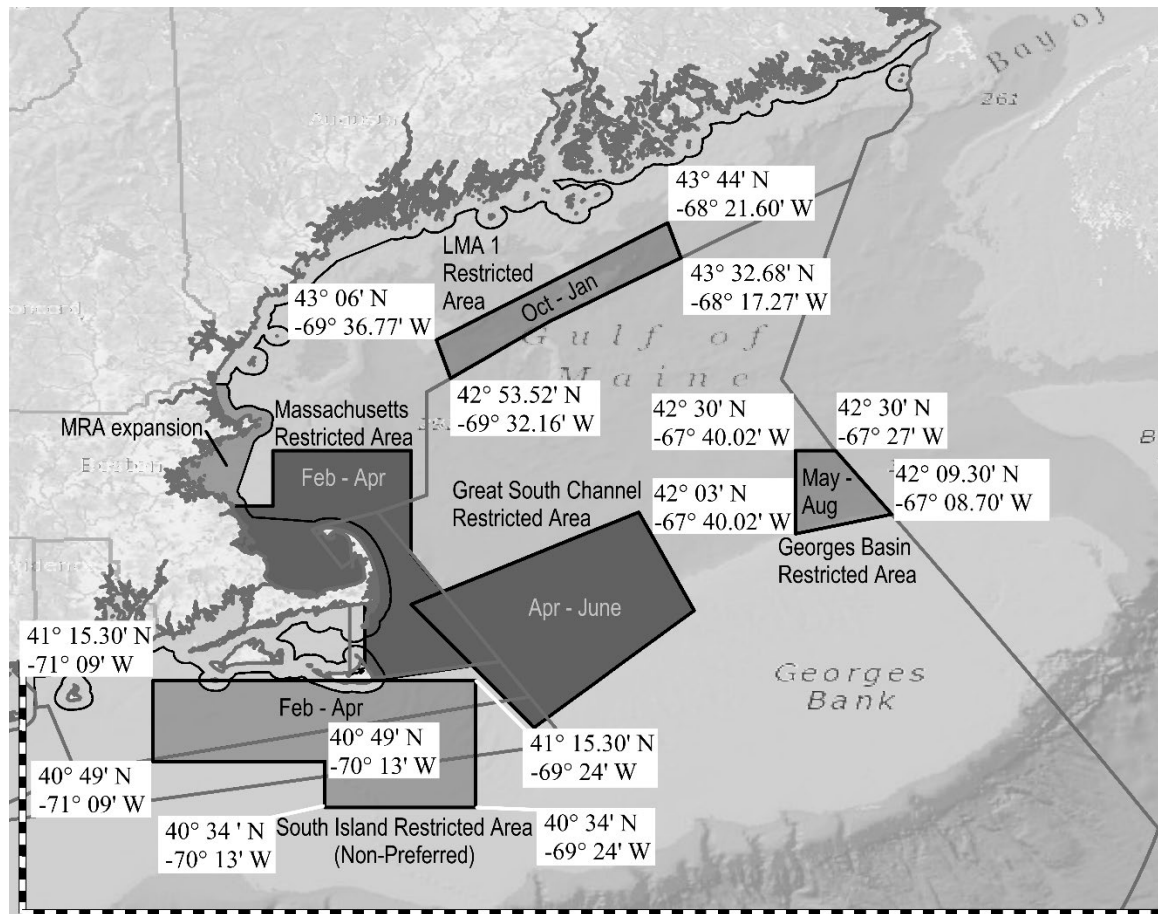


Figure 6.4: The buoy line restriction options proposed in Alternative 3 (Non-preferred). The LMA 1 Restricted Area is proposed from October through February. The South of Island Restricted Area from February to April is L-shaped and covers most LMA 2 waters and a small portion of LMA 3. The Georges Basin Restricted Area is proposed from May through August. An extension of the Massachusetts Restricted Area through May, with a potential opening if whales are no longer present, is also included. The MRA North is included in Alternative 3 as well. In dark gray are existing seasonal restricted areas that would become areas with restrictions to fishing with buoy lines, with the exception of the Outer Cape Cod LMA, which would remain closed to lobster harvest from February through March. This change is intended to encourage ropeless gear testing and accelerate the development of ropeless fishing and associated long-term benefits to right whales. The area north and east of the checked line and west of the EEZ encompasses the Northeast Region.

Table 6.9: Summary table of seasonal buoy line restricted areas and the number of affected vessels

Restricted Area	Alternative	Restricted Period	Size (Square miles)	Max vessels-lines out	Max vessels-relocation
ME LMA1	2	Oct - Jan	967 (2,505 km ²)	0	62
MRA North	2	Feb - Apr	497 (1,287 km ²)	106	0
South Island	2	Feb - Apr	5,468 (14,162 km ²)	16	11
ME LMA1	3	Oct - Feb	967 (2,505 km ²)	0	62
MRA North	3	Feb - May	497 (1,287 km ²)	193	0
MRA	3	May	3,566 (9,326 km ²)	138	21
Georges Basin	3	May - Aug	557 (1,443 km ²)		16
South Island	3	Feb - May	3,506 (9,080 km ²)	3	7

6.3.1 *Costs of Suspending Fishing*

6.3.1.1 **Lost Revenue and Saved Operation Costs**

Fishermen may respond to restricted areas by suspending fishing during the restricted period. The forgone revenue associated with inactivity would be the primary cost for fishermen who choose to sit out restricted areas. At the same time, fishermen would save operation costs by not fishing. The total cost variation will be the summation of these two parts. The sections below describe the general method used to estimate costs for trap/pot vessels that suspend fishing activity.

The analysis of the cost of suspending fishing is based on estimates of revenue per trap, which are then used to estimate forgone revenue based on the number of traps fished on affected vessels. The estimates of revenue impacts are tailored to the area and season each restricted area would affect. In each case, the analysis incorporates catch-per-trap estimates based on the best available data. As described in the gear configuration approach section, the catch per trap data are estimated using VTR data from 2010 to 2017.

Catch per trap is then combined with ex-vessel price data to estimate gross revenue per trap. To characterize typical market conditions, the analysis incorporates the average price data for the three most recent years available (2015 to 2017). To align prices with the area and season specific catch-per-trap data, the analysis uses ex-vessel price data from the states and months relevant to each restricted area.

Gross revenue per trap is the product of the catch per trap and the applicable ex-vessel price for each restricted area. A final adjustment is needed to convert gross revenue per trap to net revenue per trap. Fishermen who suspend fishing during restricted areas will forgo revenue but will save the operating costs associated with the effort (while continuing to pay fixed costs such as boat

payments). Operating costs are the costs that vary with fishing effort, and primarily include bait, fuel, and payments to sternmen (when relevant). In this analysis, we adopt the operation costs from a recent economic research on lobster vessel profitability conducted by NFMS using cost survey data collected by the Social Science Branch of NMFS NEFSC. On average, vessels less than 35 ft have an annual operation cost of \$68,858; the operation cost for medium-sized vessels (35-44 ft) is \$120,704. For large (45-54 ft) and extra-large (55+ ft) vessels, the operation costs are \$182,137 and \$718,034 respectively. (Zou, Thunberg, and Ardini 2021). From VTR data, we calculate the percentage of trips that vessels take during the restricted months, and then we estimate the average operation costs during the restricted time.

As discussed further below, the analysis includes a restricted area-specific estimate of the number of traps fished per vessel. Thus, the impact of the restricted area on the net revenue of each affected vessel is the product of the number of traps the vessel would ordinarily fish in the closed area and the estimate of forgone revenue per trap, net of operating cost savings.

6.3.1.2 Caveats

VTR data have been used extensively in the calculation of catch per trap and trip percentage during the closed period. We are aware that VTR are self-reported data and the catch and location data are limited in accuracy and variation for some vessels. However, the geographic information and gear configuration data could not be found in any other data sources consistently for trap and pot fisheries. In addition, the data quality has been largely improved in recent years due to the use of new technology like electronic reporting. Therefore, we decided to use the recent years' data after carefully reviewing and the removal of outliers. (See Appendix 6.2 for documentation)

It is also important to note that the analysis of the revenue losses associated with suspending fishing assumes that fishermen lose all the catch they would ordinarily harvest during the restricted period. The loss in landings may actually be less, depending on lobster movements and behavior. Specifically, some of the lobsters not caught during the closure may simply be harvested once the closed area is reopened (i.e., catch rates may be higher than normal following the restricted area). To the extent that this occurs, the analysis may overstate the economic losses associated with suspending fishing.

6.3.2 Relocation Costs

When a vessel has the opportunity to relocate its traps during the closed period, it may do so if the expected returns of fishing elsewhere exceed costs. Assuming restricted areas will not affect lobster prices and most operating costs, such as bait, will be unaffected. Relocation has two major impacts on the vessel: change in catch rate and fuel consumption. Some other factors, like time and transition cost, may also affect total costs, however, these costs could not be reliably estimated so we do not include them in the quantitative analysis in this section.

6.3.2.1 Fuel Costs

One potential impact of relocating effort during restricted time is a change in operating costs associated with fuel consumption. This is a function of the change in distance that a vessel operator must travel in order to tend his or her gear, the number of trips taken during the period in question, the vessel's fuel efficiency, and the price of fuel.

The difference of travel distance before and after relocation is determined by the size of the restricted area. We assume vessels relocate their traps in areas adjacent to the restricted area where the difference in travel is measured from the center to the edge of the restricted area. Most restricted areas are in irregular shape, so we take the shortest route as the lower bound of relocation and the longest as the upper bound. Additional information on the areas to which vessels were assumed to relocate is provided in the detailed discussion of the analysis of each restricted area. In all cases, however, the method assumes that relocation to the substitute fishing area is temporary, and that the affected vessels will return to their preferred fishing grounds when the restricted area has ended.

Once the alternative fishing location is identified, the total change in distance traveled depends on the number of fishing trips made during the restricted period. In this analysis, only vessels in federal waters are assumed to relocate their traps, so we use multi-year VTR data to estimate the average number of trips each model vessel will take in a certain month.

Any change in fuel costs also depends on the fuel-efficiency of the affected vessels, which is a function of engine size (horsepower). Information on the engines with which affected vessels are equipped is not available; however, it is possible to estimate the horsepower of affected vessels based on the general correlation between horsepower and vessel length. The analysis employs an equation characterizing this relationship, using it, in combination with an estimate of the average length of affected vessels, to estimate the horsepower of vessels that may relocate their effort while a restricted area is in effect (Table 6.10).

Consistent with data from a study by the Maine Maritime Academy (MMA 2011), the analysis assumes that marine engines burn 0.053 gallons of diesel fuel per hour for each unit of horsepower delivered. The analysis uses this figure to estimate total fuel use per hour for all affected vessels. Based on input from NMFS gear specialists, the analysis also assumes that vessels steam at an average speed of 14 knots (25.9 km/hr). This figure, in combination with data on distances, provides a basis for estimating the change in steaming time to and from alternative fishing grounds. The analysis then multiplies this figure by the estimate of diesel use per hour to obtain an estimate of the change in fuel use per trip.

Multiplying fuel use per trip by the number of trips and price of diesel fuel yields the change in fuel costs. In calculating the change in costs attributable to each regulatory alternative, average diesel price data from 2017 to 2019 from the American Petroleum Institute for the New England Area were used. The adjusted price for all areas is \$3.11 per gallon in 2020 U.S. dollars.

Table 6.10: Summary of fuel use parameters used in restricted area cost assessment

Parameter	Value/Estimation Method	Source
Horsepower (Lobster Vessels)	$HP = -16.3566 + 9.71 * (\text{Vessel Length in Feet})$	NMFS Permit Data (2011)
Fuel Consumption at Cruising Speed	0.053 gallons/hour/HP	Maine Maritime Academy, 2011
Typical Cruising Speed (Lobster Vessels)	14 knots	NMFS Gear Specialists
Retail Price for Diesel Fuel (Tax included, New England Area)	\$3.11 per gallon	Energy Information Administration, 2017-2019

6.3.2.2 Catch Impacts

It is also possible that relocating vessels will experience a reduction in catch relative to their preferred fishing location inside the closed area. Catch reductions could result because of crowding and heightened competition in the areas to which fishermen relocate; because fishermen are less familiar with the bottom structure or other determinants of catch in the new area; or simply because the available alternative fishing grounds are less productive than those inside the closed area.

The data required to develop a rigorous estimate of potential catch impacts are not available. Such an estimate would require a well-defined characterization of catch rates in the closed area and similar knowledge of conditions (e.g., lobster density) in a specific alternative fishing area. In practice, the potential impact is likely to vary significantly from individual to individual, depending upon the fisherman's expertise and ability to adapt to a new area. As a result, any catch reduction estimated for vessels that relocate their effort is subject to significant uncertainty.

Lacking more specific data, it was assumed that vessels that choose to relocate would experience reduction in catch during the restricted period. Using catch per trap and price data from previous analysis, then multiplying the total traps fished in each period, we can estimate the total value of each month. Five percent of total value is the lower bound of lost revenue and 10 percent is the upper bound. Unlike catch reduction from trawling up measures, these reductions are assumed to happen every year.

6.3.2.3 Caveats

In addition to the assumptions noted above, the analysis of relocation costs is based on a number of other assumptions about fishermen behavior that are subject to considerable uncertainty. These include:

- The assumption that fishermen would reconfigure their gear, as necessary, to meet the minimum trawl length requirement in any area to which they relocate, but would incur no gear conversion costs beyond those associated with meeting these requirements;

- The assumption that fishermen who relocate their effort would continue to fish the same number of end lines and traps they used in the closed area.
- The assumption that fishermen will find productive ground to relocate to and would not have a reason to create dense gear fencing around the perimeter that could pose a risk to whales entering or leaving the buoy line closure area.
- The assumption that fishermen will continue to make the same number of fishing trips while using the alternate location.

Reviewers expressed concerns that restricted areas to protect whales would cause a “curtain effect” resulting from fishermen lining up to surround a restricted area. Curtain effects have been observed around finfish closure areas that were closed to protect spawning areas or for other target species’ conservation purposes. Target species become more productive within those closed areas and spill across the restricted area borders. This productivity prompts fishermen to fish around restricted area edges. Areas closed to protect whales would have some seasonal protection for lobster, but once opened, those lobsters would again be available for harvest. Rather than line up around the perimeter of an area that is not designed to increase target species production, to prevent conflict agile fishermen would be more likely to search for and relocate to productive bottom nearby. Responses would be dependent on other fishery practices, such as seasonal fishing habits nearshore, for example, in areas where most gear is removed seasonally, relative to offshore areas where gear is relocated.

Though movement of gear to productive fishing grounds closest to a restricted area is anticipated, and it is important to properly place a restricted area to avoid increasing line density in areas of high whale density, actively fishing fishermen are unlikely to overcrowd gear because of the impacts on catch rates. To functionally create a fence or curtain of vertical buoy lines, gear would need to be set up close enough to adjacent gear for the buoy lines to have a non-additive effect. It is unclear how close gear would have to be to have this non-additive effect but it seems improbable that offshore fishers would set their gear this close to adjacent gear on a broad scale. However, in response to comments like these, the analyses in the FEIS reconsidered areas where gear would be moved into areas of high risk. As a result, a different South Island Restricted Area was chosen and the Georges Basin Restricted Area was not selected in the Preferred Alternative based on their tendency to push gear into high risk areas in the DEIS. Please see Chapters 3, 5, and 6 for more details.

Until 2021, no curtain effects were observed around existing seasonal restricted areas. However in 2021, Massachusetts modified their regulations to close state waters to lobster fishing into mid-May. Between the northwest MRA closure and state waters, a narrow band of Massachusetts Bay was still open to fishing. Dual permitted fishermen apparently moved their gear out of state waters and federal permit holders began moving gear from the beach to stage outside of MRA to prepare for the May 1 opening. NMFS and Massachusetts DMF are investigating and an extension of the MRA closure to the beach will be considered for further rulemaking to prevent that in the future. Outside of that incident, however, and despite heavy surveillance, similar concentration of gear along a seasonal restricted area has not been documented and is not anticipated.

The net effect of these assumptions on the cost estimates is unclear. The methodological discussion for each of the individual restricted areas highlights additional uncertainties associated with the selection of specific relocation sites for affected vessels.

6.3.3 *Ropeless fishing*

Under a revised restricted area definition, Northeast Region lobster and Jonah crab trap/pot fishermen could fish with trap/pot gear using “ropeless” methods, although exempted fishing permits would be required to exempt fishermen from surface marking requirements under current laws. The gear would still require ropes between pots in the trawls on the ocean floor. Most designs also include buoy lines, but they are stored on the bottom until retrieved acoustically by a vessel operator. Team members disagreed about further consideration of “ropeless fishing” for multiple reasons, including but not limited to: costs of the technology; concerns about gear conflicts; lack of testing under commercial fishing conditions; questions about impacts on trawlers and other mobile gear fishermen; ability of enforcement agents to retrieve, inspect, and reset the gear; and the belief that it could not be rapidly adapted for commercial use. Some Team members recognized that ropeless fishing could provide an alternative to seasonal closures and many strongly supported the need for commercial fishermen to be involved in the further development and design of ropeless gear. Because the overall sense was that the Team would not provide a consensus recommendation on modifications to the closed areas to allow ropeless fishing, NMFS did not move the action further in 2018.

Since 2018, NOAA has invested a substantial amount of funding in the industry's development of ropeless gear, in specific geographic areas and in general. We anticipate that these efforts to facilitate and support the industry's development of ropeless gear would continue, pending appropriations, and would be essential to defray costs for early adopters. Through these efforts, and associated outreach by the NMFS gear team, interest does not appear to be substantial among the commercial fishery in the Northeast Region, and participation within any restricted area can be limited through the authorization process. We anticipate that at least through 2025, ropeless fishing in these restricted areas is likely to be done primarily by collaborators borrowing gear from the NMFS gear cache, with up to an additional 10 percent of effort by other researchers and fishermen coast-wide. The NEFSC gear team projects that by 2025, they expect to have about 300 ropeless units and enough deck controllers for about 30 vessels, as well as technology to support adjacent mobile fishing vessels. That is, coast-wide, there would be up to 33 vessels fishing ten ropeless trawls. If congressionally appropriated and private funding remains available, NMFS will continue to reimburse participating fishermen for some of their time and will provide the onboard and in-water technology so that costs to fishermen will be minimal and could be offset by higher catch rates within an area closed to most fishermen. To incentivize participation, the alternatives consider modifying current seasonal restricted areas and defining new restricted areas as seasonal closures to trap/pot fishing that use persistent vertical buoy lines. The economic impacts of ropeless fishing is expected to be primarily borne by NMFS and collaborators, and costs to fishermen are expected to be negligible over the next few years.

The costs of converting to ropeless are described as high at this time (estimated to range from over \$55,000 to over \$240,000 per vessel; Black et al. 2019). Participating vessels may still incur

some costs with transitioning gear to ropeless fishing within these areas. For example, switching to ropeless gear takes time. Additionally, participants in research note that it takes additional time to set and haul the gear, due in part to logistical differences from traditional gear and crew familiarity with ropeless gear, which improves over time. Researchers are working on quantifying this difference in operational costs, but currently are unable to estimate how this difference may impact revenue opportunities.¹⁷

Generally, participants are expected to benefit due to the revenue they gain from ropeless fishing in these areas during seasonal restriction, in comparison to suspending fishing activities due to the seasonal restrictions. Because of the uncertainty regarding the operational differences in tending this gear, we are unable to estimate how monthly revenue may differ between traditional trap/pot and ropeless gear. However, we expect that ropeless participants will be able to gain a portion of the revenue that is currently estimated to be lost due to inactivity during the closures.

6.3.4 Analysis of Specific Restricted Area Scenarios

Vessel operators are likely to respond to a particular restricted area in the way they believe would have the least adverse impact on their income, subject to financial, regulatory, and other constraints on the options available to them. Their responses will depend not only on the nature of their fishing operations (e.g., fishery, vessel type, quantity of affected gear) but also on the features of the restricted area itself (area and time period). The variety of possible outcomes and the large number of potentially affected fishermen precludes a vessel-by-vessel analysis of likely responses.

As noted above, this analysis examines three general response scenarios to evaluate the potential impact of restricted areas: relocation or suspension of fishing effort. Within that framework, however, the analysis of economic impact seeks to recognize key variables that may differ from case to case, such as the number of vessels a particular restricted area would affect, the scale of the fishing operations affected, regional differences in the prices that affected vessels may receive for their catch, and the availability of alternative fishing sites. The sections below discuss each restricted area individually, focusing on unique aspects of the approach to analyzing their potential impacts.

6.3.4.1 Offshore Waters of Maine Zone C, D, and E

The buoy line restricted area approximately 30 nm (55 km) offshore of Maine, across the Maine lobster management Zones C, D, and E provide protection for right whales in an area of relatively high co-occurrence during the fall and winter according to both the DST and the NMFS/IEC co-occurrence model. In Alternative 2, the proposed season is from October to January, and in Alternative 3, one more month of restricted area in February is proposed.

As shown in Figure 6.3, the entire 967 square miles (2,505 km²) of closed area is located in federal waters offshore of LMA 1. All vessels fishing in this area are required to have a federal permit with a designated fishing area of LMA 1. Using VTRs, the analysis in the DEIS identified

¹⁷ Pers. comm. with NEFSC gear specialist Henry Milliken.

about 45 vessels that would be affected by the LMA 1 seasonal restricted area. However, public comment from Maine fishermen suggested that this estimate was very low, likely in part because reporting is not mandatory for all Maine and federally permitted vessels. As a result of public comment, for this analysis, the Maine DMR harvester report and dealer report data, we estimated that at least 123 vessels fished outside 12 nm in Zone C, D, and E, where half of the area is covered by the proposed restricted area. Without further detailed location information of these vessels, we assume a uniform distribution and assign half of them to the restricted area. We also assume these vessels within the restricted area would re-locate all their traps within the same zone but closer to shore for two reasons: firstly, vessels with only LMA 1 permit are not able to get over the Eastern border of the restricted area to fish in LMA 3. Secondly, even though vessels in Zone C and E could move a portion of their traps into adjacent zones, the trap numbers and available fishing grounds are limited. It is unlikely to be economically efficient to tend traps in two distant areas.

Based on the assumptions above, fuel costs for affected vessels will go down due to shorter travelling distance, but may be counter-balanced by lost revenue from catch impacts by moving traps out of their premium fishing ground. Table 6.11 shows the details of affected vessels and the fuel cost changes. The average vessel horsepower in this area is 349, the lower bound of saved distance from relocation is 10 miles (16 km) per round trip and the upper bound is 20 miles (32 km).

Table 6.11: Cost savings from relocation in the closed area by month

Month	Average Trip	Affected Vessel	Fuel Cost Saving Lower Bound (\$)	Fuel Cost Saving Upper Bound (\$)
Oct	11.3	36.2	12,542	25,085
Nov	8.9	43.8	18,258	36,514
Dec	5.2	50.5	11,125	22,249
Jan	3.6	61.5	11,822	23,644
Feb	2.5	43.1	4,935	9,870
Oct-Jan (Alt 2)			53,747	107,492
Oct-Feb (Alt 3)			58,681	117,362

Offsetting fuel savings is reduced catch. We assume vessels that fish in the closed area choose it as primary fishing ground based on their gear setup. Therefore, it is reasonable to assume catch reduction if they have to relocate their gears to secondary ground. Additionally, the crowding effects created by the relocated vessels would also reduce landings for other vessels outside 12 nm in Zone C, D, and E. From the dealer report data, we could assess the monthly landings in each zone; and from the harvester report data, we could estimate the proportion of landings by distance from shore. Combining results from these two data sources, we could provide an estimate of landings in areas outside 12 nm (22.2 km) from October to February (Table 6.12). With assumptions from the previous section, we apply a 5 percent to 10 percent catch reduction on all traps fished in the closed area.

Table 6.12: Catch impacts outside 12 nm (22.2 km) in Maine Zone C, D, and E by month

Month	Price (\$/lb)	Total Catch (lb)	5% Value (\$)	10% Value (\$)
Oct	3.9	552,871	107,810	215,620
Nov	3.9	1,135,207	221,365	442,731
Dec	4.1	843,463	172,910	345,820
Jan	4.8	555,956	133,430	266,859
Feb	6.4	193,725	61,992	123,983
Oct-Jan (Alt 2)		3,087,497	635,515	1,271,030
Oct-Feb (Alt 3)		3,281,222	697,507	1,395,013

6.3.4.2 Massachusetts Restricted Areas

The Massachusetts Restricted Area (MRA) has been closed from February through April since 2015, with extensions of the state water closure into May by Massachusetts when right whales remain in the area. Modifications to the seasonal restricted areas are analyzed as part of Alternative 2 and 3. In 2021, Massachusetts DMR expanded the MRA in Northern state waters to the New Hampshire border (Code of Massachusetts Regulations 322 Section 12) and extended the closure to May 15, with the option of opening early or delaying the opening of state waters when right whales have left the area. Under Alternative 2 (Preferred), the Plan would adopt the extension of the MRA in state waters to the New Hampshire border, mirroring the state regulations. The seasonal extension into May would not be included. In Alternative 3 extension of the entire MRA into May is analyzed, with possible reopening if surveys demonstrate that right whales have left the restricted area. In addition, Alternative 3 includes the expansion of the MRA in northern state waters.

Table 6.13 summarizes key features of the restricted areas and associated costs. The general approach used to assess the impact on affected vessels is the same for all the restricted areas. MRA North (Massachusetts state waters north to New Hampshire), Cape Cod Bay, and Outer Cape Cod are state waters; we assume all vessels will suspend fishing during the seasonal restriction. In the federal waters, both relocation and suspending fishing are analyzed. Considering both lost revenue and saved operation costs, Alternative 2 would have the total cost of \$0.3 million, and Alternative 3 would have a total cost of \$1.8 million.

Table 6.13: Cost for affected vessels in Massachusetts Restricted Area

	Alt 2	Alt 3	Alt 3	Alt 3	Alt 3	Total (Alt 2)	Total (Alt 3)
Area	MRA North	MRA North	MRA	MRA	MRA	MRA North	MRA
Month	Feb-Apr	Feb-May	May	May	May	Feb-Apr	Feb-May
Action	Lines Out	Lines Out	Lines out	Relocation	Relocation		
Cost Type	Catch impacts	Catch impacts	Catch impacts	Catch impact	Extra Fuel		
Affected Vessels	106	193	137.6	20.5	20.5	106	351
Catch per Trap (lb)	0.8-1.3	2.4	2.2	2.2			
Average Trip per	3.3-5.7	8.6	8.1	8.1	8.1		

	Alt 2	Alt 3	Alt 3	Alt 3	Alt 3	Total (Alt 2)	Total (Alt 3)
Month							
Price (\$/lb)	5.9-7.4	5.9	5.9	5.9			
Total Traps	75,859	82,765	70,507	12,603			
Total Landing Value (\$)	618,289	1,221,589	1,008,462				
5% Lost Revenue Lower Bound (\$)				9,013			
10% Lost Revenue Upper Bound (\$)				18,026			
Cost Saving(\$)	305,504	210,207	573,810				
Lower Total Cost (\$)	312,784	1,324,165	434,652	9,013	10,610	312,784	1,778,440
Upper Total Cost (\$)	312,784	1,324,165	434,652	18,026	15,916	312,784	1,792,758

6.3.4.3 Massachusetts South Island Restricted Area

In recent years, right whale aggregations have appeared in the waters south of Martha's Vineyard and Nantucket. Two different seasonal restricted areas to buoy lines are analyzed in Alternative 2 and 3 as shown in Figure 6.3 and Figure 6.4. Consistent with the restricted area in MRA, the period for the South Island Restricted Area would be from February through April in the Preferred Alternative and February through May in the Non-preferred.

Table 6.14: Number of affected vessels by area and month

Alternative	Month	Affected vessels (lines out only)	Affected vessels (relocated)	Total
2	Feb	9.19	8.92	18.11
	Mar	9.02	8.16	17.18
	Apr	15.03	11.14	26.17
3	Feb	1.14	3.73	4.87
	Mar	1.14	3.76	4.89
	Apr	2.27	6.96	9.23
	May	2.92	7.25	10.18

The seasonal buoy line closed area in Alternative 2 is a large rectangle area that covers both most LMA 2 waters and a small portion of LMA 3 waters. The Vertical Line Model suggests that 17 to 26 vessels fish in this area during the months it would be closed.

Table 6.15: Costs of suspending fishing in the South Island Restricted Area

	Total Traps	Catch per Trap Lobster (lb)	Price Lobster (\$/lb)	Value Lobster (\$)	Catch per Trap Jonah Crab (kg)	Price Jonah Crab (\$/kg)	Value Jonah Crab (\$)	Operation Cost Savings	Total Cost
	Alternative	2							
Feb	13,389	0.6	6.2	55,637	10.8	0.8	122,626	25,326	
Mar	11,764	1.0	6.9	81,398	8.6	0.8	85,270	37,395	

	Total Traps	Catch per Trap Lobster (lb)	Price Lobster (\$/lb)	Value Lobster (\$)	Catch per Trap Jonah Crab (kg)	Price Jonah Crab (\$/kg)	Value Jonah Crab (\$)	Operation Cost Savings	Total Cost
Apr	15,618	1.9	7.4	233,046	2.7	0.8	37,284	150,189	
Sum				370,081			245,179	212,910	381,557
Alternative 3									
Feb	3,679	0.6	6.2	15,289	10.8	0.8	33,696	3,135	
Mar	3,568	1.0	6.9	24,685	8.6	0.8	25,859	4,719	
Apr	5,894	1.9	7.4	87,944	2.7	0.8	14,070	22,722	
May	5,522	2.4	5.8	79,376	2.5	0.8	12,063	52,905	
Sum				207,294			85,689	83,480	209,503

Given the size and proximity to shore, for both restricted areas in Alternative 2 and 3, some vessels may suspend fishing and some vessels may relocate their gears depending on the type of permits they hold. Table 6.14 displays the number of vessels that are affected by these two restricted areas. Applying a similar analysis to that previously described when vessels suspend fishing, they will lose all the revenue they could normally generate during that time period, but they will also save on operation costs. For vessels that may relocate, they have to pay extra fuel costs to get to the new fishing grounds, and bear the assumed loss of 5 to 10 percent of their catch due to the loss of their primary fishing location. Both alternatives capture important winter fishing grounds for Jonah crab, which has become an important target species in winter months and a major contributor to revenue for Southern New England fishermen. While a seasonal closure would likely increase lobster catch rates once an area opens, making up for lost landings during the closure, Jonah crab landings are limited only by trap and vessel capacity. Catch cannot be made up during the open fishing season. Because Jonah crabs are normally caught together with lobsters, for this analysis they are added to the total harvest of traps in these closed areas. Table 6.15 to 6.17 shows the details of all the costs incurred from the two restricted areas in Alternative 2 and 3.

Table 6.16: Costs of relocation in the South Island Restricted Area

	5% Lobster Value (\$)	10% Lobster Value (\$)	5% Jonah Crab Value (\$)	10% Jonah Crab Value (\$)	5% Total Value (\$)	10% Total Value (\$)	Lower Fuel Cost (\$)	Upper Fuel Cost (\$)	Total Lower Cost (\$)	Total Upper Cost (\$)
Alternative 2										
Feb	1,629	3,258	3,591	7,181	5,220	10,440	2,798	3,730		
Mar	2,162	4,323	2,265	4,529	4,427	8,854	3,218	4,291		
Apr	5,593	11,185	894	1,789	6,487	12,975	6,732	8,977		
Sum	9,384	18,767	7,573	15,147	16,956	33,914	12,749	16,997	29,705	50,911
Alternative 3										
Feb	700	1,401	1,544	3,089	2,245	4,489	780	1,172		
Mar	1,154	2,307	1,208	2,417	2,362	4,725	988	1,482		
Apr	3,877	7,755	620	1,241	4,497	8,995	2,802	4,202		
May	3,297	6,594	501	1,002	3,798	7,597	4,288	6,431		
Sum	9,029	18,057	3,874	7,748	12,903	25,806	8,858	13,287	21,761	39,092

Table 6.17: Cost estimation of vessels in the South Island Restricted Area

	Catch Impact Lower(\$)	Catch Impact Upper (\$)	Fuel Impact Lower (\$)	Fuel Impact Upper (\$)	Lines Out (\$)	Total Lower (\$)	Total Upper (\$)
Alt 2	16,956	33,914	22,220	29,626	402,350	432,055	453,261
Alt 3	12,903	25,806	8,858	13,287	209,503	231,264	248,595

6.3.4.4 Georges Basin Restricted Area

Unlike the other restricted areas discussed earlier, the Georges Basin Restricted Area is located far offshore, on the EEZ border within LMA 3, and is mostly fished by lobster vessels from New Hampshire. Right whales have been sighted using the grounds during summer months while transiting from Southern waters to Northern feeding grounds.

The average distance from homeport to Georges Basin is more than 100 miles (160 km). Based on NMFS VTR and permit data, most vessels take multiple-day trips to fish this ground. The average vessel length exceeds 65 feet and most of them currently fish 35 traps per trawl. All vessels hold federal lobster permits and submit VTRs regularly.

The duration of the Georges Basin Restricted Area would be from May through August. Vessels would be required to remove gear from the area during the restricted season and are most likely to relocate their traps to productive waters adjacent to the restricted area. Since the transit distance to adjacent areas is the same as to the restricted area, fuel costs would not change, however, catch rates may be lower. Following previous assumptions, all catch may be reduced by 5 to 10 percent if vessels have to relocate their traps during May to August. Table 6.18 displays the catch impacts from this restricted area.

Table 6.18: Costs of relocation in Georges Basin Restricted Area

Month	Catch per Trap (lb)	Price (\$/lb)	Total Traps	Total Landings (lb)	5% Value (\$)	10% Value (\$)
May	16.5	5.7	10,410	381,345	52,238	104,476
June	21.8	5.6	17,487	842,098	112,292	224,586
July	16.1	5.5	14,956	527,064	69,715	139,430
August	34.0	5.4	11,549	862,861	111,649	223,298
Sum					345,895	691,789

6.3.4.5 Summary

Table 6.19 summarizes the economic impact analysis of all proposed restricted areas in Alternative 2 (Preferred) and Alternative 3 (Non-preferred). The total cost of the seasonal restricted areas analyzed for Alternative 2 range from \$1.2 to \$1.9 million. The seasonal restricted areas analyzed in Alternative 3 would have economic impacts ranging from \$2.8 to \$3.9 million because there are more restricted areas and closures of longer duration.

Table 6.19: Summary of Economic Impact of Restricted areas

Restricted area	Alternative	Analysis period	Size (Square miles)	Max vessels-lines out	Max vessels-relocation	Lower Bound Cost (\$)	Upper Bound Cost (\$)
ME LMA1	2	Oct - Jan	967 (2,505 km ²)	0	62	562,656	1,232,804
MRA North	2	Feb - Apr	497 (1287 km ²)	106	0	312,784	312,784
South of Islands	2	Feb - Apr	5,468 (14,162 km ²)	16	11	432,055	453,261
Total	2		6,932 (17,954 km ²)	122	73	1,307,495	1,998,849
ME LMA1	3	Oct - Feb	967 (2,505 km ²)	0	62	618,156	1,353,674
MRA North	3	Feb - May	497 (1287 km ²)	193	0	1,324,165	1,324,165
MRA	3	May	3,566 (9,32649 km ²)	138	32	454,275	468,593
Georges Basin	3	May - Aug	557 (1,443 km ²)	0	16	345,895	691,789
South of Islands	3	Feb - May	3,506 (9,080 km ²)	3	7	231,264	248,595
Total	3		8,099 (20,976 km ²)	141	117	2,973,755	4,086,817

Commenters on the DEIS and Proposed Rule were asked to consider whether a trigger mechanism was feasible for the LMA 1 Restricted Area so that the area could remain open to fishing unless some trigger threshold was reached. The seasonal closure of LMA 1 is estimated to make up approximately 5 to 6 percent of the risk reduction achieved by the risk reduction elements of Alternative 2 (Preferred). Although some commenters expressed a preference for a trigger, no trigger thresholds were proposed that could ensure a similar level of right whale risk reduction. Maine DMR, for example, suggested a trigger based on right whale entanglement rates within Maine LMA 1, however, because right whale entanglements are often documented miles and months away from the original incident, this type of trigger could not be demonstrated to be an effective or protective measure on a year to year basis.

6.4 Analytic Approach: Gear Marking Requirements

The proposed action would implement additional gear marking requirements compared to no action. As explained in Chapter 3, under Alternative 2 (Preferred), NMFS would mirror the Maine state regulations for all non-exempted waters, and would implement analogous marking for the other New England states. In state waters, the gear marking requirement would include one state-specific 3-foot (91cm) colored mark within 2 fathoms (3.7 m) of the buoy and at least two additional 1-foot (30 cm) marks in the top and bottom half of the gear. In federal waters, in addition to the top 3-foot (91 cm) mark, an additional green 1-foot (30 cm) mark would be required in the top 2 fathoms (3.7 m) of line, and at least three 1-foot (30 cm) marks would be required in the top, middle, and bottom of the buoy line below the surface system. Within 6 inches of each 1-foot state-colored mark, another 1-foot green mark would also be required to

distinguish lines in federal waters from state waters. This Alternative would continue to allow multiple methods for marking line below the surface system (paint, tape, rope twine inserts, etc.), with highly visible paint required for the 3-foot mark in the surface system. Under Alternative 3 (Non-preferred) the 3-foot (91 cm) state-specific color would be marked on the buoy line within 2 fathoms (3.7 m) of the buoy, as in the Preferred, but the entire line would also have to be replaced with a line woven with identification tape with the home state and fishery (for example Maine, lobster/crab trap/pot) repeated in writing along the length of the buoy line.

The analysis relies on the Vertical Line Model to estimate the number of vertical lines that would be necessary to mark under Alternative 2 and 3. In each case, the estimate of gear marking demands is consistent with the new trawling requirements the alternative specifies. Aggregate gear marking costs are based on numbers of active vessels estimated in the Vertical Line Model.

The estimate of gear marking costs considers both the cost of material/equipment and labor costs. A few assumptions are made here based on communication with our gear specialists¹⁸:

1. The NMFS gear specialist indicated that fishermen replace external marks annually. That assumption is not the case for buoy line with inserted ID tape. So the time and cost burden are the same for each year in Alternative 2. In Alternative 3, markings are assumed to repeat every year, while ID tape lasts for six years.
2. Time for marking: 20 min per line + 2 min per mark if using taping or painting. For twines in federal waters, the time is estimated to be 10 min per mark. For example: a five-mark line with taping would cost $20 + 2 \times 5 = 30$ min; an eight-mark line with twines would cost $20 + 10 \times 8 = 100$ min. For dual-permitted vessels moving from state to federal waters, twine is the likely marking that will be used to insert the green federal water mark, because paint and tape are unlikely to be effective on wet rope. Note that this is an increase from past estimates based on observations during 2020 marking conducted by Maine fishermen in response to similar gear marking requirements.
3. Material cost for each foot marking is \$0.04 per foot (see below for detail calculation); the cost for enough twine to make a one foot mark once woven in is up to \$0.5. Labor cost per hour is \$25.15 in 2017 dollars (\$26.52 in 2020 dollars, see table 6.1 for details).

ID tape ropes are not available at this time. Suppliers that have produced it in small batches could not provide an estimate of the price range. On a conservative basis, here we assume that the cost of ID tape rope will be twice as much as conventional rope, which costs \$0.11 per foot for 3/8 in. rope and \$0.26 per foot for 3/4 in. rope. Table 6.20 describes the gear marking cost for Alternative 2 and 3.

Table 6.20: The first year gear marking cost for Alternative 2 and 3

¹⁸ Email correspondence with NMFS gear specialists from June 30, 2020 to May 9, 2021.

	Number of Affected Vessels	Number of Endlines	Total Lower Cost Alt 2 (\$)	Total Upper Cost Alt 2 (\$)	Marking Cost Alt 3 (\$)	ID Tape Cost Alt 3 (\$)	Total Cost Alt 3 (\$)
ME	2,301	233,508	3,107,273	4,407,985	2,300,229	8,611,698	10,911,927
NH	241	14,815	173,382	173,382	145,939	144,339	290,278
MA	1,216	100,651	1,215,509	1,346,020	991,488	1,120,599	2,112,087
RI	131	6,525	88,260	129,581	64,276	71,170	135,446
LMA 3	81	4,119	55,835	122,088	40,575	977,683	1,018,259
			0	0	0	0	0
Total	3,970	359,618	4,640,260	6,179,056	3,542,507	10,925,490	14,467,997

Notes: 1. All dollar values are adjusted to 2020.

2. Gear marking is assumed to repeat every year except for ID tape. Depending on fishing areas, some marks might need replacement earlier due to weather or bottom condition. Therefore, annual costs could be higher in some areas.

6.5 Analytic Approach: Line Cap Reduction

Under Alternative 3, a 50 percent line cap reduction is proposed for federal waters to reduce the risk score by 45 percent in federal waters. Line tags would likely be the implementation mechanism, with permitting entities distributing enough tags for 50 percent of the 2017 vertical line estimate fished under their permitting authority. No specific measures are proposed at this time, so each state could identify distribution methods and fishermen could choose their own line reduction measures to fish under this limit. Vessels could keep fishing all their traps with twice as many traps per trawl, or maintain their gear configuration but reduce the total active fishing traps by half; or they can combine trawling up and trap reduction at the same time toward a 50 percent buoy line reduction goal. The estimation of the economic impact of line cap reduction is difficult without knowing the exact measures of each area. Therefore, we estimate the more likely (and more expensive) situation to get an estimate of economic impact, by assuming all vessels comply by trawling up.

Similar to the trawling up measure in Section 6.2, the economic impact of a change in line cap reduction includes the change in gear configuration costs and impacts on total catch. Gear configuration costs would include cost savings from fewer surface systems and buoy lines, but costs would increase due to the need for more groundlines and the associated labor costs from converting gear to meet the end line cap reduction goal. Table 6.21 describes the details of the cost estimation using a worst-case scenario of trawling up, which assumes twice the fishermen's current traps per trawl on half the trawls.

Table 6.21: Estimation for 50 percent line cap reduction in federal waters by area at year one

	Surface System Savings (\$)	Buoy line Savings (\$)	Groundline Material Cost (\$)	Groundline Labor Cost (\$)	5% Catch Impact Lower Bound (\$)	10% Catch Impact Upper Bound (\$)	Total Cost Lower Bound (\$)	Total Cost Upper Bound (\$)
ME A	2,324,719	1,023,539	53,130	557,086	1,892,903	3,785,805	-845,140	1,047,763
ME B	143,525	477,511	40,201	227,060	771,527	1,543,055	417,752	1,189,280
ME C	188,538	902,198	37,464	332,767	1,130,311	2,260,621	409,807	1,540,117
ME D	253,048	740,393	40,830	354,337	1,203,690	2,407,381	605,416	1,809,106
ME E	94,027	349,626	17,433	150,215	510,450	1,020,900	234,445	744,895
ME F	163,258	757,685	22,988	305,455	1,038,003	2,076,005	445,502	1,483,505
ME G	89,032	368,978	19,905	190,341	646,706	1,293,410	398,941	1,045,646
MA	38,123	206,765	13,738	391,554	1,107,742	2,215,485	1,268,146	2,375,889
RI	11,661	21,067	4,786	71,194	89,614	179,228	132,868	222,482
LMA3	134,823	547,795	7,544	284,607	1,176,756	2,353,512	786,290	1,963,046
Total	3,440,755	5,395,556	258,018	2,864,618	9,567,702	19,135,401	3,854,028	13,421,728

Notes: All values are adjusted to 2020 dollars.

6.5.1 *Alternative Responses to Line Cap Reduction*

The economic analysis above considers the first option described below—a fairly costly response that would cause safety challenges for some fishermen by doubling the number of traps per trawl. Other potential line cap reduction approaches that were not analyzed for costs are briefly described below.

6.5.1.1 **Trawling up to double trap/trawl number and length, no trap reductions**

A 50 percent line cap could result in broad scale trawling up in federal waters across the Northeast Region. In areas where two buoy lines are allowed on trap/trawls given current configurations, this would require double the number of traps per trawl. Vessels with higher capacity for longer trap trawls will likely have the ability to mitigate the impacts of a line cap and increase the number of traps per trawl, though this is anticipated to vary by distance to shore. Those fishing farther offshore are most likely to double their trap trawl lengths and fish the same number of traps. This represents the lower bound of changes to fishing effort where the number of traps fished does not change.

6.5.1.2 **Reduce traps**

If a 50 percent line cap was implemented, it is unlikely that all vessels would be capable of trawling up in order to fish the same number of traps. Reducing trap caps by half could also achieve a 50 percent reduction in buoy lines when paired with traps/trawl requirements. Fisheries managers that participated in public meetings of the Atlantic State Marine Fisheries Commission and the Team have expressed confidence that on productive fishing grounds, lobster

trap reductions could occur without negative economic consequences. Described further below, a number of studies have demonstrated this, for example Myers and Moore (2020) and Acheson (2013). However, to be a reduction in the number of buoy lines actively being fished, and to be fairly distributed based on vessel fishing histories or other commonly used metrics, detailed knowledge of the amount of fishing effort by sector or individual vessel is required. Allocation decisions in effort control management of a capped resource (lines or traps) are also usually informed by iterative public fishery management processes and include appeal options that are administratively burdensome. Because the lobster/Jonah crab fishery has variable reporting requirements across states, and because only about 10 percent of Maine fishermen have been required to report in any year and federal reporting has not been mandatory, existing data are not available to easily determine effective trap and line cap measures. This was demonstrated by the failed attempt by the Atlantic States Marine Fisheries Commission to identify an effort limit addendum, described in Chapter 3 Section 3.1.1.2.

A line cap that would allow fishermen to choose could result in some choosing trap reductions. Trap reduction applications would likely differ based on the location and size of fishing operations. In federal waters, outside of 3 nautical miles (5.6 km), most areas have minimum trap trawl configurations already, with the exception of a few small exempted areas outside of 3 nm (5.6 km) offshore of Maine. Common configurations in this area start at one to three traps per trawl and increase with distance from shore. There is a minimum of 10 traps per trawl outside of state waters and a minimum of 14 traps per trawl in offshore waters. Therefore it is likely that there will be some trap reductions as a result of a line cap, which could fall under a few different categories:

- Vessels constrained by vessel size, rope storage constraints, hauling block capacity, number of crew, or other operational constraints would have to either invest in major modifications to their vessel and capacity or reduce the number of traps fished by up to 50 percent of their current trap level. This is a more likely scenario with smaller vessels that are not capable of trawling up from their current capacity, especially those still fishing singles. A 50-percent trap reduction represents the upper bound of potential changes to fishing effort to achieve a 50-percent line reduction, likely limited to regional areas where no trawling up would be expected.
- Some degree of trawling up is most likely to occur in some nearshore and all offshore waters but in many cases doubling the traps/trawls would still be prohibitive. Given not all vessels will be able to adjust the scale of their vessel or current operations it is most likely that there will be a response somewhere in the middle, where a combination of trawling up and trap reductions occurs. In federal waters outside of Maine lobster zones, most fishermen are already trawling up to at least ten traps per trawl so the capacity to trawl up further will be dependent on the size of the operation, the number of buoy lines currently used for each trawl, and safety concerns. A doubling of traps per trawl would strain smaller fishing operations, requiring a greater reduction in total traps fished than on larger vessels. Predicting how many allocated traps would be latent is difficult to estimate without additional details on vessel class and capacity.

6.5.1.3 Ropeless on one end

One additional scenario available is the use of only one tagged buoy line on trap/pot trawls with no buoy line or the incorporation of a ropeless fishing device on the other end. Under Alternative 2 (Preferred), Maine DMR's conservation equivalency that would allow trawls of up to ten traps to be fished with one buoy line is analyzed. Those trawls would be fished without a ropeless retrieval unit on the buoyless end of the groundline. For longer trawls, a ropeless unit could be used. There are a number of manufacturers of devices to remotely retrieve buoy lines that are working with NMFS and commercial fishermen. Currently an authorization for an exemption to surface marking requirements under the Atlantic Coastal Act is required; however, in some areas where gear is more dispersed and gear conflicts may be of less concern, modifications to surface marking requirements could be developed to allow ropeless operations. Costs vary, but for some devices are as low as \$5,000 per retrieval device. A buoy line on one end and a stored buoy line on the other end would achieve a 50-percent line cap without impacting the number of traps being fished in federal waters. Because ropeless devices are being developed to transmit location information, increased gear loss would not be anticipated. The primary costs would be those associated with purchasing and maintaining the equipment necessary to deploy, locate, and retrieve the buoy line.

6.5.2 *Potential Impacts:*

As discussed above, if the first scenario is widely adopted, the cost of the line cap comes primarily from catch impacts as a result of trawling up, estimated in the analysis as being from 5 to 10 percent. Additionally costs to reconfigure vessels to accommodate line or to hire additional crew may also be incurred. There could be some savings in the amount of buoy lines that need to be purchased and replaced. It is likely that this response is limited to larger, offshore vessels and it would not be feasible or safe to double or quadruple trawl lengths. Total costs would range from \$3.9 million to nearly \$13.4 million, a range of costs that likely encompasses most of the alternative options discussed qualitatively below.

Areas closer to shore would likely experience either a mix of responses, ranging from a combination of trawling up and reduced traps fished, or a halving of traps fished with the same trap/trawl configuration to achieve the line cap (up to a 50-percent trap reduction). Cost impacts are difficult to estimate and are likely to be variable by area fished. Effort reduction could increase profits and salaries of lobster fishermen if operation costs decrease and the size, and subsequent value, of harvested lobster increases (Richardson and Gates 1986, Wang and Kellog 1988, Meyers et al. 2007, Steinbeck et al. 2008, Holland et al. 2011, Dayton et al. 2018). Some indicate this level would have to be fairly high to have a measurable impact on profitability (Steinbeck et al. 2008, Holland et al. 2011). There is evidence the industry is overcapitalized and that many vessels are not operating at full efficiency, suggesting that effort reduction could help, particularly if it resulted in a decline in operating costs (Dayton et al. 2018). Previous research also suggests that reducing effort has a more measurable impact than solely relying on minimum size classes to maintain a healthy fishery (Richardson and Gates 1986).

Steinbeck et al. (2008) posits that personal income would increase with sharp decreases in trap numbers. Myers and Moore (2020) also agree that reducing effort in the U.S. lobster fishery could lead to higher profits and more protection for right whales. Canadian lobster fisheries in

Nova Scotia have maintained profitability despite only operating seasonally, indicating effort reduction does not necessarily correlate with a decline in profitability (Meyers et al. 2007, GMRI 2014) while U.S. profitability has decreased despite increases in landings and will need to reduce effort to maintain a profit (GMRI 2014). If effort is not sufficiently reduced, it is possible widespread trap reductions as a result of a line cap would not necessarily translate into a change in profitability.

The trap reduction necessary to increase profitability may be higher than what would be expected with the implementation of a 50-percent line cap. The maximum trap reduction would be around 50 percent, but a mixed-response scenario where some trawling up is used to recoup traps and some traps become latent is far more likely. If effort reduction does not result in fewer trips and other adjustments that reduce operational costs, it is possible that the effort reduction would be less effective at increasing profitability. The proposed line cap does not require a change from year-round fishing, thus it would be left to the vessel operators whether or how to reduce operational costs in response to a reduction in traps. Plan modifications conducted under the Marine Mammal Protection Act are not normally done to control fishing effort, but rather are more commonly a goal of fishery management measures under the Atlantic Coastal Act. As a result, there is likely to be more variation in how vessel operators respond to trap reduction. Effort reduction might not translate into an increase in the size and value of harvested lobster and overall profitability of fishing operations.

The last response scenario suggested is the use of ropeless devices on one end in the event of a 50 percent line cap of 2017 buoy line estimates. Similar to first scenario, where no trap reduction would be anticipated and current trawl configurations would be maintained, this alternative would allow vessels to continue operating at their current capacity. This scenario would likely have the smallest impact on landings. However, there would be at least a short term increase in the cost of operations with the need to purchase new equipment. The estimated initial per vessel investment for switching to full ropeless fishing is around \$56,000 to \$243,000 depending on which technology is preferable (Black et al. 2019). Fishermen are likely to choose the more affordable technology and would likely only modify half of their buoy lines. Additional maintenance costs would include replacement and maintenance of gear. Increased gear conflict might occur, causing costs in lost gear or time to find and retrieve gear. Despite the costs, the benefits of this approach would be to maintain the current level of operation and minimize lost revenue. The more vessels that switch over to using ropeless devices, the more affordable the equipment will become in the future, minimizing the future costs of this approach.

This Final Rule also proposed measures to allow ropeless fishing in areas that are seasonally closed to persistent buoy lines. Thus, an investment in ropeless equipment as a result of a line cap could also allow vessels with this capacity to access fishing areas that would be otherwise unavailable (though this would require an additional exempt fishing permit).

6.6 Estimated Compliance Costs By Alternative

As noted in the introduction to this chapter, the economic analysis is designed to measure regulatory compliance costs of the Plan modifications that would be implemented by federal rulemaking on an incremental basis, i.e., to measure the change in costs associated with a change

in regulatory requirements. If no change in regulatory requirements is imposed as would be the case under Alternative 1 the economic burden attributable to the ALWTRP would be unchanged. Thus, Alternative 1 would impose no additional costs on the regulated community.

For this analysis, we consider costs of only those measures that would be regulated under the federal Plan modifications. Costs of ongoing and anticipated lobster fishery management measures, measures within Maine exempted waters, and the extension into May of a buoy line closure for state waters in the Massachusetts Restricted Area, are not analyzed.

The cost changes in Alternative 2 and 3 are displayed in Table 6.22. Three sets of values are presented: the first year costs, the total six year costs, and the annualized value using both 3 percent and 7 percent discount rates. In general, the largest cost changes originate from the assumed catch impacts associated with the gear configuration change. In Alternative 2, using a 7 percent discount rate (this rate applies to all annualized costs below) trawling up measures were estimated to cost between \$2.5 million to \$8.3 million annually, and in total \$12.1 million to \$39.8 million over six years. The full range of costs for the options under Alternative 3, including primarily the 50-percent buoy line reduction in federal waters, is estimated to be \$5.5 million to \$14.4 million annually, and \$26.1 million to \$68.6 million in total.

The total cost of all proposed measures for Alternative—including gear marking, weak rope, seasonal restricted areas, and gear conversion costs—ranges from \$10.5 million to \$19.1 million annually, and \$50 million to \$91.1 million in total. It is much lower than the Alternative 3, which ranges from \$29.6 million to \$40 million annually, and \$141.3 million to \$190.5 million in total.

Table 6.22: Summary of compliance costs by alternatives (in million \$)

	Discount Rate	Gear Marking Lower	Gear Marking Upper	Weak Rope	Trawling up Lower	Trawling up Upper	Restricted Area Lower	Restricted Area Upper	Line Cap Lower	Line Cap Upper	Total Lower	Total Upper
Alt 2 Year 1		4.6	6.2	2.2	1.6	8.8	1.3	2.0	0.0	0.0	9.8	19.2
Alt 2 Total		27.8	37.1	2.2	12.1	39.8	7.8	12.0	0.0	0.0	50.0	91.1
Alt 2 AV	3%	5.1	6.8	0.4	2.2	7.3	1.4	2.2	0.0	0.0	9.2	16.8
Alt 2 AV	7%	5.8	7.8	0.5	2.5	8.3	1.6	2.5	0.0	0.0	10.5	19.1
Alt 3 Year 1		14.5	0.0	10.6	1.0	2.0	3.0	4.1	3.9	13.4	32.8	44.6
Alt 3 Total		86.8	0.0	10.6	3.1	7.4	17.8	24.5	23.0	61.3	141.3	190.5
Alt 3 AV	3%	16.0	0.0	2.0	0.6	1.4	3.3	4.5	4.2	11.3	26.1	35.2
Alt 3 AV	7%	18.2	0.0	2.2	0.6	1.5	3.7	5.1	4.8	12.9	29.6	40.0

Notes:

1. Year 1 values are in 2020 dollars
2. Total represents value of year 1 to year 6, in 2020 dollars.
3. AV represents annualized value of the net present value. It is an equalized yearly cost during the 6-year time period with 3% and 7% discount rate.

6.7 Social Impact

The social impact assessment examines the social consequences of the potential changes to the ALWTRP that are under consideration. In this section, we will identify the groups of vessels that may be affected; then we provide a detailed socioeconomic characterization of the communities that may be affected by modifications to the ALWTRP, and assesses the vulnerability of these communities to adverse impacts. The analysis involves two basic elements:

First, based on the results of the economic impact assessment, the social impact analysis identifies the number of affected vessels by each proposed measure, and characterizes the changes in fishing practices and fishing activity that may occur.

Second, the analysis uses county-level socioeconomic data and fishery-dependent data to assess the vulnerability of communities (i.e., counties) to adverse social impacts stemming from promulgation of commercial fishing regulations under the ALWTRP. The analysis is primarily built on data from NMFS VTR, dealer reports, and social indicator databases, as well as demographic and socioeconomic data from the U.S. Census and the U.S. Department of Labor.

This analysis also qualitatively considers various other social impacts—both negative and positive—that may result from modification of the ALWTRP. In all cases, the analysis measures these impacts relative to Alternative 1, the No Action Alternative.

6.7.1 *Characterization of Affected Vessels under ALWTRP*

According to the estimation in the Vertical Line Model, there are 3,970 vessels in trap/pot fisheries in the Northeast Region, not including Maine exempt waters. Most of them are fishing for lobster and a few in Southern New England waters also fish for Jonah crab. This rule will affect vessels differently based on the fishing area. Table 6.23 displays the number of affected vessels under each measure except for restricted areas, which is shown separately in Table 6.24.

Gear marking proposed in both Alternatives 2 and 3 and the weak rope requirements in Alternative 2 would affect all vessels in the Northeast Region, except for those in Maine exempt waters, where Maine would be responsible for rulemaking. Maine has the most affected vessels, and Massachusetts has the second most. The minimum trap/trawl requirement in Alternative 2 affects the most vessels in Maine outside the exempt waters. Fewer inshore or nearshore vessels outside of Maine are affected by trawling up measures because they already fish with the proposed minimum trawl length or more traps per trawl. Vessels in LMA 2 would not be required to trawl up; instead they could use weak rope as a conservation equivalency. Under Alternative 2, all LMA 3 vessels would be required to trawl up from 35 to 50 traps, depending on where they fish. Under Alternative 3, LMA 3 vessels are only required to trawl up to 45 traps from May to August, which would affect 74 offshore vessels. Alternative 3 also requires vessels in the federal waters to reduce their line cap of average monthly buoy lines by 50 percent. A total of 1,491 vessels would be affected, most of them from Maine.

A number of vessels would be impacted by proposed seasonal buoy line restricted areas in Alternatives 2 and 3. Under Alternative 2, the Maine LMA 1 seasonal restricted area from

October through January would affect at least 123 vessels outside 12 nm in Zone C, D and E. The MRA North expansion from February through April would affect 106 vessels, and the South Island Restricted Area would affect 27 vessels. Under Alternative 3, the Massachusetts Restricted Area extension in May would affect 159 vessels, most of which are state permit holders and have to suspend fishing during the seasonal restrictions. The Massachusetts Restricted Area would affect more vessels because of the larger closed area, including 138 vessels that fish in state waters and 21 in federal waters. The MRA North extension in May analyzed in Alternative 3 would affect 50 more vessels than the Preferred Alternative. A Georges Basin buoy line restricted area from May through August would affect 16 offshore vessels, most of which are from Rockingham County, New Hampshire. The L-shaped South Island Restricted Area analyzed in Alternative 3 would affect ten vessels in total. Table 6.24 shows the details of the number of affected vessels by restricted area under Alternatives 2 and 3.

Table 6.23: Number of affected vessels by measures and area

	Gear Marking, Weak Rope	Trawling up Alternative 2	Trawling up Alternative 3	Line Cap
ME A	545	376		281
ME B	256	178		129
ME C	439	137		189
ME D	432	122		191
ME E	209	74		107
ME F	233	103		179
ME G	187	129		109
NH	241	0		0
MA	1,216	7		187
RI	131	0		37
LMA 3	82	82	74	82
Total	3,970	1,206	74	1,491

Table 6.24: Number of affected vessels in different restricted areas

Restricted Area	Alternative	Restricted Period	Size (Square miles)	Max vessels-lines out	Max vessels-relocation
ME LMA1	2	Oct - Jan	967 (2,505 km ²)	0	62
Northern MRA	2	Feb - Apr	497 (1,287 km ²)	106	0
South Island	2	Feb - Apr	5,468 (14,162 km ²)	16	11
ME LMA1	3	Oct - Feb	967 (2,505 km ²)	0	62
Northern MRA	3	Feb - May	497 (1,287 km ²)	193	0
MRA	3	May	3,069 (7,949 km ²)	138	21
Georges Basin	3	May - Aug	557 (1,443 km ²)		16
South Island	3	Feb - May	3,506 (9,080 km ²)	3	7

The compliance costs for these vessels were discussed in the economic analysis section (see Section 6.2-6.6). In the next section, we will focus on the community level impacts.

6.7.2 *Characterization of Vulnerability and Resilience in Fishing Communities*

6.7.2.1 Factors Affecting Vulnerability and Resilience

When considering the effect of proposed regulations on fishing communities, one potential approach is to focus the analysis on individual ports or municipalities. Clearly, however, fishing communities can extend beyond the boundaries of a particular port or city. Fish can be landed in one town and processed in a neighboring town. Likewise, a fisherman can land catch in one town, live in a neighboring town, and register his vessel in yet another location. In recognition of these factors, this analysis focuses at the county level.¹⁹ While a county's political boundaries do not limit the network of social interactions and economic resource flows described above, the use of counties as an analytic focus offers several advantages. First, the geographic range of the county is a useful spatial mid-point between individual towns/ports and large regions; this is especially important given that ALWTRP regulations apply to such an extensive geographic area (virtually the entire northeast coast of the U.S.). In addition, many of the data used to characterize communities (e.g., unemployment rate, population) are readily available at the county level.

This analysis focuses primarily on coastal counties in the Northeast that landed ALWTRP affected species at values greater than \$1 million per year. As Figure 6.5 indicates, this includes most coastal counties in Maine, New Hampshire, Massachusetts, and Rhode Island. For these counties, NMFS 2018 data shows that more than \$628 million in ex-vessel revenue was attributable to trap/pot lobster and Jonah crab landings. Trap/pot vessels operating out of ports in this region are most likely to be affected by the weak rope, minimum trawl length, gear marking, and restricted area requirements.

In both fishing and non-fishing communities, the ability to adapt to change varies with social, political, and economic considerations. The vulnerability of fishing communities, however, is influenced by additional factors, including the importance of familial relationships, the vulnerability of infrastructure, and the commitment to fishing as a culture and way of life (Clay and Olson 2008). From an analytic perspective, vulnerability includes the characteristics of “exposure, sensitivity, and capacity of response to change or perturbation” (Gallopín 2006, as cited in Colburn and Jepson 2012). Consistent with Gallopín's definition, this social impact assessment considers each county's vulnerability to be a function of the extent to which its fishing industry is affected by the regulations (i.e., exposure), the significance of the fishing industry within the county (i.e., sensitivity), and baseline factors that may affect communities' ability to absorb the economic costs imposed by the regulations (i.e., capacity to respond to change). The discussion that follows briefly describes the parameters used to evaluate each aspect of vulnerability.

¹⁹ This discussion thus uses the terms “counties” and “communities” interchangeably

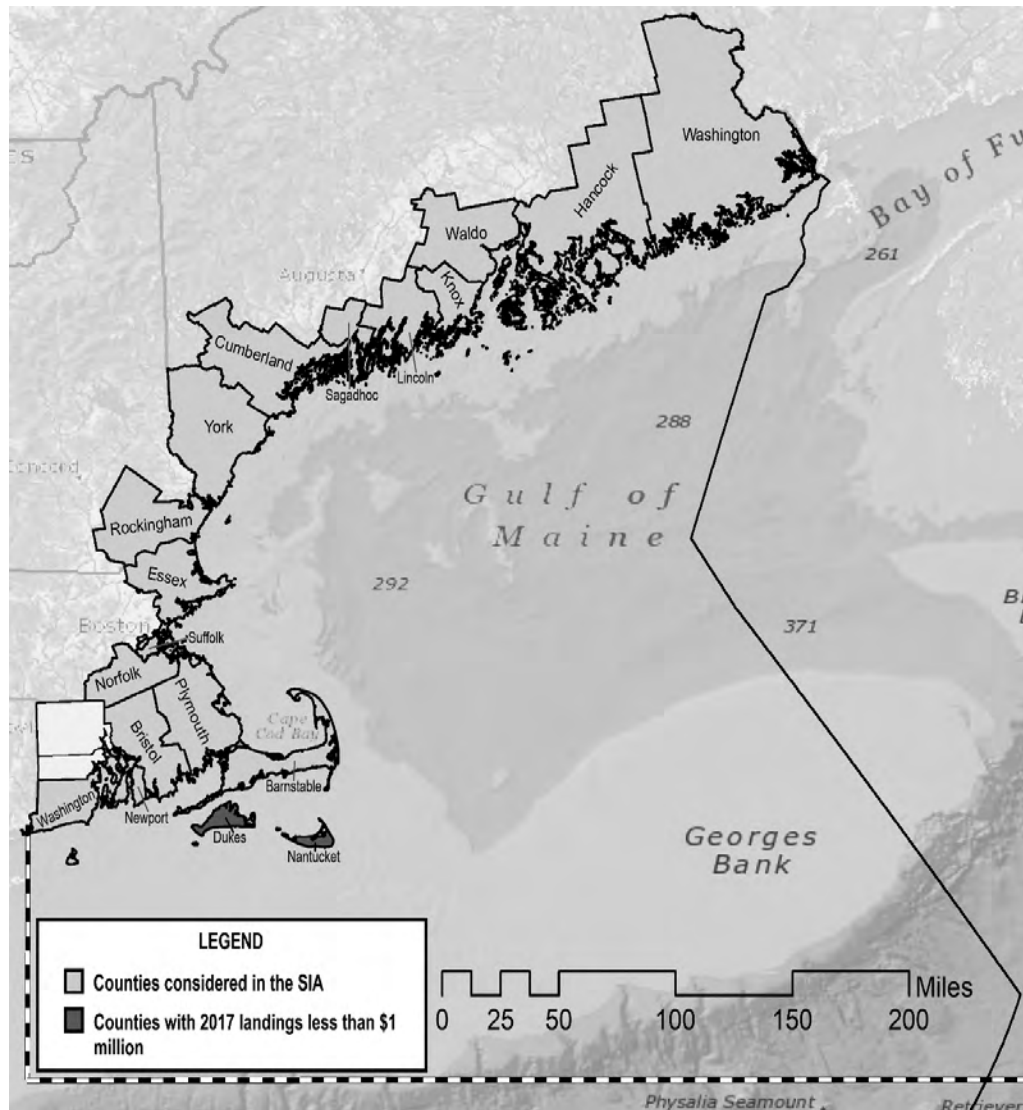


Figure 6.5: Counties considered in the social impact analysis

Exposure: The analysis first considers the extent to which the local fishing industry is exposed to ALWTRP regulations. Exposure is defined in two ways:

- **Value/proportion of harvest associated with affected gear**—The counties most likely to experience adverse social impacts are those in which gear regulated under the ALWTRP is an important source of commercial fishing revenue, either on an absolute or a relative basis.
- **Number of entities affected**—Similarly, the most vulnerable counties are likely to be those that are home to the greatest number of vessels that fish with gear regulated under the ALWTRP.

Sensitivity: Those communities that are more heavily dependent (both economically and socially) on the fishing industry are more likely to experience adverse social impacts due to fishing regulations. This analysis relies upon a measure of fishing dependence designed to take

additional factors into account. This measure, the Occupational Alternative Ratio Summary (OARS), emphasizes the importance of fishing as an occupation to participants in the labor force as a whole, and the dependence of the local economy on the fishing industry. In general, a higher score indicates a greater dependence on fishing as an occupation, and a lower likelihood that displaced fishermen can easily enter into alternate occupations.²⁰

Capacity to Respond to Change: A number of economic and demographic factors will influence a community's ability to absorb economic stress, tempering or exacerbating vulnerability to social impacts stemming from ALWTRP regulations:

- **Unemployment rate, poverty rate, median income**—Fundamental economic indicators such as the unemployment rate, poverty rate, and median income can indicate the local economy's resilience to regulatory impacts. Communities that are already economically depressed may find it more difficult to absorb the economic effects of regulatory changes and may be subject to greater social impacts.
- **Gentrification**—Gentrification can be a key source of coastal community vulnerability (Jacob et al. 2010 and Clay and Olson 2008, as cited in Colburn and Jepsen 2012). According to Hall-Arber et al. (2001), as former working waterfronts succumb to the pressures of gentrification, community character and culture are lost, diversity diminishes, and the fishing community is less able to adapt to changes in the environment. Additional fishing regulations can make it even more difficult for individuals to maintain a "fishing way of life." Communities that are already experiencing gentrification will likely be more susceptible to social impacts as ALWTRP regulations are implemented. Hall-Arber et al. (2001) integrate various measures of gentrification into a score that can be used to characterize community vulnerability.

6.7.2.2 Assessment of Community Vulnerability

Table 6.25 presents socioeconomic data for each county identified as potentially vulnerable to social impacts due to ALWTRP regulations. By evaluating the vulnerability indicators described above, the analysis characterizes the extent to which the counties are susceptible to regulatory-driven social impacts.

Counties in mid-coast and Downeast Maine, where the lobster fishery is the major driver of the commercial fishing economy, tend to be the most vulnerable to adverse social impacts from ALWTRP regulations. Hundreds of lobster vessels are based in these counties, and their landings are extensive (see Table 6.26). Hancock and Knox counties report the greatest value of landings with ALWTRP gear (\$156 million and \$136 million in 2018, respectively), as well as the greatest number of vessels fishing with such gear (approximately 1150 and 950, respectively).

²⁰ Measures of fishing dependence and gentrification (see below) are based on Hall-Arber et al. (2001). At the time this analysis was developed, these data represented the most recent published attempt to address these issues systematically, allowing for a direct comparison between counties. Colburn and Jepsen (2012) have developed additional indices allowing for evaluation of fishing dependence and gentrification; however, they have yet to be broadly applied. For a qualitative discussion of these issues, see the Community Profiles for Northeast U.S. Marine Fisheries developed by the NMFS Northeast Fisheries Science Center (2010). These profiles are available online at: <http://www.nefsc.noaa.gov/read/socialsci/communityProfiles.html>

The exposure of these counties to adverse impacts is heightened by the fact that landings made with ALWTRP gear account for a high percentage (around 90 percent in both cases) of overall ex-vessel revenues. Washington County (Maine) is also highly exposed, with potentially affected landings of \$81 million. Each of these counties is highly dependent on fishing, as measured by commercial dependence and commercial reliance indicator. Moreover, the high poverty and unemployment rates in these counties suggest that they have limited capacity to absorb additional economic stress. As a result, they are particularly vulnerable to the impacts of ALWTRP regulations. In addition to commercial fisheries, more entities along the industry supply chain could be affected by the Plan modification such as seafood wholesalers, distributors, processors, vessel and gear suppliers and maintenance businesses et al. Based on an economic impact analysis of the lobster distribution supply chain in Maine conducted by researchers from Colby College (Donihue and Tselikis 2018), the wholesale lobster distribution supply chain contributed more than \$967 million to Maine's economy and supported over 5,500 workers in 2016.

More than 50 percent of ex-vessel revenue in Maine's other coastal counties is attributable to landings made with ALWTRP gear. In some instances, however, such as Waldo County, the overall value of these landings is relatively low. In others, such as Lincoln, Sagadahoc, Cumberland, and York, the value of potentially affected landings is substantial, but the economy as a whole is more diversified. As a result, these counties are somewhat less sensitive to adverse impacts that may stem from changes in ALWTRP regulations. The same is true of New Hampshire's Rockingham County. There, 90 percent of ex-vessel revenue is derived from landings made with ALWTRP gear, which suggests that the county's harvesting sector is highly exposed. The sensitivity of the county's economy as a whole, however, is tempered by its low commercial dependence score. In addition, Rockingham County's unemployment rate is lower than most other counties analyzed; this suggests that its economy has a relatively strong capacity to respond to change and that the region is less vulnerable to adverse impacts than areas where the unemployment rate is higher.

In Massachusetts and Rhode Island, the situation is more varied. In general, the value of landings made with ALWTRP gear in the counties of these states is lower than that reported for counties in Maine and New Hampshire, both on an absolute and a relative basis. In addition, the economies of coastal counties in Massachusetts and Rhode Island tend to be more diversified and less dependent on the commercial fishing sector. Nonetheless, ALWTRP gear accounts for ex-vessel revenues of more than \$15 million per year in Essex (Massachusetts), Barnstable (Massachusetts), and Bristol (Massachusetts) counties, suggesting that exposure to adverse impacts in these counties may be substantial.

Table 6.25: Social-economic indicators for coastal communities

State	County	Key Ports	Population (2018)	Median Household Income (2014- 2018)	Persons below Poverty Level (2014-2018)	Unemployment Rate (2018)	Population Composition	Personal Disruption	Housing Disruption	Urban Sprawl	Commercial Engagement	Commercial Reliance
ME	Washington	Beals Island/Jonesport, Cutler, Eastport, Lubec	31,490	41,384	18.30%	4.90%	1.11	1.50	2.46	1.00	1.71	1.82
ME	Hancock	Stonington/Deer Isle, Bucksport	54,811	53,068	11.60%	3.80%	1.00	1.14	2.18	1.00	1.86	1.93
ME	Waldo	Belfast, Searsport, Northport	39,694	51,564	13.70%	3.50%	1.00	1.53	1.93	1.00	1.00	1.00
ME	Knox	Rockland, Vinalhaven, Port Clyde	39,771	55,402	11.00%	3.20%	0.94	1.28	1.72	0.94	2.11	1.94
ME	Lincoln	South Bristol, Boothbay Harbor	34,342	55,180	11.10%	3.30%	1.00	1.12	1.59	1.00	1.59	1.59
ME	Sagadahoc	Georgetown, Phippsburg	35,634	62,131	8.70%	2.70%	1.00	1.00	1.89	1.00	1.33	1.22
ME	Cumberland	Portland, Harpswell	293,557	69,708	8.20%	2.70%	1.00	1.04	1.48	1.08	1.44	1.24
ME	York	Kennebunkport/Cape Porpoise, York	206,229	65,538	9.00%	3.00%	1.00	1.13	1.96	1.04	1.38	1.17
NH	Rockingham	Hampton/Seabrook, Portsmouth, Isle of Shoals	309,176	90,429	5.30%	2.8%	1.00	1.06	1.65	1.76	1.38	1.12
MA	Essex	Gloucester, Rockport, Marblehead	790,638	75,878	10.70%	3.60%	1.24	1.21	1.55	2.79	1.42	1.06
MA	Suffolk	Boston Harbor	807,252	64,582	17.50%	4.50%	3.33	2.33	2.67	4.00	2.00	1.00
MA	Norfolk	Cohasset	705,388	99,511	6.50%	3.00%	1.16	1.08	1.68	2.84	1.04	1.00
MA	Plymouth	Plymouth, Scituate, Hingham	518,132	85,654	6.20%	3.20%	1.11	1.11	2.25	2.46	1.50	1.04
MA	Barnstable	Sandwich, Hyannis, Chatham, Provincetown, Woods Hole	213,413	70,621	8.00%	2.40%	1.00	1.03	3.03	1.75	1.63	1.25
MA	Bristol	New Bedford, Fairhaven, Westport	564,022	66,157	10.80%	3.20%	1.15	1.30	1.95	2.10	1.50	1.10
RI	Newport	Jamestown, Newport, Tiverton, Sakonnet Point	82,542	77,237	8.10%	3.00%	1.00	1.00	3.00	2.00	1.83	1.17
RI	Washington	Point Judith/Galilee	126,179	81,301	8.00%	4.50%	1.00	1.29	2.43	1.29	2.14	1.29

Source: NMFS social indicator data from 2016; Maine.gov <https://www.maine.gov/labor/cwri/county-economic-profiles/countyProfiles.html>, 1/28/2020 U.S. Census Bureau <https://www.census.gov/quickfacts/fact/table/washingtoncountymaine,ME/INC110218> U.S. Census Bureau 2018 :ACS 1-year estimates data profiles; FRED <https://fred.stlouisfed.org/series/MADUKE7URN>. Notes: social indicator data are categorical, ranging from 0 to 4. Higher numbers indicate communities that are more vulnerable.

Table 6.26: Socioeconomic Profile of Substantively Affected Counties – Harvest Parameters

State	County	Top Species Landed by Value	2018 ALWTRP Harvest Value (\$)	ALWTRP Harvest Value as% of Total Harvest Value	Estimated Number of Vessels Fishing with ALWTRP Gear	Total Estimated Employment on ALWTRP Vessels_Lower	Total Estimated Employment on ALWTRP Vessels_upper
ME	Washington	Lobster, softshell clam, sea scallop	81,003,814	81%	838	1,601	2,514
ME	Hancock	Lobster, American eel, softshell clam	156,154,329	89%	1158	2,221	3,472
ME	Waldo	Lobster, American eel, sea scallop	3,041,380	72%	113	196	322
ME	Knox	Lobster, softshell clam, Atlantic herring	136,413,697	92%	945	1,834	2,872
ME	Lincoln	Lobster, oysters, softshell clam	29,770,294	69%	465	859	1,374
ME	Sagadahoc	Lobster, worms, quahog	5,808,239	75%	210	375	621
ME	Cumberland	Lobster, pollock, cod	60,664,397	69%	646	1,204	1,950
ME	York	Lobster, bluefin tuna, cod	21,354,828	93%	261	479	770
NH	Rockingham	Lobster, cod, pollock	35,026,477	91%	179	396	574
MA	Essex	Lobster, cod, pollock	30,202,297	39%	277	579	856
MA	Suffolk	Cod, lobster, pollock	2,631,553	16%	28	18	25
MA	Norfolk	Lobster, softshell clam, bluefin tuna	1,916,586	99%	24	47	70
MA	Plymouth	Lobster, oysters, cod	13,502,085	49%	192	421	613
MA	Barnstable	Lobster, sea scallops, bluefin tuna	17,499,519	24%	173	346	519
MA	Bristol	Sea scallop, cod, lobster	26,829,026	6%	97	670	865
RI	Newport	Lobster, sea scallop, monkfish	7,313,508	60%	63	152	215
RI	Washington	Loligo squid, lobster, illex squid	5,923,447	81%	128	349	480

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CHAPTER 7 SUMMARY AND INTEGRATION OF IMPACT FINDINGS

This chapter summarizes and integrates the findings of the biological, economic, and social impact analyses presented in the two preceding chapters, assessing the relative merits of the regulatory alternatives considered in this Final Environmental Impact Statement (FEIS). In all cases, the analysis measures these impacts of the action alternatives relative to Alternative 1, the No Action Alternative, which considers the fishery as it was fished in 2017.

Alternative 1 would make no change in the requirements of the Atlantic Large Whale Take Reduction Plan (ALWTRP or Plan), preserving the regulatory status quo under the Plan. Ongoing changes in management of the lobster and Jonah crab fishery may reduce buoy line numbers, and states may modify fisheries in state waters that could reduce risk to large whales, but no regulations modifying the Plan would be implemented. Alternative 1 would have no economic impact beyond those analyzed for baseline fishery management and state management, and no additional effects on social conditions in fishing communities. Alternative 1 would likely maintain the rate at which North Atlantic right whales, North Atlantic humpback whales, fin whales, or minke whales are seriously injured or killed as the result of incidental entanglement in commercial fishing gear.

As Chapter 2 discusses in detail, the available data indicate that additional action is needed to reduce the risk of entanglement and achieve the degree of protection mandated for these species, right whales in particular, under the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA). Accordingly, the National Marine Fisheries Service (NMFS) is considering modifications to the Plan designed to meet the requirements of the ESA and MMPA. NMFS estimated that to reduce mortality and serious injury below the potential biological removal level (PBR), entanglement risk across U.S. fisheries needs to be reduced by 60 to 80 percent. The vast majority of buoy lines along the east coast belong to lobster and Jonah crab trap/pot fisheries in the Northeast Region Trap/Pot Management Area (Northeast Region). This FEIS focusses on these fisheries to speed up rulemaking. The Atlantic Large Whale Take Reduction Team (ALWTRT or Team) has been informed of the intention to consider all fixed gear fisheries coast-wide during the next Team deliberations. Large whale entanglement data and the rationale for the scope of the alternatives considered in this FEIS are also described in greater detail in Chapter 2: Purposes and Needs.

The modifications analyzed in this FEIS are detailed in Table 1.1. All risk reduction measures are analyzed toward the target of a 60 to 80 percent risk reduction for lobster and Jonah crab trap/pot fisheries. The economic analysis considers only those measures that would be implemented to modify the Plan, with the exception of measures in Maine exempt waters. Measures analyzed include:

- Minimum trawl-length requirements (traps per trawl), which would apply to the certain regions of the Northeast lobster and Jonah crab trap/pot fisheries
- New gear configuration requirements including requiring weak rope or weak inserts in buoy lines and change in weak link requirements, which would apply to all lobster and Jonah crab trap/pot buoy lines in the Northeast Region except for Maine exempt waters

- A change in existing seasonal restricted areas to modify them from trap/pot closure areas to closures to persistent buoy lines that would allow ropeless fishing under exemption authorization. New seasonal restricted areas that would be closed to persistent buoy lines would be implemented
- New gear marking requirements, which would apply to all regulated lobster and Jonah crab trap/pot buoy lines in the Northeast Region except for Maine exempt waters
- Line cap allocation at 50 percent of the average monthly of 2017 buoy line numbers in federal waters

NMFS has specified two action alternatives – Alternatives 2 (Preferred) and 3 – that include different parameters and combinations of these measures. NMFS’ assessment of the biological impacts of these alternatives and the economic and social impacts of the components that would be implemented by federal regulations to modify the Plan are summarized below.

7.1 Biological Impacts

7.1.1 *Impacts on Large Whales*

The provisions that would be implemented by federal and state rulemaking to reduce entanglement risk under consideration are likely to have a direct effect on large whales. Under Alternative 1, the No Action Alternative, the number of buoy lines in the water column would not change. Estimates of right whale mortalities and serious injuries in U.S. commercial fisheries would continue to exceed the population’s PBR. Alternatives 2 (Preferred) and 3 incorporate various provisions that would reduce the number of trap/pot buoy lines fished by Northeast lobster and Jonah crab fishermen to levels below the 2017 buoy line estimate. Analysis using the NMFS Decision Support Tool (DST) (version three) indicates that the line reduction measures in the two alternatives, which include ongoing fishery management measures in lobster management areas (LMAs) 2 and 3 as well as state measures in Maine and Massachusetts, as well as a credit for the Massachusetts Restricted Area (MRA) in Alternative 2, would reduce the number of buoy lines in the Northeast Region by approximately seven percent under each alternative. By reducing the number of buoy lines in the water column, these provisions would help to reduce the co-occurrence of whales and lines, lowering encounter rates and reducing the frequency of entanglements. Though line reduction is similar between the two alternatives, co-occurrence is reduced more through more expansive closures in Alternative 3. However, both alternatives include additional risk reduction measures that accomplish substantial levels of co-occurrence reduction.

Under Alternative 2 (Preferred), exempt state waters would remain exempt from minimum trawl-length regulations. Other than in waters closed to trap/pot fisheries in Massachusetts Bay, whales are less likely to be found in persistent aggregations in most nearshore areas. Under Massachusetts state and federal regulations, the MRA will be expanded into coastal state waters in LMA 1 to reduce some of the risk in Massachusetts Bay and the closures will be extended through state regulations until at least May 15th if whales remain in the area, further mitigating the threat of buoy lines in coastal waters. NMFS believes that keeping state exemption areas from minimum trawl-length regulations would be unlikely to have a significant adverse impact on ESA-listed or MMPA-protected whales compared to Alternative 1, the No Action Alternative,

and the exemption allows the continuation of traditional fishing practices by smaller vessels and entry level fishermen. Broad weak rope insertion requirements will be implemented by state or federal regulations in these waters, a precautionary measure that would minimize entanglement severity should one occur.

Beyond the provisions described above, Alternatives 2 (Preferred) and 3 would also allow ropeless fishing but seasonally close designated areas in the Northeast to persistent trap/pot buoy lines during months in which right whales are most likely to be present (Table 7.1). Ropeless fishing will only be tested outside of Cape Cod Bay and Outer Cape where whale densities are likely to be very high while the MRA is in place, which will further reduce the potential for interactions with groundlines. Buoy line closures of these areas further reduce co-occurrence to reduce the risk of entanglement compared to Alternative 1, the No Action Alternative. These seasonal restricted areas are expected to primarily benefit right whales; the co-occurrence model estimates a reduction in co-occurrence for other large whale species (Table 7.2).

Table 7.1: The length and size of the proposed restricted areas included in both alternatives.

Restricted Area	Alternative	Time Period	Size (Square Miles)
Offshore Maine	2	October - January	967
Cape Cod Bay	2	May, until only 3 whales remain	644
Outer Cape State Waters	2	May, until only 3 whales remain	260
Large South Island Restricted Area	2	February - April	5,468
Massachusetts Restricted Area North	2 & 3	Feb – Apr, soft opening into May	497
Offshore Maine	3	October - February	967
Georges Basin Core Area	3	May - August	557
Massachusetts Restricted Area	3	May, possible early open	3,069
L-shaped South Island Restricted Area	3	February - May	3,506

Alternatives 2 (Preferred) and 3 would also introduce additional gear restrictions for lobster and Jonah crab vessels fishing trap/pot gear in the northeast. These restrictions would require weak rope or weak insertions, breaking at 1,700 pounds or less, to allow large whales to break free from gear before a mortality or serious injury can occur. Different configurations would be required based on lobster management area and distance from shore. The weak rope/weak insertion requirements seek to minimize the severity of an entanglement should one occur, reducing the number of serious injuries and mortalities caused by trap/pot gear. Under Alternative 1, the No Action Alternative, no additional safeguards would be put in place. Alternative 3 reduces the strength of buoy lines closer to an average of 1,700 pounds, or the equivalent of Alternative 2, and though this provision does not reduce the risk of entanglement, it would provide additional protection against mortality and serious injury should an entanglement occur.

All of the action alternatives include provisions that would revise the gear marking requirements specified under the Plan. Under gear marking Alternatives 2 and 3, the new requirements would apply to all lobster and Jonah crab trap/pot gear in the Northeast Region. Under Alternative 2 (Preferred), gear marking will be required under federal rulemaking except that Maine already implemented regulations for gear set in Maine exempted waters, which was effective September 2020. The new gear-marking provisions would have no immediate impact on entanglement risks.

In the long run, however, they may help NMFS target and improve its efforts to protect large whales. As has been noted, whales showing signs of entanglement often have no gear remaining on them once seen, or gear is not retrieved. However, even when gear is retrieved, it is often difficult to identify the particular location or fishery where an entanglement occurred. The gear marking requirements, including a large mark in the surface system that may be detectable from shipboard or aerial surveys, would increase gear identification and help to generate information on the origins of gear involved in entanglements. The goal is to allow the ALWTRT and NMFS to improve the effectiveness of the ALWTRP. Under Alternative 1, the No Action Alternative, no additional improvements to the effectiveness of the ALWTRP would occur.

7.1.2 *Other Biological Impacts*

In addition to impacts on large whale species, changes to Plan regulations may affect other aspects of the marine environment, including other protected species (ESA-listed large whales and sea turtles) and habitat. Reductions in buoy line are also likely to benefit other protected species prone to entanglement. Specifically, NMFS believes that trawling up requirements and line caps could help reduce entanglement risks for sea turtles and other large whales. With similar line reduction it is unclear if either alternative is more advantageous for other protected species, though Alternative 3 would reduce more lines during summer months in offshore LMA 3 and may provide added benefit to species in offshore areas during that time.

Likewise, weak line requirements will result in a net positive impact on other protected species, particularly benefiting sei and sperm whales by reducing entanglement severity similar to the large whale Valued Ecosystem Component (VEC). These changes are not likely to impact sea turtle species or minke whales negatively but also do not provide a benefit since the weak line is likely not weak enough for smaller animals to break out, therefore it would likely not decrease entanglement severity for smaller animals. Overall, both Alternatives 2 (Preferred) and 3 (Non-Preferred) could reduce mortality and serious injury in other protected large whales compared to Alternative 1 (No Action), where Alternatives 3 may reduce entanglement severity to a greater degree than Alternative 2 (Preferred).

Alternative 2 (Preferred) does not require small vessels fishing in state waters to trawl up and reduce buoy lines. However, weak rope or weak inserts are required as a precautionary measure to reduce the severity of entanglements. These changes would not benefit other protected species since weak line would likely not decrease entanglement severity for smaller animals such as leatherback sea turtles.

The closure of designated areas in the Northeast Region to trap/pot buoy lines could provide ancillary benefits to sea turtles and sei whales that may be present when the restricted areas are in effect. Compared to Alternative 1, the No Action Alternative, these benefits are likely to be greatest under Alternative 3, which proposes larger restricted areas for longer periods of time, and lower under Alternative 2 (Preferred), which proposes the less extensive restricted areas for slightly shorter time periods (see Table 7.1).

There are not likely significant differences among Alternatives 2 (Preferred) and 3 with respect to impacts on habitat; any impacts on habitat from the presence of trap/pot gear, as well as

proposed gear modifications, are generally expected to be slightly negative. Any possible impact is likely limited to offshore environments with Alternative 2 and could impact offshore and nearshore environments with Alternative 3 in the event that trap/pot trawls are expanded in these areas in response to a large cap in the number of lines allotted to each vessel. Areas too close to shore (i.e., those within state waters), are unlikely to experience excessively long trap/pot trawls given the nature of the fishery and the vessels operating in these areas. If ropeless fishing is implemented widely in closed areas, it is not expected that Alternative 2 or 3 will significantly change the amount of gear that comes into contact with the seafloor. Though there may be some additional impact on habitat under Alternative 2 compared to 3 because trawl lengths will likely be longer throughout the year under Alternative 2 compared to 2, these impacts are likely not measurable and thus impacts between the two alternatives is likely negligible.

7.1.3 Comparison of Biological Impacts across Alternatives

The biological impacts analysis presented in Chapter 5 relies primarily on NMFS' DST (version three) to examine how the regulatory alternatives might reduce the possibility of interactions between whales and fishing gear. As discussed in that chapter, the model integrates information on fishing activity, gear configurations, and right whale habitat density models to provide indicators of the potential for entanglements to occur and the potential severity of an entanglement if it occurred. The fundamental measures of change in entanglement potential are change in line numbers, co-occurrence, and estimated risk. The measures used to evaluate potential severity include change in mean line strength and total gear threat. The co-occurrence value estimated in the model is an index figure, integrated across the spatial grid, indicating the degree to which whales and the buoy line employed in trap/pot fisheries coincide in the waters subject to the Plan. Risk is an integration of the co-occurrence measure with the total gear threat. Biological impacts are characterized with respect to the percentage reduction in the overall co-occurrence indicator each alternative would achieve.

Table 7.2: The annual summary of all quantitative measures for each alternative, including the change in annual buoy line numbers, co-occurrence, and reduction in gear threat from conversion to weak line.

Alternative:	1 (status quo)	2 (Preferred)	3 (Non-preferred)
Line Reduction		% Reduction	% Reduction
Risk Reduction		60%	72%
Risk Reduction (with MRA Credit)		69% – 73%	
Line Reduction		7%	7%
Co-Occurrence		% Reduction	% Reduction
Right Whale		54%	60%
Right Whale (with MRA Credit)		65%	
Humpback Whale		12%	19%
Fin Whale		14%	17%
Weak Line			
Mean Line Strength	2,162 lb/ 981 kg.	1,976 lb/ 896 kg.	1,753 lb/ 795 kg.
Change in Line Strength		9%	19%
Change in Gear Threat		17%	29%

Table 7.2 summarizes the estimated change in co-occurrence, reduction in entanglement risk, and threat of gear according to the strength of buoy lines under each action alternative relative to the No Action Alternative (Alternative 1). Alternative 2, which includes trawling requirements, restricted areas, and broad use of weak inserts, is estimated to yield a reduction in co-occurrence of approximately 54 percent for right whales without the MRA credit recommended by the ALWTRT and 65 percent with the MRA credit. Alternative 2 will reduce line strength by nine percent for an average of 1,976 pounds per buoy line. Alternative 3 estimates a co-occurrence reduction of 60 percent and reduces line strength by 19 percent to an average 1,753 pounds. The estimated impact of restricted areas is greater when affected vessels are assumed to suspend fishing rather than relocate to alternative fishing grounds but it is anticipated most proposed restricted areas, aside from those in the MRA, will result in relocation of lines. Alternative 2 also includes conversion of less rope to fully weak buoy line and therefore would result in a higher mean line strength than Alternative 3, which does not directly reduce entanglement risk, and provides fewer positive benefits for other protected species. Though co-occurrence reduction is slightly greater in Alternative 3, there is greater uncertainty of how a line cap would be implemented and if it will increase lines and potentially co-occurrence in some months. The variation in co-occurrence between alternatives options is fairly small for right whales between alternatives, with Alternative 2 offering similar line reduction with fewer gear modifications and higher compliance rates. Both alternatives meet the minimum risk reduction target requirement.

7.2 Economic Impacts

Chapter 6 evaluates the economic and social impacts of Alternatives 2 and Alternative 3 relative to the status quo (Alternative 1), including a yearly distribution of the compliance costs for the six years following implementation. For the purpose of summarizing and comparing the economic impact of the alternatives, this discussion will focus on initial implementation costs of the two action alternatives.

The first year costs of all proposed measures for Alternative 2 including gear marking, weak rope, restricted areas, and trawling up costs range from \$9.8 million to \$19.2 million. As described in Chapters 6, the range of costs depends primarily on assumptions about catch loss caused by trawling up and about whether fishermen choose to remove lines or relocate due to buoy line closures. Year one compliance costs for Alternative 3 range from \$32.8 million to \$44.6 million. Thus, the costs associated with Alternative 2 are well under one third the Total costs associated with Alternatives 3.

Alternative 2 achieves less risk reduction than Alternative 3. The DST indicated Alternative 2 would likely achieve the 60 percent risk reduction, on average, for lobster and Jonah crab trap/pot buoys in the Northeast Region, within the target established for reaching right whale PBR. The co-occurrence model suggested right whale co-occurrence would be reduced by over 54 percent. The first year costs associated with the co-occurrence reduction (trawling up and buoy line closures) under Alternative 2 range from \$2.9 million to \$10.8 million (Table 7.3), depending on implementation assumptions (buoy lines relocated vs. buoy lines removed). For every unit of co-occurrence reduction, the costs of Alternative 2 is estimated at \$54,000 to \$199,000.

Alternative 3 performed better at reducing risk than Alternative 2, achieving a risk reduction of nearly 72 percent from the DST, and co-occurrence reduction of approximately 60 percent. This alternative would increase the likelihood of achieving PBR, even when considering unobserved mortality of right whales. However, the first year costs associated with co-occurrence reduction in Alternatives 3 (trawling up, buoy line closures, federal water line caps) are substantially higher, ranging from \$7.8 million to \$19.5 million dollars; or \$130,000 to \$325,000 for each unit of co-occurrence reduction. That is, each risk reduction unit of Alternative 3 would cost about two to three times the cost per risk reduction unit in Alternative 2.

Analysis of the weak rope modification measures are similar, with Alternative 3 performing better but at a high cost. Proposed modifications in Alternative 2 would impact every buoy line in the Northeast Region lobster and Jonah crab trap/pot fishery outside Maine exempt waters, weakening mean line strength by nine percent, with an estimated cost of \$2.2 million dollars, or about \$250,000 for each percent of line strength weakened (Table 7.2). Alternative 3 would weaken line by approximately 19 percent of the buoy lines to weak rope, with an estimated cost of \$10.6 million or about \$557,000 for each percent of line strength weakened.

Table 7.3: A summary of first year initial compliance costs related to right whale co-occurrence (2020 dollars). Note: the lower and upper bounds of co-occurrence reduction score are based on the assumptions of 100 percent lines out and 100 percent relocation respectively.

	Alternative 2	Alternative 3
Trawling Up Lower	\$1.6 million	\$1.0 million
Trawling Up Upper	\$8.8 million	\$2.0 million
New Buoy Line Closure Lower	\$1.3 million	\$3.0 million
New Buoy Line Closure Upper	\$2.0 million	\$4.1 million
Line Cap Lower		\$3.9 million
Line Cap Upper		\$13.4 million
Total Lower	\$2.9 million	\$7.8 million
Total Upper	\$10.8 million	\$19.5 million
Co-occurrence Reduction	54% – 65%	60%

Chapter 6 provides a full analysis and comparison of the economic impacts of the elements of the alternatives that would modify the Plan through federal rulemaking. While the Table 7.3 comparison of the costs of implementation of the risk reduction elements in each action alternative is an oversimplification, it demonstrates that relative economic impacts, and shows that Alternative 2 meets the purposes and needs laid out in Chapter 2 of this FEIS while minimizing the potential economic impacts of the proposed modifications to the Plan.

7.3 Social Impact of Alternatives

The social impacts are analyzed in Chapter 6. The analysis estimates that 3,970 vessels in lobster and Jonah crab trap/pot fisheries in the Northeast Region except for Maine exempt waters (which will be regulated by the state of Maine) would be impacted by either action alternative. These represent 3,504 unique entities including 3,500 small entities, although impacts do not appear to be disproportionate across small and large entities. These vessels fish primarily for lobster and Jonah crab. Under both Alternatives 2 and 3, proposed gear marking and weak rope requirements

would affect every lobster and Jonah crab vessel fishing in the Northeast Region outside Maine exempt waters. Line reduction measures (i.e. trawling up) under Alternative 2 would affect 1,206 vessels, slightly fewer than the 1,565 vessels affected by the Alternative 3 line reduction measures (line caps, trawling up in LMA 3). Federally regulated seasonal buoy line closures of Alternative 2 would affect up to 256 vessels, compared to more than 501 vessels affected by the buoy line closures under Alternative 3. Chapter 6 provides further details on the economic impacts of the alternatives.

Community impacts vary across the region, with more vulnerable communities in Downeast and mid-coast Maine, where the lobster fishery is a major economic driver. The value of 2020 lobster landings in Hancock and Knox Counties each exceeded \$100 million. Southern Maine and New Hampshire have a more diversified economy, making communities more resilient to adverse economic impacts that may stem from Plan modifications. Similarly, revenues from ALWTRP fisheries exceed \$15 million per year in some counties in Massachusetts and Rhode Island communities suggesting that the economic stability and well-being of those counties rely to some extent on these fisheries. However, relative to Maine communities, the economies are more diversified in Massachusetts and Rhode Island, so there may be other job and economic opportunities within these communities, making them more resilient to loss of fishery revenue.

7.4 Integration of Results

7.4.1 Comparison of Biological, Social, and Economic Analyses

Because some of the value of the benefits of potential changes to the ALWTRP are qualitative, it is difficult to provide a quantitative benefit-cost analysis to identify the regulatory alternative that would likely provide the greatest net benefit. Instead, Table 7.4 summarizes the estimated cost of complying with each federally regulated element in the alternatives, coupled with the estimated decrease in co-occurrence estimated by the NMFS DST. Nonetheless, the cost-effectiveness figures provide a useful means of comparing the relative impacts of the regulatory provisions that each alternative incorporates.

Table 7.4: The annual summary of all quantitative measures Alternatives 2 (Preferred) and 3, including the biological, economic, and social impacts expected compared to Alternative 1 (baseline). The risk reduction and right whale co-occurrence range represents the lower bound estimate of the measures with and without the MRA credit.

Alternative:	2	3
Biological Impacts	Percent Reduction	Percent Reduction
Risk Reduction	60% - 69%	72%
Line Reduction	7%	7%
Right Whale Co-Occurrence	54 - 65%	60%
Humpback Whale Co-Occurrence	12%	19%
Fin Whale Co-Occurrence	14%	17%
Change in Line Strength	9%	19%
Change in Gear Threat	17%	29%
Economic and Social Impacts		
Cost	\$9.8 -19.2 million	\$32.8 -44.6 million

Alternative:	2	3
Number of Vessels Impacted	3,970	3,970

Table 7.4 reveals several noteworthy findings:

- Co-occurrence reduction: Under Alternative 2, the costs associated with the co-occurrence reduction (trawling up and buoy line closures) range from \$2.9 million to \$10.8 million. For every unit of co-occurrence reduction, the costs are estimated at \$54,000 to \$199,000. Under Alternative 3, the costs associated with co-occurrence reduction in (trawling up, buoy line closures, federal water line caps) are substantially higher, ranging from \$7.8 million to \$19.5 million dollars; or \$130,000 to \$325,000 for each unit of co-occurrence reduction
- Weak Rope: Under Alternative 2 proposed modifications would reduce the mean strength of rope in all Northeast Region by nine percent in lobster and Jonah crab buoy lines outside of Maine exempt waters to weak, with an estimated cost of \$2.2 million dollars, about \$249,000 for each percent of line strength weakened. Alternative 3 weak line measures would reduce the mean strength of rope by 19 percent in Northeast Region trap/pot buoy outside of Maine exempted waters to weak rope, with an estimated cost of \$10.6 million or about \$557,000 for each percent of line converted.
- Both Alternatives reduce co-occurrence by 60 percent or more and modify all buoy lines to include some weak rope.
- Taking into account the value of the MRA in Alternative 2 achieves a substantially higher risk reduction.

NMFS believes that Alternative 2 (Preferred) offers the best option for achieving compliance with MMPA and ESA requirements. Alternative 2 (Preferred) provides substantial benefits to large whales, has more stakeholder buy in, and is less likely to have unintended consequences compared to the implementation of a line cap in Alternative 3. Based on these considerations, NMFS has identified Alternative 2 (Preferred) as its proposed approach to achieve the goals of the Plan.

7.4.2 *Final Impact Determinations*

Table 7.4 summarizes the results from the biological, economic, and social impact analyses from Chapters 5 and 6. To compare the biological, economic, and social impacts of all alternatives on all VECs we used the impact designations outlined in Table 7.5. Table 7.6 describes the direct and indirect impacts of the alternatives on the four VECs.

Alternative 1 (No Action) maintains the Plan's current levels of impacts on the VECs. With this alternative, the impact of trap/pot fishing will remain at a moderate to high negative because the rate of mortality and serious injury of right whales is well above PBR and therefore unsustainable for the population. While observed mortality and serious injury of other MMPA protected large whale species (i.e. minke whales and humpback whales) is above PBR, entanglements remain a significant threat to fin whales (an ESA-listed species) as well as humpback and minke whales, particularly for humpback whales because undocumented mortality could be occurring above PBR given the current levels of human caused incidents (see

Chapter 2). The impact of trap/pot fisheries would remain a slight to moderate negative for other protected species and negligible to slightly negative for habitat as defined in Chapter 4. Under Alternative 1, the impact of continuing the fishery in its current state would be mixed for Human Communities, with a moderate positive impact on harvesters but slight negative impacts to the intrinsic public benefits of healthy whale populations due to population declines. It is important to note that, when assessed individually, Alternative 2 and Alternative 3 would each have a moderate negative to slight negative impact on large whales, a slight negative impact on other protected species, and a negligible to slight negative impact on the habitat.

Table 7.5: A key of the direction and magnitude of the actions being assessed in the biological and economic effects analysis.

VEC	<i>General Definitions</i>			
	Resource Condition	Direction of Impact		
		Positive (+)	Negative (-)	No Impact (0)
<i>Large Whales</i>	For ESA listed species: populations at risk of extinction (endangered) or endangerment (threatened). For MMPA protected species: stock health may vary but populations remain impacted	For ESA listed species: alternatives that contain specific measures to ensure no interactions with protected species (i.e., no take). For MMPA protected species: alternatives that will maintain takes below PBR and approaching the Zero Mortality Rate Goal	For ESA listed species: alternatives that result in interactions/take of listed resources, including actions that reduce interactions. For MMPA protected species: alternatives that result in interactions with/take of marine mammals that could result in takes above PBR	For ESA listed species: alternatives that do not impact ESA listed species, For MMPA protected species: alternatives that do not impact marine mammals
<i>Other Protected Species Habitat</i>	Same as large whales	Same as large whales	Same as large whales	Same as large whales
	Many habitats degraded from historical effort	Alternatives that improve the quality or quantity of habitat	Alternatives that degrade the quality, quantity or increase disturbance of habitat	Alternatives that do not impact habitat quality
<i>Human Communities (Socio-economic)</i>	Highly variable but generally stable in recent years	Alternatives that increase revenue and social well-being of fishermen and/or communities	Alternatives that decrease revenue and social well-being of fishermen and/or communities	Alternatives that do not impact revenue and social well-being of fishermen and/or communities
<i>A range of impact qualifiers is used to indicate any existing uncertainty</i>	Magnitude of Impact			
	Negligible	To such a small degree to be indistinguishable from no impact		
	Slight	To a lesser degree / minor	e.g. Slight Negative or Slight Positive	
	Moderate	To an average degree (i.e., more than “slight”, but not “high”)	e.g. Moderate Negative or Moderate Positive	
	High	To a substantial degree (not significant unless stated)	e.g. High Negative or High Positive	
	Significant	Affecting the resource condition to a great degree,	See 40 CFR 1508.27.	
	Likely	Some degree of uncertainty associated with the impact		

There are a few important differences between Alternatives 2 and 3 (Preferred and Non-Preferred, respectively), relative to Alternative 1, with respect to impacts on all four VEC's. All of the Alternatives (with the exception of Alternative 1) include some form of gear modifications and some level of increased traps per trawl. The main differences among these alternatives stem from differences in the approach and magnitude of buoy line reductions, size or season of closures to persistent buoy lines, and the extent of the use of weak rope or weak insertions. Since both action alternatives effectively reduce the number of buoy lines and co-occurrence between whales and buoy line as well as reduce the mean line strength closer to the equivalent of 1,700 pounds breaking strength through engineered weak rope or weak inserts, impacts are assumed to be relatively positive for all large whales compared to the baseline. Large whales would see a slight to moderately positive benefit from implementation of either Alternative 2 or 3 compared to Alternative 1 because the other large whale species likely benefit from these alternatives to a lesser degree than right whales. Alternative 3 likely reduces entanglement risk to a slightly greater degree than Alternative 2 with a slightly higher decrease in co-occurrence and the strength of lines. Though this analysis does not take into account the MRA risk reduction credit, which achieved a higher co-occurrence reduction than Alternative 3. A larger decrease in co-occurrence and strength will likely offer more benefits, particularly to right whales, though compliance is expected to be greater for Alternative 2 rather than Alternative 3 because Alternative 2 reflects extensive state and stakeholder input and associated preferences as well as safety concerns. Furthermore, Alternative 2 likely contains fewer regulations that would lead to uncertain outcomes that could potentially increase line in some areas. Minke whales are less likely to benefit from line strength reduction and are more likely to be negatively impacted by long trawl lengths. Therefore, compared to Alternative 2, Alternative 3 is likely to have negligible to slight positive impacts on large whales.

Other protected species prone to entanglement in trap/pot gear would also positively benefit from the Plan modifications being considered. Compared to Alternative 1, Alternative 2 and 3 will provide negligible (i.e. little change in line where these species are commonly sighted) to slight positive (i.e., reducing co-occurrence of buoy lines protected species, weak links requirements, and line reduction provisions) for ESA-listed protected species. Relative to Alternative 2, Alternative 3 is expected to have negligible to slight positive impacts to ESA-listed species (i.e., reduced co-occurrence of buoy lines and sea turtles, use of more full weak line to lessen entanglement severity for large whales, weak line requirements, and line reduction provisions). Any additional indirect impacts of Alternatives 2 and 3 on habitat are expected to be extremely small and not measurable (i.e. negligible). Compared to Alternative 1, the impact of Alternative 2 and 3 on Human Communities are expected to be a slight negative and moderate negative, respectively, due to the initial gear modifications and anticipated short term catch impacts, though this impact may decline over time. Relative to Alternative 2, Alternative 3 would have slight negative impacts because it requires more costs for gear modifications and potentially greater catch losses.

Table 7.6: The direct and indirect impacts of the alternatives on the four VECs.

Alternatives	Large Whales	Other Protected Species	Habitat	Human Communities
Risk Reduction				
Alternative 1 (No Action)	High Negative to Moderate Negative – Mortality and Serious injury would continue to occur and impact ESA listed species’ population health. More so for right whales and other large whales to a lesser degree other ESA listed or MMPA protected species.	Moderate Negative – Mortality and serious injury due to entanglement would continue to harm ESA listed species.	Negligible to Slight Negative – Areas with trawls above 15 traps per trawl may have a short-term impact.	Slight Negative to Moderate Positive – Positive in that there are no new impacts or costs to harvesters and markets but the lack of recovery of whale species has a slight negative impact on public welfare benefits due to whale population declines.
Alternative 2 (Preferred)	Moderate Negative to Slight Negative – Would reduce entanglement risk for ESA listed and MMPA protected species. However risk of interactions will not be entirely eliminated by the proposed action.	Slight Negative – Would reduce entanglement risk for ESA listed species. However risk of interactions will not be entirely eliminated by the proposed action.	Negligible to Slight Negative – Trawling up to trawls above 15 traps per trawl may have a short-term impact.	Slight Negative – Fisheries would experience extra costs and catch reduction in the short term term that could ease over the long term.
Alternative 3 (Non-preferred)	Moderate Negative to Slight Negative – Would reduce entanglement risk for ESA listed and MMPA protected species. However risk of interactions will not be entirely eliminated by the proposed action.	Slight Negative – Would reduce entanglement risk for ESA listed species. However risk of interactions will not be entirely eliminated by the proposed action.	Negligible to Slight Negative – Areas with trawls above 15 traps per trawl may have a short-term impact.	Moderate Negative – Costs of gear modifications and catch reduction would be significant.
Gear Marking				
Alternative 1 (No Action)	Negligible	Negligible	Negligible	Slight Negative – Current gear marking costs would have a slight economic burden on fishermen.
Alternative 2 (Preferred)	Negligible	Negligible	Negligible	Slight Negative – Gear marking requirements would generate economic burden to fishermen, but could lower the future regulatory costs.
Alternative 3 (Non-Preferred)	Negligible	Negligible	Negligible	Slight Negative to Negative – Gear marking requirements would generate high economic burden to fishermen, but could lower the future regulatory costs.

CHAPTER 8 CUMULATIVE EFFECTS ANALYSIS

This chapter describes the cumulative effects analysis (CEA) and examines the consequences of the regulatory alternatives within the context of past, present, and future factors that influence resources associated with the Atlantic Large Whale Take Reduction Plan (Plan or ALWTRP). It is organized as follows:

- Section 8.1 contains background information on the Cumulative Effects Analysis.
- Section 8.2 provides Valued Ecosystem Components (VECs) status and trends.
- Section 8.3 contains effects of past, present, and reasonably foreseeable future actions.
- Section 8.4 is a summary of the direct and indirect impacts of the alternatives covered in Chapters 5 through 8.
- Section 8.5 is a summary of the Cumulative Impacts of Alternatives for the Preferred Alternative (Alternative 2).

8.1 Introduction

Under the 1978 regulations this document is written under, the National Environmental Policy Act (NEPA) requires all environmental impact statements for proposed federal actions to include a cumulative effects analysis that examines the impact of the actions in conjunction with other factors that affect the physical, biological, and socioeconomic resource components of the affected environment. The purpose of the cumulative effects analysis is to ensure that federal decisions consider the full range of an action's consequences, incorporating this information into the planning process. This document follows steps depicted in Figure 8.1 to conduct a cumulative effects analysis of the proposed actions. Table 8.1 provides the framework used to determine the impacts actions had on each valued ecosystem component.

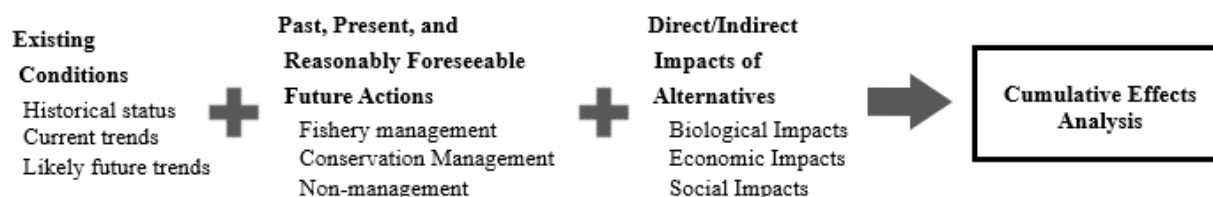


Figure 8.1: Cumulative effects analysis steps, and how they inform the cumulative effects analysis (adapted from Canter 2012).

8.1.1 Valued Ecosystem Components

The following Valued Ecosystem Components (VECs) would be affected by changes to the ALWTRP and are addressed in this analysis:

1. **Large whales (based on frequency of entanglement in ALWTRP fisheries):** North Atlantic right whale, fin whale, humpback whale, and minke whale
2. **Other protected species:** Sei whale, sperm whale, leatherback sea turtle, and loggerhead sea turtle
3. **Habitat:** The physical environment, benthic organisms, and essential fish habitat

4. Human communities: The economic and social aspects of the potentially affected fisheries

Table 8.1: Guidelines for defining the direction and magnitude of the impacts of alternatives on the VECs in the cumulative impacts analysis.

<i>General Definitions</i>				
VEC	Resource Condition	Direction of Impact		
		Positive (+)	Negative (-)	No Impact (0)
<i>Large Whales</i>	For ESA-listed species: populations at risk of extinction (endangered) or endangerment (threatened). For MMPA protected species: stock health may vary but populations remain impacted	For ESA-listed species: alternatives that contain specific measures to ensure no interactions with protected species (i.e., no take). For MMPA protected species: alternatives that will maintain takes below PBR and approaching the Zero Mortality Rate Goal	For ESA-listed species: alternatives that result in interactions/take of listed resources, including actions that reduce interactions. For MMPA protected species: alternatives that result in interactions with/take of marine mammals that could result in takes above PBR	For ESA-listed species: alternatives that do not impact ESA listed species. For MMPA protected species: alternatives that do not impact marine mammals
<i>Other Protected Species Habitat</i>	Same as large whales	Same as large whales	Same as large whales	Same as large whales
	Many habitats degraded from historical effort	Alternatives that improve the quality or quantity of habitat	Alternatives that degrade the quality, quantity or increase disturbance of habitat	Alternatives that do not impact habitat quality
<i>Human Communities (Socio-economic)</i>	Highly variable but generally stable in recent years	Alternatives that increase revenue and social well-being of fishermen and/or communities	Alternatives that decrease revenue and social well-being of fishermen and/or communities	Alternatives that do not impact revenue and social well-being of fishermen and/or communities
<i>A range of impact qualifiers is used to indicate any existing uncertainty</i>	Magnitude of Impact			
	Negligible	To such a small degree to be indistinguishable from no impact		
	Slight	To a lesser degree / minor	e.g. Slight Negative or Slight Positive	
	Moderate	To an average degree (i.e., more than “slight” but not “high”)	e.g. Moderate Negative or Moderate Positive	
	High	To a substantial degree (not significant unless stated)	e.g. High Negative or High Positive	
	Significant	Affecting the resource condition to a great degree, see 40 CFR 1508.27.		
	Likely	Some degree of uncertainty associated with the impact		

8.1.2 Geographic and Temporal Scope

This analysis and most of the actions considered are focused primarily on the Northeast Region Trap/Pot Management Area (Northeast Region) of the ALWTRP. This includes waters from the

U.S./Canada border south to a straight line from Watch Hill Point, Rhode Island to 40° 00' N. latitude bounded on the west by land or the 71°51.5' W. longitude line, and on the east by the eastern edge of the Exclusive Economic Zone (EEZ). This is an area currently subject to the requirements of the ALWTRP and includes the seawater and sea bottom of the Atlantic Ocean within U.S. jurisdiction. We also consider serious injury and mortality that is occurring in Canadian waters as a result of human activities (primarily entanglement and vessel strikes) because of the magnitude of impact this is having on the population (see Section 8.3.3.10).

The temporal scope of the analysis varies by resource. In all instances, the analysis attempts to take into account past (primarily the past two decades), present, and reasonably foreseeable future actions (within five years) that could affect valuable physical, biological, or socioeconomic resources. The discussion here focuses on impacts of management actions as well as the direct impact of potential stressors: interactions with commercial and recreational fisheries, vessel strikes, pollution, noise, climate change, renewable energy development, oil and gas development, harmful algal blooms, and prey availability. Stressors that are not expected to impact a VEC may be noted but will not be analyzed.

8.2 VEC Status and Trends

The status and trends of each VEC was presented in Chapter 4 and is summarized in Table 8.2.

Table 8.2: A summary of the current status and trends of the four valued ecosystem components

<i>Affected Resource of Concern</i>	<i>Historical Conditions</i>	<i>Current Conditions</i>	<i>Possible Future Conditions</i>	<i>Implications of Conditions Relative to Sustainability</i>
<i>Large Whales</i>	Stocks were depleted by whaling and other anthropogenic impacts.	Right and fin whales are endangered. Right whale stock is declining, humpbacks are slightly increasing, and the trends of the others are unknown.	Under current conditions, right whales are likely to continue declining.	The stocks are very vulnerable to anthropogenic perturbations due small sizes and population declines (right whales and fin whales).
<i>Other Protected Species</i>	Many whale species were previously depleted. Sea turtle species were overharvested and caught excessively as bycatch.	Sperm and sei whales, and leatherback turtles are endangered. Loggerheads are threatened. Trends are unavailable for the whales, loggerheads have been stable with short term increases, and leatherbacks are generally decreasing in numbers.	Certain protected species may be resilient to future changes while others may remain small or continue to decline.	Certain stocks that are still depleted are still vulnerable to additional anthropogenic stressors and population decline.
<i>Habitat</i>	The habitat has slowly degraded over time with increasing exposure to anthropogenic stressors.	The habitat is rapidly shifting from historical baselines from the impacts of climate change as well as other anthropogenic stressors.	Shifts in habitat features are expected to continue as the climate shifts and alters the frequency and magnitude of disturbance.	The habitat is vulnerable to additional disturbance.
<i>Human</i>	American Lobster	Total lobster landings	GOM lobster	Target species, lobster and

<i>Affected Resource of Concern</i>	<i>Historical Conditions</i>	<i>Current Conditions</i>	<i>Possible Future Conditions</i>	<i>Implications of Conditions Relative to Sustainability</i>
Communities	stocks have been abundant in GOM but depleted in SNE waters; Jonah Crab fishery was supplement of lobster fishery.	peaked in 2015 and started to decrease. GOM represents about 80 percent of all lobster landings; Southern MA and RI landed the most Jonah crabs.	landing will keep trending down and SNE stock stays depleted; more Jonah crabs will be landed from SNE.	Jonah crab, are vulnerable to anthropogenic and environmental stressors, posing a threat to human communities that depend on commercial fisheries.

8.3 Effects of Past, Present, and Reasonably Foreseeable Future Actions

8.3.1 Fishery Management Actions

Fishery management actions include the creation of a new Fishery Management Plan (FMP) and additional amendments and addenda that modify how the fishery is conducted. These amendments and addenda can include actions such as quotas, trap reductions, administration of taxes, and guidelines on how data is collected and shared with management agencies. These actions can have a variety of impacts on the economic aspects of fisheries as well as the environment. These are summarized in Table 8.3 and discussed below.

Table 8.3: A summary of the past, present, and foreseeable future fishery management actions on the four VECs.

Fishery	Management Action	Large Whales	Other Protected Species	Habitat	Human Communities
American Lobster	Amendment 3 Addenda I and IV trap reductions Addenda XVII - Area 2 trap reductions Addenda XXI, XXII – Area 2 aggregate trap cap, Area 3 active trap cap with banking• Addendum XXIV - conservation tax Addendum XXVI – expand reporting and sampling Vessel tracking	Moderate Negative	Slight Negative to Moderate Negative	Negligible to Slight Negative	Slight Positive
Northern Black Sea Bass	Amendment 9 harvest quotas Amendment 13 harvest quotas 2020-2021 implemented increased quota up to 60%	Negligible to Moderate Negative	Slight Negative	Negligible to Slight Negative	Slight Positive
Hagfish	State managed	Negligible to Slight Negative	Negligible to Slight Negative	Negligible to Slight Negative	N/A
Red Crab	Red Crab FMP harvest quota Amendment 3 (ACL/AM) Amendment 4 - bycatch reporting 2020-2023 new specifications implemented	Slight Negative to Moderate Negative	Slight Negative	Negligible to Slight Negative	Slight Positive

Fishery	Management Action	Large Whales	Other Protected Species	Habitat	Human Communities
Scup	Amendment 8 harvest quota Amendment 18 (review quota allocations) future action Addendum XXIX - quota periods 2020-2021 specifications implemented	Negligible to Slight Negative	Slight Negative	Negligible to Slight Negative	Slight Positive
Jonah Crab	Initial FMP, Addenda I and II Addendum III - the reporting and data collection	Moderate Negative	Moderate Negative	Negligible to Slight Negative	Slight Positive
Conch/Whelk	State managed	N/A	N/A	N/A	N/A
Net Impact Summary		Slight Negative to Moderate Negative	Slight Negative	Negligible to Slight Negative	Slight Positive

While not specifically a fishery management action, to assess impacts on large whale and sea turtle species protected under the ESA, NMFS has prepared Biological Opinions for the continued authorization of federal fisheries under federal regulations for the deep-sea red crab and lobster fishery, among others, as well as consultations on rulemakings to modify the Atlantic Large Whale Take Reduction Plan. Per an October 17, 2017, ESA 7(a)(2)/7(d) memo issued by NMFS, consultation has been reinitiated on the federally permitted Atlantic deep sea red crab and American lobster fisheries as well as other fisheries that use fixed gillnet and trap/pot gear. A Biological Opinion was issued on May 27, 2021, that considered the effects of the NMFS' authorization of ten fishery management plans (FMP), NMFS' North Atlantic Right Whale Conservation Framework, and the New England Fishery Management Council's Omnibus Essential Fish Habitat Amendment 2, on ESA-listed species and designated critical habitat

The 2021 Opinion determined that the proposed action may adversely affect, but is not likely to jeopardize, the continued existence of North Atlantic right, fin, sei, or sperm whales; the Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead, leatherback, Kemp's ridley, or North Atlantic DPS of green sea turtles; any of the five DPSs of Atlantic sturgeon; Gulf of Maine DPS Atlantic salmon; or giant manta rays. The Biological Opinion also concluded that the proposed action is not likely to adversely affect designated critical habitat for North Atlantic right whales, the Northwest Atlantic Ocean DPS of loggerhead sea turtles, U.S. DPS of smalltooth sawfish, Johnson's seagrass, or elkhorn and staghorn corals. An Incidental Take Statement (ITS) was issued in the Opinion. The ITS includes reasonable and prudent measures and their implementing terms and conditions, which NMFS determined are necessary or appropriate to minimize impacts of the incidental take in the fisheries assessed in this Opinion.

8.3.1.1 Large Whales

Fishery Management Plans and their amendments can mitigate some of the impact of fishing gear on protected large whale species. The amendments and addenda included here were primarily intended to optimize fishing practices, restrict overfishing, manage bycatch, and gather information to better manage the stock. Lobster and crab management that reduces rope in the

water column would be an improvement compared to current conditions, improved reporting and monitoring would inform future management and may have an indirect net positive impact, and modifications to maintain or restrict fishing on other species and likely would cause negligible impacts. However, any fishing generally has a negative effect on protected species because any line in the water increases the risk of interaction so, while fisheries management can mitigate some of this, the overall effect is anticipated to be between slight negative to moderate negative.

8.3.1.2 Other Protected Species

The impact of past, present, and reasonably foreseeable future fishery management actions that reduce rope in the water column and improve data collection for lobster and crab fisheries would partially mitigate the negative impacts on some protected species, such as leatherback sea turtles. However, this is not enough to eliminate risk entirely and the overall impact of fishing activity is expected to be a slight negative.

8.3.1.3 Habitat

The operation of trap/pot fisheries that operate longer trap trawls could have a slightly deleterious impact on the habitat. Setting quotas and trap limits that reduce gear on the bottom are likely indirectly better for the habitat than unmanaged fisheries. Overall, the impact of trap/pot fisheries management on habitat is considered to be negligible to slight negative.

8.3.1.4 Human Communities

The aims of many of these management actions include improving maintenance of the target stock and mitigating bycatch. Both of these goals are likely to have a slight positive impact on the economics of the fishery by allowing the continuation of a healthy fishery as a source of income for human communities.

8.3.2 *Conservation Management Actions*

Several management actions have been implemented to mitigate the impact of stressors on wildlife and habitats. Though climate change mitigation is intended to have long term impacts on the VECs analyzed here, the effects of these regional measures are likely not sufficient to impact climate change on a larger scale, particularly within the scope of this analysis, and is therefore considered to have a negligible impact. The impact of other past, present, and foreseeable future actions are discussed below.

8.3.2.1 Large Whales

All of these past, present, and reasonably foreseeable future actions aim to mitigate the impact of known human or environmental stressors. All of these stressors are known or thought to negatively impact large whales and, therefore, mitigating actions are expected to improve impacts on this VEC. U.S. vessel strike management measures may be effective (Conn and Silber 2013) but given changes in right whale distribution and status, they are being reviewed and evaluated and are expected to be modified to further reduce the impacts of vessels on right whales. Actions like speed reductions and observers would also benefit other large whale

species. However, the risk of entanglement with vertical lines and vessel strikes remains, albeit less so after these mitigation measures are taken. Therefore, ESA-listed species of large whales are expected to experience moderate negative to slight positive impacts and MMPA-protected species of large whales are expected to have slight positive impacts (i.e., PBR not exceeded, see Table 8.1).

8.3.2.2 Other Protected Species

Similar to large whales, the mitigation measures for each of these stressors that have been or are expected to be enacted are likely to reduce the impact of the stressor on other protected species. The combination of multiple stressors can impede population health and recovery. For example, sea level rise, coastal development, and climate change have all been factors in reducing available nesting habitat for loggerhead turtles in Florida, where climate change and development have pushed nests toward areas with increased erosion risk (Reece et al. 2013). While many species can survive and reproduce despite exposure to environmental stressors, an increasing stress load reduces an organisms' capacity to respond, behaviorally or physiologically, to avoid negative consequences. Mitigating the impact of multiple stressors in the environment by protecting habitats and habitat quality can reduce the overall stress by reducing the energy necessary to adapt to new baselines. Multiple conservation measures are likely to be beneficial to other protected species, similar to the large whale VEC. However, because there is still a risk of interaction with these other ESA-listed protected species, impacts are still moderate negative to slight positive.

8.3.2.3 Habitat

Some of the environmental mitigation actions are likely to reduce the number or magnitude of stressors on fish habitat and benthic organisms in the Northeast Region, particularly those related to regulating pollutants. Pollution and climate change can contribute to habitat degradation through mechanical disruption of habitat structure and negative impacts on the health of organisms (see the next section). Measures that directly protect habitats, address the effects of climate change, or protect water and sediment quality via pollution mitigation will prevent additional environmental degradation as a result of these stressors. These measures are expected to have positive impacts on marine habitats. Other regulations likely have a negligible impact on habitat, such as vessel strike regulations, that are not expected to interact with the physical environment. However, continued fishing effort will continue to impact habitats. Therefore, the impacts of the fishery on the physical environment are not expected to change relative to the current condition under the preferred alternative (i.e., slight negative for the physical environment). The net impact of all actions is likely slight negative to slight positive.

8.3.2.4 Human Communities

Most of the mitigation actions included in this analysis are expected to have negligible impact on the human communities that rely on fisheries. Actions that have been implemented to mitigate entanglement likely have a negative impact on this VEC, whereas those that have a positive impact on fishery habitat are expected to have a slight positive impact by supporting healthy fisheries. It is expected that these management actions have a negligible impact on the VEC when combined.

8.3.3 *Other Human Activities*

There are several anthropogenic actions that could potentially impact the VECs included in this analysis, including fishing, aquaculture, manufacturing, agriculture, construction, military activities, shipping, and climate change. These activities can have an impact individually as well as collectively and should be considered when proposing management actions. The nature of these activities are listed in Table 8.4 with the predicted impact of past, present, and foreseeable future actions on each VEC.

Table 8.4: A summary of human activities on the four VECs.

Action	Description	Large Whales	Other Protected Species	Habitat	Human Communities
Aquaculture	Placement of fish pens and lines in the water	Moderate Negative	Moderate Negative	Negligible to Slight Negative	Slight Negative to Negligible
Climate Change	Ocean warming, increased climatic variability, ocean acidification, more extreme weather events	High Negative	Likely Negative	High Negative	High Negative
Entanglement	Interaction with fishing gear	Negative	Negative	Negligible	Slight Negative
Noise	Sources of anthropogenic noise, including vessels, military exercises, seismic surveys, etc. (wind turbines discussed below)	Slight Negative to Moderate Negative	Slight Negative to Moderate Negative	N/A	Negligible
Offshore wind farm	Construction and operation of wind turbine structures in specified area	Moderate Negative	Moderate Negative	Moderate Negative	Moderate Negative
Pollution/water quality	Land runoff, precipitation, atmospheric deposition, seepage, or hydrologic modification; Point-source and unpermitted discharges	Slight Negative	Slight Negative	Slight Negative	Negligible
Oil and gas	Prospecting for, construction of, and operation of oil and/or gas platforms in marine areas. Transport of oil. May include geological and geophysical surveys (e.g., certain seismic surveys).	Moderate Negative	Moderate Negative	Moderate Negative	Moderate Negative
Prey availability	Changes in primary production and prey species (i.e. nutritional stress)	Moderate Negative	Slight Negative	N/A	N/A
Vessel Strikes	Injury or mortality from vessel collision	High Negative	Moderate Negative	N/A	N/A
Harmful algal blooms	Overgrowth of algal species that produce biotoxins and also contribute to oxygen-depletion	Moderate Negative	Moderate Negative	Moderate Negative	Moderate Negative
Canadian Mortalities	Serious injury and mortality as a result of entanglement and vessel strike in Canadian waters as well as other unknown causes.	High Negative	Slight Negative	N/A	N/A
Net Impact Summary		Moderate Negative	Moderate Negative	Moderate Negative	Moderate Negative

8.3.3.1 Aquaculture

Aquaculture can have a variety of impacts on the environment, some that differ based on the species being farmed. Figure 8.2 shows the distribution of aquaculture structures along the coast of New England, primarily within embayments and river mouths or nearshore. Two proposals to expand existing offshore aquaculture operations are anticipated. One proposal would expand a longline mussel operation from 3 to 20 horizontal long lines on a 33-acre (0.13 square km) lease site 8.5 miles (13.7 km) off the coast of Cape Ann, Massachusetts. The second proposal would expand existing experimental aquaculture installations off the Isle of Shoals in New Hampshire. The expansion includes a kelp array, as well as an integrated multi-trophic aquaculture raft. Neither the Cape Ann nor the Isle of Shoals project expansions have received permits, nor have they undergone ESA section 7 consultation.

An informal programmatic section 7 consultation with the Army Corps of Engineers has been conducted for aquaculture projects in the Northeast U.S. The programmatic consultation analyzes impacts on endangered and threatened species caused by small-scale shellfish aquaculture (almost entirely oyster shell on bottom, cage on bottom, and floating cage/bags). The vast majority of projects occur in the nearshore environment (bays, inlets, and other estuarine/brackish waters). Thirty one New England District (Maine through Connecticut) aquaculture projects were analyzed under the terms of this programmatic consultation in 2019, and a similar number is expected annually moving forward. Considerations for this cumulative impacts analysis are listed below.

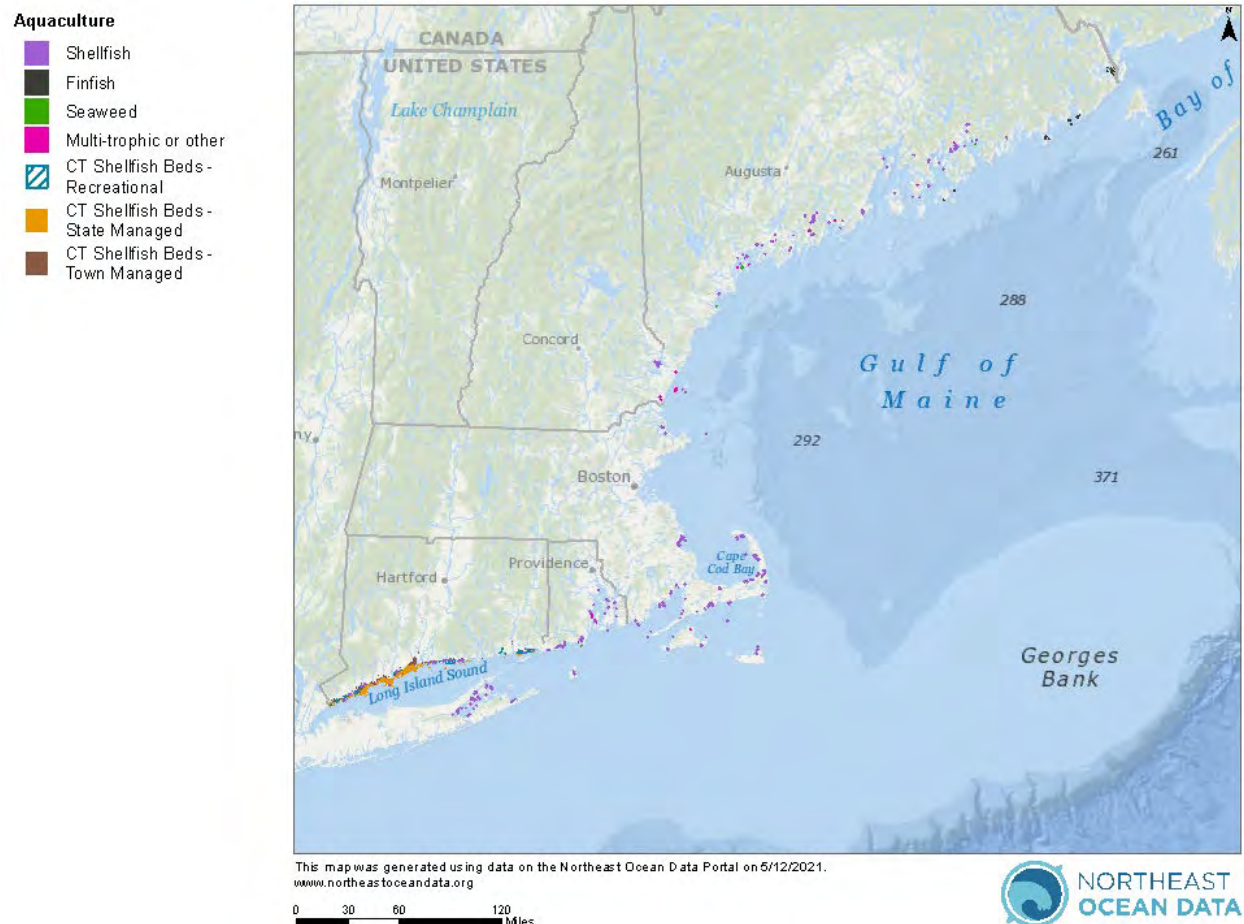


Figure 8.2: The aquaculture structures currently in place along the coast of New England by type (Northeast Ocean Data Portal, 2021).

8.3.3.1.1 Large Whales

Aquaculture structures in open water that involve lines or nets in the water can pose an entanglement risk to large whales in the affected area. Although farms are currently not as abundant compared to other fisheries that entangle large whales, right, humpback, and minke whales have all been found entangled in aquaculture-specific gear (Young 2015, Price et al. 2017). The outcomes of entanglement in aquaculture gear are expected to be similar to entanglement in other fishing gear, ranging from minor injury to mortality (Chapters 2 and 5). Aquaculture also is associated with an increase in vessel traffic due to operation and maintenance of the gear as well as from recreational fishermen that aggregate to fish around the gear. Increased vessel traffic would cause increased risk of vessel strike for right whales. NMFS is developing best practices for minimizing the impacts of aquaculture installations on large whales and other protected species. Therefore, this risk is assumed to be moderate negative at current and reasonably foreseeable aquaculture operations within the geographic scope of this analysis.

8.3.3.1.2 Other Protected Species

Similar to large whales, other marine mammals and sea turtles have been found entangled in aquaculture gear, including sperm whales, and leatherback sea turtles (Kemper et al. 2003, Lloyd 2003, Baker 2005, Clement 2013, Ishikawa et al. 2013, Young 2015, Price et al. 2017). The impact of aquaculture on other protected species is assumed to be similar that on large whales, moderate negative.

8.3.3.1.3 Habitat

Aquaculture can also have impacts on the physical environment and fish habitat. Aquaculture can change the substrate, benthic organisms, and habitat or community structure (Simenstad and Fresh 1995, Gallardi 2014). Aquaculture can result in input of excess contaminants, diseases, and nutrients into the environment (Lai et al. 2018), which can degrade habitats. This excess filtering of water can be positive, by removing waste from the water column, or negative through impacts like out-competing native species for resources and altering food webs (Gallardi 2014). As shellfish structures are more prevalent within the Northeast Region, it is likely that aquaculture would have a negligible to slight negative impact on water quality and other habitat changes within the scope of this analysis.

8.3.3.1.4 Human Communities

The economic impacts of aquaculture on wild fisheries and fishing communities could be complex. On one hand, aquaculture may cause significant environmental degradation around aquaculture sites and block coastal access, thus causing economic loss for the inshore fisheries (Primavera 2006, Wiber et al. 2012, D'Anna and Murray 2015). On the other hand, aquaculture could provide positive economic support to coastal communities through job creation in related industries, such as processing and distribution (Pomeroy et al. 2014, D'Anna and Murray 2015, Grealis et al. 2017). The overall economic impacts will depend on the scale and type of aquaculture. Large scale finfish aquaculture will have more negative impacts on wild fisheries than small scale and shellfish aquaculture. Combined, the impact is likely to be negligible to slight negative.

8.3.3.2 Climate Change

The Northwest Atlantic Ocean is expected to warm at a rate of up to three times faster than the global average (Saba et al. 2016). Climate change has already contributed to oceanographic and marine ecosystem shifts (Doney et al. 2012), including in the North Atlantic (Greene et al. 2013). Warming seas have shifted suitable habitats and resource availability for marine vertebrates including marine mammals, sea turtles, and fisheries in the region (e.g. lobster (Boavida-Portugal et al. 2018)). In addition to higher water temperatures, climate change is also expected to increase the frequency and intensity of oxygen depletion, harmful algal blooms, ocean stratification, and acidification (Doney et al. 2012, Stramma et al. 2012, Birchenough et al. 2015, Deutsch et al. 2015, Gobler et al. 2017). These changes can negatively impact the physiological health of marine organisms and habitats and their capacity to respond to additional stressors.

8.3.3.2.1 Large Whales

Large whales are susceptible to ecosystem changes caused by climate change. Baleen whales will most likely expand or shift their current range in response to movement of prey species, but the nature of the impacts varies by species (MacLeod 2009). Right whale habitat has shifted in recent years to follow their preferred prey, the zooplankton *Calanus finmarchicus*, farther north as the Gulf of Maine has warmed (Meyer-Gutbrod et al. 2018, Meyer-Gutbrod and Greene 2018, Record et al. 2019a, Record et al. 2019b). In the Gulf of Maine, warming has been linked to a decline in the summer and fall abundance of *C. finmarchicus*, especially after 2010. During this time, right whales were observed spending more time in the Gulf of St. Lawrence (Pershing and Stamieszkin 2020). Increasing temperatures can decrease both the body size and egg production of *C. finmarchicus*, in addition to reducing the available nutrients and dissolved oxygen in the environment needed for their productivity (Grieve et al. 2017). Even if *C. finmarchicus* remains abundant in the region, climate-induced changes in the water column could disrupt their aggregations that right whales depend on to feed (Baumgartner et al. 2017). Increasing bottom temperatures in the Gulf of St Lawrence may also exceed the thermal optimum for *C. finmarchicus* in future years, which could push right whales into foraging areas continuously further north (Gavrilchuk et al. 2021). Decreases in prey abundance are known to impede reproductive success in this whale species (Meyer-Gutbrod et al. 2015a). Humpback, fin, and minke whales are also species known to shift their range in response to temperature (Kovacs and Lydersen 2008, Becker et al. 2019) but, as more generalist species, may be better able to adjust to changing climates compared to specialist species like the North Atlantic right whale (Flemming and Crawford 2006, Víkingsson et al. 2014, Becker et al. 2019). This is consistent with predictions that climate change range shifts will be unfavorable for the North Atlantic right whale and neutral for minke and humpback whales (MacLeod 2009). Overall sensitivity estimates have identified fin whales as more vulnerable to climate change due to the small population size (Sousa et al. 2019).

Indirect effects of climate change are also important to consider, including the increase of harmful algal blooms that can lead to die offs (see Section 8.3.3.9 on HABs) and potential nutritional stress. Repeated exposure to conditions beyond optimal ranges can also increase the physiological demands on aquatic organisms, reduce physiological resilience to additional stressors, and impact reproductive success (Fair and Becker 2000, Tilbrook et al. 2000). Additionally, because measures to reduce the impacts of shipping and fishing on protected species are often area specific, another indirect effect of climate change is a species distribution shift into unregulated waters, outside of managed areas. For right whales, this has had lethal results (Meyer-Gutbrod et al. 2018, Meyer-Gutbrod and Greene 2018). Given the high rate of warming projected by Saba et al. (2016) for the Northwest Atlantic, the anticipated direct and indirect impact of climate change on large whales is likely a high negative.

8.3.3.2.2 Other Protected Species

Other marine mammals and sea turtles included in this analysis are also expected to be impacted by climate change in a manner similar to large whales. For marine mammals, the biggest impact is likely to species ranges, availability of prey, and additional physiological stress. MacLeod (2009) predicted minimal significant changes in range for other large whales, including sperm

and sei whales. However, sperm whales were identified as a sensitive marine mammal species based on low population sizes (Sousa et al. 2019).

Sea turtles are also vulnerable to the impacts of climate change. Nest temperature is known to determine the proportion of male to female eggs in a nest with higher temperatures producing higher numbers of females (Mrosovsky 1980, Yntema and Mrosovsky 1980). This occurs over a narrow temperature range and existing changes have already started producing majority female nests in some regions (Mrosovsky 1980, Yntema and Mrosovsky 1980). Increased tidal inundation and sea level rise on nesting beaches could reduce the amount of nesting habitat available and the success rate of nests on remaining beaches (Caut et al. 2010, Reece et al. 2013, Patino-Martinez et al. 2014, Pike et al. 2015), a pattern that has occurred at a faster rate along the Northwest Atlantic coast than the global average (Sallenger et al. 2012). Climate change could cause range expansion and changes in migration routes as increasing ocean temperatures shift range-limiting isotherms north (Robinson et al. 2009) and also move or restrict the availability of suitable nesting habitat for several species (McMahon and Hays 2006, Mazaris et al. 2008, Pike 2013a, b). Despite these impacts, it is thought that leatherback and loggerhead population management units in the Northwest Atlantic specifically will be more resilient to climatic change than similar species in other areas (Fuentes et al. 2013). Overall, in the study area the impact of climate change on other protected species is likely moderate negative.

8.3.3.2.3 Habitat

The impacts of climate change have already been observed in many parts of the North Atlantic. Climate change has already influenced the distribution, density, and species richness of benthic organisms in the North Atlantic (Birchenough et al. 2015). Ocean acidification may further lead to population declines in structural organisms that rely on calcification (e.g. calcifying algae, mollusks) and increases in others species (e.g. other algae) leading to changes in primary ecosystem structures (Birchenough et al. 2015, Sunday et al. 2017). Increasing storm frequency is also likely to change the seafloor substrate in some areas (Brierley and Kingsford 2009). Combined, these impacts may be highly negative on Essential Fish Habitat and Habitat Areas of Particular Concern, particularly those that are more sensitive to changes in temperature or physical disturbance.

8.3.3.2.4 Human Communities

Target species of several fisheries have already exhibited changes in distribution northward (Kleisner et al. 2017), including the North American lobster (Boavida-Portugal et al. 2018, Le Bris et al. 2018). This shift has already had an economic impact on fisheries in southern New England (Peck and Pinnegar 2019) and is expected to reduce catch and revenues (Cheung et al. 2010, Lam et al. 2016) and put economic strain on fishing-dependent communities along the eastern seaboard (Colburn et al. 2016). Oremus (2019) estimated that climate variability from 1996 to 2017 is responsible for a 16 percent decline in county-level fishing employment in New England, beyond the changes in employment attributable to management or other factors. Shellfish are particularly vulnerable to both changes in temperature and ocean acidification, which could lead to revenue losses under future climate scenarios. Mackenzie and Tarnowski (2018) estimated that between 1980 and 2010, landings of the four most important bivalve

mollusks (oysters, quahogs, soft shell clams, and bay scallops) fell by 85 percent. Warmer winter water played a key role in the declines. For these reasons, climate change is expected to have a highly negative impact on fisheries and fishing communities.

8.3.3.3 Noise

Anthropogenic noise is a known stressor that can impact wildlife health. This includes such activities as vessel traffic, air traffic, construction, military exercises, seismic surveys, the use of sonar, and other human activities. Anthropogenic noise can either be lethal or impose sublethal stress on vertebrates, which can impact population health by reducing reproduction or increasing susceptibility to other stressors (e.g. a compromised immune system that increases disease susceptibility). The duration of the sound, the animal's physical condition, the activity at time of exposure, the context of exposure, and proximity to the source of the sound all influence impacts (United States Department of the Navy 2018). Since it is assumed that noise has a negligible impact on the physical environment or fish habitat, it will not be discussed here.

8.3.3.3.1 Large Whales

Anthropogenic noise can impact whales both physiologically and behaviorally. Physiologically, noise causes a stress response in the North Atlantic right whale (Rolland et al. 2012). Over an extended period of time, physiological stress can impact marine mammal health by altering metabolism and energy stores (Romero and Butler 2007, Christiansen et al. 2014, Lysiak et al. 2018), decreasing immunity (Romano et al. 2004, Romero and Butler 2007), and impacting reproduction (Tilbrook et al. 2000, Romero and Butler 2007). Whales can suffer from organ and tissue damage, hearing loss, or related trauma. Noise can also impact behavior, including initiation of avoidance behavior in large whales (McCauley et al. 2000), changing communication patterns (Di Iorio and Clark 2010, Parks et al. 2011) that can reduce mating opportunities, and interrupting feeding behavior (Blair et al. 2016, Sivle et al. 2016). Extreme behavioral response could lead to stranding. The physiological impacts of these behavioral changes is unclear, but could impact nutritional health and reproductive success. Small populations with limited home ranges may be more vulnerable to the physiological impacts of noise (Forney et al. 2017). Given this information, impacts of noise on large whales is likely to be slight negative to moderate negative.

One noted cause for concern is the potential for Navy training activities to expose marine mammals, notably right whales, to multiple acoustic stressors. This is especially a concern in their calving areas in the Southeast Atlantic. To minimize the negative impacts of these stressors, the Navy's Atlantic Fleet is implementing the seasonal (November 15-April 15) Southeast North Atlantic Right Whale Mitigation area, encompassing right whale migration and calving areas and part of the species' critical habitat in the region. Mitigation measures include reporting total hours and counts of active sonar and in water explosives used in the area, not using sonar except as necessary for specific training activities, not expending explosive or non-explosive ordinances, obtaining the latest right whale data, implementing speed reductions in the case of right whale sightings or when operating at night or during periods of reduced visibility, and minimizing north-south transits as much as possible (United States Department of the Navy 2018).

8.3.3.3.2 Other Protected Species

Other large marine mammals are similarly sensitive to physiological and behavioral responses to noise as large whales. Many of the predicted impacts on large whales noted above are similar for other large whales (outside of the Large Whale VEC). For example, noise from geological and geophysical survey activities related to oil and gas in the Gulf of Mexico was predicted to cause as high as a 25 percent stock declines in sperm whales (Farmer et al. 2018). Though these whales were not from the same stock that is present in the Northeast Region, the species in general may be sensitive to particularly loud noises.

Limited evidence suggests that noise can affect sea turtles through habitat exclusion or hearing damage (Nelms et al. 2016). Many sources of anthropogenic noise fall within the range of sea turtle detection (50 Hz to 1100 Hz (DeRuiter and Larbi Doukara 2012, Martin et al. 2012, Lavender et al. 2014)) and could impact their behavior or damage their hearing at close range. Noise from prospecting or removal of oil and gas structures is thought to pose risk of injury or behavioral modification (Viada et al. 2008, DeRuiter and Larbi Doukara 2012). It is anticipated that other protected species also experience a slight negative to moderate negative impacts from noise.

8.3.3.3.3 Human Communities

There is a limited amount of information that suggests noise can impact catch of some species (Skalski et al. 1992, Engås et al. 1996). However, most crustaceans only show physiological rather than behavioral responses to noise (Weilgart 2018), reducing the likelihood of a reduction in catch. As such, impact of noise on fishery revenue is assumed to be negligible.

8.3.3.4 Offshore Wind Energy Projects

This section describes offshore wind development activities that NMFS is considering reasonably foreseeable for the purpose of assessing cumulative effects in this FEIS. The impact of offshore wind farms on the VECs includes noise (discussed in further detail in Section 9.4.2.3) emitted during site assessment activities exploration, construction pile driving, operation, and other effects during construction, including cable laying, dredging, and increased vessel traffic.

Offshore wind energy development is being considered in parts of the Atlantic Outer Continental Shelf (OCS) that overlap with resources associated with the ALWTRP, specifically in the southern New England region. Large whales, other protected species, and potentially affected fisheries occur in southern New England at present and are expected to remain for the near future.

To identify the possible extent of reasonably foreseeable future offshore wind development on the OCS, the Bureau of Ocean Energy Management (BOEM) conducted a thorough process to develop criteria levels. As a result of this process, BOEM has assumed that approximately 18 gigawatts (GW) of Atlantic offshore wind development is reasonably foreseeable within the 13 lease areas along the East Coast ranging from offshore of Massachusetts to Virginia (Figure 8.3). Reasonably foreseeable development includes 17 named projects within lease areas. In addition, BOEM has assumed future development is reasonably foreseeable to occur within lease areas

outside of named project boundaries. BOEM has recently begun a planning process for the Gulf of Maine via a regional intergovernmental renewable energy task force (<https://www.boem.gov/Gulf-of-Maine>). It is not clear at this time where development might occur in the Gulf of Maine. Given the water depth in the region, floating turbines will likely be the primary type of wind turbine foundations to be deployed in the area. Levels of assumed future development are based on state commitments to renewable energy development, available turbine technology, and the size of potential development areas.

Under the renewable energy regulations (30 CFR 585), the issuance of leases and subsequent approval of wind energy development on the OCS is a staged decision making process and occurs over several years, with each step having varying impacts to marine and/or terrestrial resources. The process follows these general steps: lease issuance, site assessment plan approval, and construction and operation plan review/approval including permitting with cooperating agencies. Reasonably foreseeable activities associated with offshore wind development include site characterization studies, site assessment activities, construction, operation/maintenance and decommissioning of offshore wind farms, port upgrades, and construction and maintenance of offshore export cables. These activities in total will span approximately 30-40 years (beyond the scope of this analysis), and are expected to impact all VECs. However, impacts may be short- or long-term in duration, direct or indirect, intermittent or persistent, and differ between phases. The types of activities expected during each phase are described below and followed up with the anticipated effects of these activities on the VECs. It is important to note that currently no utility scale offshore wind energy development exists in federal waters (only a two turbine pilot project off the coast of Virginia). Although projects exist in Europe, not all effects are transferable and there are many uncertainties as to how human, marine, and terrestrial resources will interact or be affected by offshore wind energy development. The wind energy areas are in a region of continental shelf that is undergoing climate change, changes in ecological dynamics, and fisheries stock status fluctuations. Regional scale changes may make it difficult to clearly identify local impacts that are directly attributable to offshore wind energy development (Petruny-Parker et al. 2015).

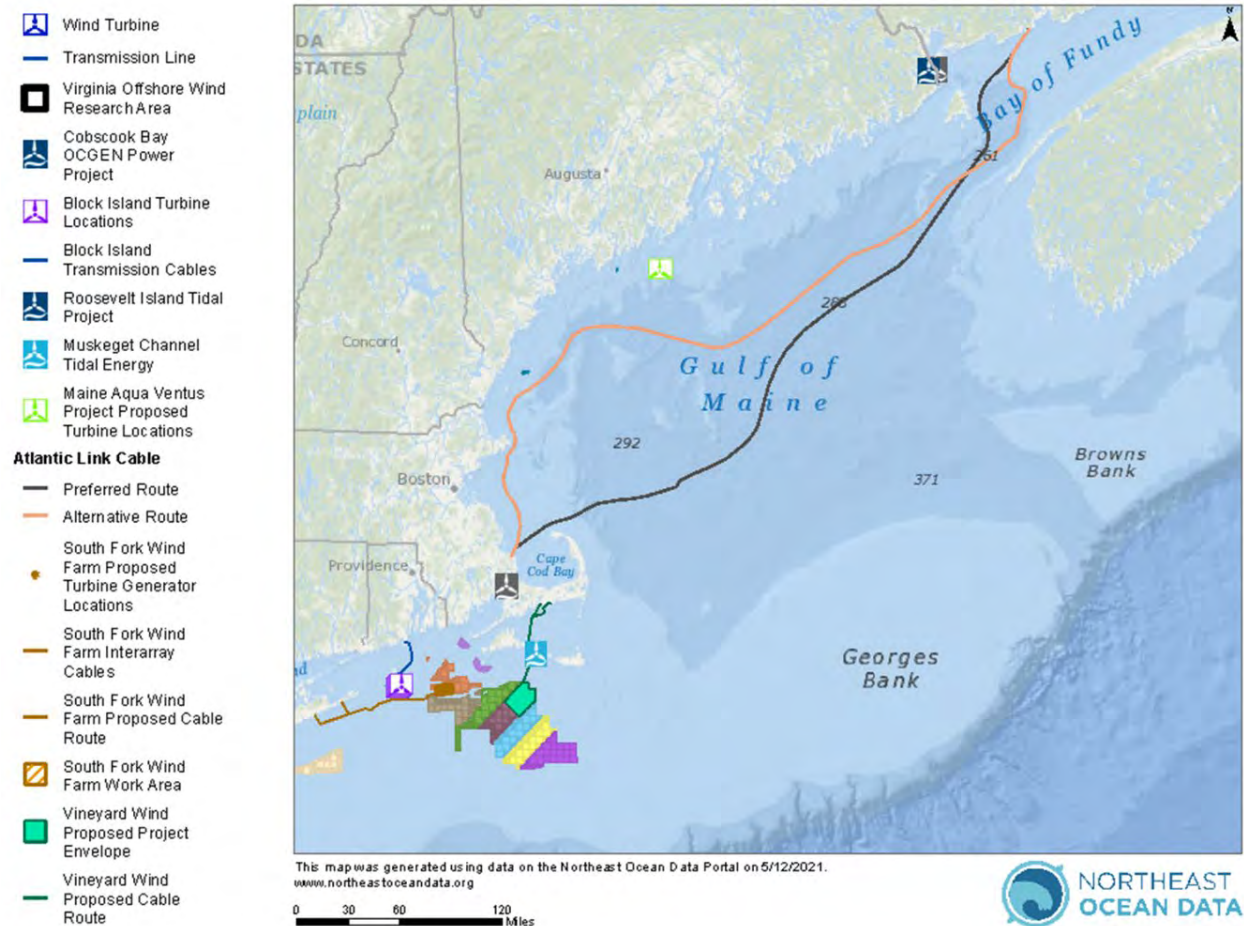


Figure 8.3: A map of the wind energy leases in the Southern New England region, namely the RI/MA Wind Energy Area, where construction is expected to start in the reasonably foreseeable future. (Northeast Data Portal, 2021)

Site Assessment and Construction Activities: During site assessment and construction activities, both direct and indirect impacts on all VECs may occur. Activities that will occur pre-construction include geophysical, geotechnical, habitat, and biological surveys, as well as potential deployment of meteorological buoys or meteorological towers for data collection. It is important to note that air guns are not anticipated to be used during offshore wind site assessment activities. During the construction phase, activities are anticipated to include foundation installation (which is likely to include pile driving at some projects) to support wind turbine generators and electric service platforms, and installation of submarine cables to connect turbines and export cables to route generated power to land-based facilities. During the site assessment and construction periods, anticipated impacts include short-term, temporary increases in vessel traffic; short-term temporary increases in anthropogenic noise from vessel traffic, survey activities, and wind turbine foundation and cable installation; short-term, temporary increased turbidity during foundation and cable installation; and short-term, temporary displacement of other users including fisheries and non-project vessels. These are the primary activities expected to occur during the scope of this analysis.

Operation and Maintenance Activities: During operational and maintenance activities, anticipated activities include the use of vessels to carry out inspections and maintenance, as well as the operation of the turbines themselves. It is important to note that currently available

information, though limited, indicates that the operational noise of wind turbines is not detectable underwater at distances of more than 164 feet (50 meters) from the foundation (Miller and Potty 2017) and is not loud enough to anticipate behavioral disturbances of large whales (Tougaard and Henriksen 2009, Thomsen et al. 2016). Both direct and indirect impacts on all VECs may occur, including:

- Long-term, increased presence of structures that may affect recreational and commercial fishery operations, habitat, oceanographic and atmospheric environments, patterns of movement, spawning and recruitment success, and prey availability for various species
- Long-term, increased electromagnetic fields due to presence of inter-array and offshore export cables (effects depend on cable type, burial depth, and proximity to other cables)
- Long-term, increased vessel traffic
- Long-term, variable socioeconomic impacts
- Long-term, variable fishery displacement impacts, although it remains unclear how fishing or transiting to and from fishing grounds might be affected by offshore wind energy development

It is possible that wind farms will become operational within the timeframe of this analysis and thus they are considered in the impacts to the VECs below.

Decommissioning Activities: During decommissioning, foundations, wind turbines generators, and associated structures will be removed. During this period, both direct and indirect impacts on all VECs may occur including short-term, temporary increased vessel traffic; short-term, temporary increased anthropogenic noise from vessel traffic and wind turbine removal; short-term, temporary increased turbidity during foundation and cable removal and short-term, temporary fishery displacement. It is unlikely that decommissioning will occur within the timeframe of this analysis and thus decommissioning is not considered further.

For the purposes of this analysis, the description below will focus on the potential impacts of site assessment and construction as well as operation and maintenance of offshore wind energy developments on the potentially affected VECs.

8.3.3.4.1 Large Whales

All four of the large whale stocks in this VEC have been found frequently in planned offshore wind farm areas in southern New England (Stone et al. 2017). Generally, these species are most sensitive to low frequency sounds and could respond to the range of sounds emitted during pile driving and operation (Madsen et al. 2006, Bailey et al. 2010). Pile driving of turbine foundations during construction would produce the most noise and poses the greatest risk to marine mammals within close range during this period. Exposure to underwater noise can directly affect species via behavioral modification (avoidance, startle, spawning) or injury (sound exposure resulting in internal damage to hearing structures or internal organs) (Bailey et al. 2010; Bailey et al. 2014; Bergström et al. 2014; Ellison et al. 2011; Ellison et al. 2018; Forney et al. 2017; Madsen et al. 2006; Nowacek et al. 2007; NRC 2003; NRC 2005; Richardson et al. 1995; Romano et al. 2004; Slabbekoorn et al. 2010; Thomsen et al. 2006; Wright et al. 2007). Indirect effects are likely to result from changes to the acoustic environment of the species, which may affect the completion of essential life functions (e.g., migrating, breeding,

communicating, resting, foraging) (Forney et al. 2017; Richardson et al. 1995; Slabbekoorn et al. 2010; Thomsen et al. 2006).

One developer in the proposed region, Vineyard Wind, has worked with environmental organizations to develop mitigation measures to avoid pile driving during times of peak right whale presence (January 22, 2019; CLF 2019), but this does not take into account other seasons where right whales are present at lower abundance levels and when other large whale species are likely present (e.g. summer, Stone et al. 2017). During construction, it is also likely that vessel traffic will increase, adding noise and additional risk of vessel strikes that could cause injury or mortality. Changes in fishing practices or displacement of fishing vessels from traditional areas, as well as changes in whale behavior and habitat due to the installation of wind turbines, could increase interaction and entanglement risks as well (Methratta et al. 2020).

Operational sounds are quieter and often masked by shipping traffic unless in very close proximity to a turbine, and may not change overall noise risk significantly in high traffic areas (Madsen et al. 2006). Other habitat effects that are predicted to impact turbidity and potential ecosystem structure, such as dredging, could reduce the ability of this area to serve as foraging grounds for large whales. Wind farm development in this area is likely to have a moderate negative impact on large whales given the most impactful stage (i.e. construction) is planned to occur within the timeframe of this analysis (approximately 5 years), with a possible decline in the magnitude of the impact after construction.

8.3.3.4.2 Other Protected Species

The impact of wind farm development on other protected marine mammals is expected to be similar to the impact on other large whales. Sei whales have been known to frequent the areas in southern New England where wind energy developments are planned (Stone et al. 2017). Species that spend more time in deep waters, such as sperm whales, are less likely to be close to construction or operations and therefore will likely not be significantly impacted by offshore wind development, though there have been a few sperm whale sightings (Stone et al. 2017).

There is very little information available about the impact of wind turbine development on sea turtles. Turtles may respond to loud noise or electromagnetic fields and can be injured or killed through direct interaction with dredging equipment (Gill 2005, Riefole et al. 2016). Increased vessel traffic during construction and maintenance could increase chances of a vessel strike. The sound or increase in turbidity could temporarily displace turtles from the area due to disturbance to individuals or their prey items. Other habitat changes could also impact occurrence of sea turtles in the area, but it is uncertain if that would have any substantial population-wide effects. Overall, the effect of offshore wind energy development is likely moderate negative for other protected species during the timeframe of this analysis with a possible decline in the magnitude of the negative impact during the operational phase.

8.3.3.4.3 Habitat

There are several potential impacts of offshore wind farms on fish habitats, both positive and negative. The most significant changes likely occur during construction and include removal of or changes in the substrate on the bottom through dredging and the addition of gravel (Gill 2005,

Riefole et al. 2016). Dredging is also expected to increase water turbidity. Other changes include sedimentation and scouring, high-relief habitat formation around turbines, shading, and the introduction of electromagnetic fields. These physical changes could impact other aspects of the habitat, including the biodiversity and food availability in the area and could influence important areas such as spawning and nursery habitats. (Gill 2005, Riefole et al. 2016, Dannheim et al. 2019, Petruny-Parker et al. 2015). After construction, the turbines could add habitat diversity that can be beneficial for sessile organisms (Gill 2005, Riefole et al. 2016). This could include regrowth of species that were displaced during construction or introduction of invasive species. The addition of structures could also alter water currents and temperature, potentially changing the microhabitats in the area. For example, noise and vibration from pile driving as well as associated changes in ocean circulation and turbidity can affect the reproductive success of lobsters. They can injure or kill larvae or drive female lobsters away from suitable spawning grounds. There are also trends of female lobsters aggregating in Wind Energy Areas off of southern New England due to warming of inshore waters. Other concerns include impacts to migration routes due to interactions with cables (either during construction or if the cable is improperly buried or becomes uncovered), which also carry potential electromagnetic field exposure risks (Lipsky et al. 2016). Together, these suggest that offshore wind farms will have a moderate negative impact on habitat and indirectly, larval, juvenile, and adult fish and invertebrates, with a possible reduction in impact over time (i.e. after construction).

8.3.3.4.4 Human Communities

Both commercial and recreational fishing are important to the economy in the Northeast Region. In 2016, commercial fisheries contributed \$3.7 billion in value added to the economy and supported over 260,000 jobs (Methratta et al. 2020). Over 4,300 fishing vessels were federally permitted in the Northeast Region in 2017, landing fish in several major ports. These commercial fleets are tied to the overall economy in the region through direct employment and income, as well as through goods and services to maintain and operate vessels, seafood processors, wholesale/distributors, and retailers (BOEM 2020a). Relevant to this action, more than \$280,000 of lobster pot gear revenue comes from within the Massachusetts Wind Energy Area. Recreational fishing in the region added \$5.3 billion to the economy and supported more than 69,000 jobs in 2016 (Methratta et al. 2020).

It remains unclear how fishing or transiting to and from fishing grounds (whether or not those grounds are within a wind farm) might be affected by the presence of a wind farm. While no offshore wind developers have expressed an intent to exclude fishing vessels from wind turbine arrays once construction is complete, it could be difficult for operators to tow bottom-tending mobile gear or transit among the wind turbines, depending on the spacing and orientation of the array and weather conditions²¹. Radar interference and increased traffic could affect navigation as well. If vessel operators choose to avoid fishing or transiting within wind farms, effort displacement and additional steaming time could result in negative socioeconomic impacts to

²¹ The United States Coast Guard has considered transit and safety issues related to the Massachusetts and Rhode Island lease areas in a recent port access route study, and has recommended uniform 1 mile spacing in east-west and north-south directions between turbines to facilitate access for fishing, transit, and search and rescue operations. Future studies in other regions could result in different spacing recommendations (UCSG 2020).

affected communities, including increased user conflicts, decreased catch and associated revenue, safety concerns, and increased fuel costs.

Wind farm survey and construction activities and turbine/cable placement will substantially affect NMFS scientific research surveys, including stock assessment surveys for fisheries and protected species and ecological monitoring surveys. Disruption of such scientific surveys could increase scientific uncertainty in survey results and may significantly affect NMFS' ability to monitor the health, status, and behavior of marine resources and protected species²² and their habitat use within this region. Based on existing Mid-Atlantic Fishery Management Council's acceptable biological catch control rule processes and risk policies (e.g., 50 CFR §§ 648.20 and 21), increased assessment uncertainty could result in lower commercial quotas and recreational harvest limits that may reduce the likelihood of overharvesting and mitigate associated biological impacts on fish stocks. However, this would also result in lower associated fishing revenue and reduced recreational fishing opportunities, which could result in indirect negative impacts on fishing communities.

Turbine structures could increase the presence of and fishing for structure-affiliated species. Many recreational fishing trips in this region target a combination of species. For example, recreational trips that catch black sea bass often also catch tautog, scup, summer flounder, and Atlantic croaker (NEFSC 2017). For this reason, increased recreational fishing effort focusing on species such as black sea bass in wind farms could also lead to increased recreational catches of other species. This could lead to socioeconomic benefits in terms of increased for-hire fishing revenues and angler satisfaction in certain wind development areas. There could also be social and economic benefits in the form of jobs and investments associated with construction and maintenance of wind farms, and replacement of some electricity generated using fossil fuels with renewable sources (AWEA 2020). These data suggest that overall, offshore windfarms will have a moderate negative impact on human communities.

8.3.3.5 Pollution/Water Quality

Humans have significantly increased the quantity of pollution that is introduced into the ocean. Types of pollution entering the coastal environment from both point and non-point sources include suspended solids, organic and non-organic debris (e.g. plastic waste), metals, synthetic organic compounds, oil, nutrients, pathogens, and nanoparticles (i.e. microscopic forms of compounds like metals). Some of these contaminants are very slow to degrade and accumulate in wildlife species, particularly at high trophic levels (i.e. persistent organic pollutants). Others, while more easily degraded or metabolized when ingested, can still be toxic to marine organisms. Exposure to these compounds can be lethal or sub lethal, causing acute or chronic health issues in several wildlife species. Overloading of nutrients will be discussed further in the Harmful Algal Bloom section (Section 8.3.3.9).

The coastal waters near Boston, Massachusetts have historically been among the most contaminated in North America, with elevated concentrations of trace metals, PCBs, and petroleum hydrocarbons (Pearce 1990). Additional chemical and nutrient loads flow into

²² Changes in required flight altitudes due to proposed turbine height would affect aerial survey design and protocols (BOEM 2020a).

Massachusetts Bay from the Merrimack River in the north, and several other large rivers from the southern coast of Maine. Contaminant sources include sewage and industrial discharges, combined sewer overflows, stormwater runoff, groundwater inflows, in-place sediments, seeps, and atmospheric deposition (Massachusetts Bay Program 1991). Dominant current patterns in the Northeast Region make it probable that industrial pollutants released into coastal waters will affect important feeding areas off the coast of Massachusetts and Cape Cod Bay.

8.3.3.5.1 Large Whales

Large baleen whales are exposed to a variety of contaminants through their diet that are known to have negative impacts on marine mammals, including persistent organic pollutants, oil, metals, plastic debris, and nanoparticles. These compounds can disrupt hormones (Letcher et al. 2010, Schwacke et al. 2012, Bushra and Ahmad 2014), inhibit reproduction (Wells et al. 2005, Kellar et al. 2017), increase susceptibility to disease (Ross et al. 1996, Schwacke et al. 2012, Desforges et al. 2016), cause genotoxicity (Wang et al. 2013, Wise et al. 2014, Wise et al. 2015), and impact nutritional health (Tabuchi et al. 2006, Schwacke et al. 2012, Avio et al. 2017). Large whales are likely exposed to smaller quantities of contaminants than marine mammals that feed at higher trophic levels. Some of these compounds can have an impact at low levels (Vandenberg et al. 2012) and in tandem with other compounds (Mori et al. 2008). Contaminant levels in Northeast Region marine mammals are high relative to other ocean regions (Aguilar et al. 2002). North Atlantic right whales, humpback whales, fin whales, and minke whales in the affected environment are exposed to many of these compounds (Weisbrod et al. 2000, Hobbs et al. 2001, Hobbs et al. 2003a, Hobbs et al. 2003b, Metcalfe et al. 2004, Elfes et al. 2010, Montie et al. 2010, Ryan et al. 2013), but mostly at relatively less concerning levels than toothed marine mammals (Elfes et al. 2010). It is unknown what contaminant levels are biologically meaningful in different marine mammal species or the effect of multiple compounds at low levels. There may be a slightly higher risk during fasting periods where compounds are released into the blood.

Plastic ingestion is also a concern for large whales and has been documented in fin, humpback, and minke whales (Sadove and Morreale 1990, Williams et al. 2011, Fossi et al. 2016, Kühn and van Franeker 2020). Baleen whales also can ingest plastic debris (Simmonds 2012, Nelms et al. 2018, Kühn and van Franeker 2020) which can lead to starvation (Jacobsen et al. 2010) and mortality, and can potentially increase the risk of infection (Nelms et al. 2019). Ingested plastic can also increase chemical exposure via sorption to plastic in the environment (Rochman et al. 2013). Thus, contaminant exposure likely represents a slight negative risk in these species.

8.3.3.5.2 Other Protected Species

Like the large whale species discussed above, other marine mammals and turtles can be impacted by contaminant exposure as well. Marine mammals at higher trophic levels are more at risk than those that feed on lower trophic level organisms. Blue whales have been observed with similar contaminant levels as the other large whales (Gauthier et al. 1997). There is little known about sei whales in this area but, given similar diets and distribution, it is likely that levels are similar to other mysticetes (Borrell and Aguilar 1987). Conversely, sperm whales feed at a higher trophic level and have relatively high contaminant loads (Aguilar 1983, Pinzone 2015). There is concern this could impact the health of sperm whales. Large amounts of plastic debris are of

particular concern for sperm whales, but are also a health hazard for baleen whales for the same reasons discussed above (Jacobsen et al. 2010, Simmonds 2012, Kühn and van Franeker 2020).

Sea turtles are also exposed to similar compounds and can be susceptible to similar health issues, such as impaired reproduction, development, immune system, and metabolic function (Bergeron et al. 1994, Keller et al. 2004, Guirlet et al. 2010, van de Merve et al. 2010, Camacho et al. 2013, Andrés et al. 2016). Though sea turtles also generally feed at a low trophic level, contaminant loads do correlate with health parameters in loggerhead (Keller et al. 2004, Keller et al. 2006) and leatherback turtles (Andrés et al. 2016). Plastic ingestion is also prevalent in loggerheads and leatherbacks (Sadove and Morreale 1990, Mrosovsky et al. 2009, Wilcox et al. 2016, Pham et al. 2017, Kühn and van Franeker 2020), posing a mortality and starvation risk (Mrosovsky et al. 2009, Stamper et al. 2009, Wilcox et al. 2016). When combined, past, present, and reasonably foreseeable future actions represent a slight negative impact to other protected species.

8.3.3.5.3 Habitat

Pollution can impact oceanic habitats and ecosystems by altering ecosystem productivity and benthic organisms (Chang et al. 1992, Alve and Olsgard 1999, Johnston et al. 2015). Plastic pollution is also prevalent in the region (Law et al. 2010). However, there is little evidence in the Northeast Region that suggests pollution has or will have large impacts on habitat features considered in this VEC, so it is assumed that the impact is slightly negative.

8.3.3.5.4 Human Communities

The economic stability of a fishery can be impacted by pollution when there is a fish mortality event or related closure related to a spill or other exposure. Alternatively, if a large amount of the target species were exposed to non-lethal levels of contaminants that pose a human health risk, it could change demand for the target species. An exposure of this magnitude is likely rare in the Northeast Region and likely negligible in the time frame of this analysis.

8.3.3.6 Oil and Gas

Currently offshore oil and gas development activities are not ongoing or anticipated within the next five years in the Northeast Region. Few concrete proposals are likely to be implemented in the foreseeable immediate or long-term future. NOAA had issued five individual harassment authorizations (IHA) under the Marine Mammal Protection Act for planned seismic surveys involving air guns on the Atlantic Outer Continental Shelf (OCS). One applicant subsequently withdrew their survey application pending with BOEM and returned their IHA to NOAA. The remaining IHAs expired in November 2020, and these proposed surveys will not take place until the applicants obtain new authorizations from NOAA, and BOEM issues their own permits for the surveys, which are still pending. There are currently no active oil and gas leases on the Atlantic OCS, so there are currently no drilling or production activities. There is a multistage process under the OCS Lands Act before oil and gas leasing, development, or production can occur on the Atlantic OCS. First, every five years BOEM must develop a National OCS Oil and Gas Leasing Program (National Program), which sets out the proposed dates and locations of proposed sales. No Atlantic lease sales are included in the current 2017-2022 National Program. BOEM is in the process of developing the next five-year National Program, which is expected to

be completed around the time the current program ends in 2022. The next stage after the National Program is developed is the decision on whether and under what terms to hold a specific lease sale. Even if Atlantic lease sales are included in a future National Program, it could be several years before a decision on whether to hold an individual lease sale, as compliance with other laws (e.g., NEPA reviews, CZMA consistency determination, ESA consultation) will be necessary before any sale decision. Once a sale is held and leases issued, the lessee must obtain approval of its exploration plan and then its development and production plan (if it has identified sufficient resources to enter into oil and gas production). After these plans are approved, additional permit approvals are required before any individual exploration or production well can be drilled. Given this multistage process, it would likely be several years after inclusion in a National Program before oil and gas leasing could be expected in the Atlantic, and even longer before exploration or production activities could occur. On September 8, 2020, the President issued a Memorandum on the Withdrawal of Certain Areas of the United States Outer Continental Shelf from Leasing Disposition, which withdrew from disposition by leasing the areas designated by BOEM as the South Atlantic Planning Area, the Straits of Florida Planning Area, and portions of the eastern Gulf of Mexico; this memorandum effectively prevents any leasing of these areas under the OCS Lands Act through June 30, 2032. On September 25, 2020, a similar Presidential Memorandum was issued withdrawing from disposition by leasing the area off the coast of North Carolina.²³ Thus, for the South Atlantic and offshore North Carolina, oil and gas leasing is not foreseeable until at least 2032.

Given the above, it is unclear at this time when or if offshore oil and gas activity will take place in the Atlantic. Should oil and gas activity occur offshore in the Atlantic, it could impact the marine environment in several different ways. During the exploration phase, the greatest impact is likely sound exposure from air gun seismic survey activities. Any exploratory drilling could add chemical contamination into the environment. During the drilling phase there could be chemical pollution (air and water discharges through Environmental Protection Agency-regulated discharge permits) and manual disruption of physical habitat structure. During exploration and production, there is a risk of oil and chemical spills that could increase the risk of oil exposure in many marine organisms. Oil can persist in the marine environment after a spill (Barron et al. 2020, Kingston 2002, McClain et al. 2019, Peterson et al. 2003, Teal et al. 1978) and is even slower to degrade in cooler areas compared with warmer climates (Campo et al. 2013, Brakstad and Bonaunet. 2006). A very large spill could increase the risk of chronic or acute oil exposure in some organisms (Pulster et al. 2020), but is not reasonably foreseeable in the Atlantic given no expected current and long-term oil and gas development activities are anticipated. Though noise and chemical pollution are broadly described in separate sections, this section will focus specifically on the potential impact of oil- and gas-related activities on marine environments, specifically air gun surveys and oil exposure, should any oil and gas activities take place. If new oil and gas activity occurs in the region, seismic surveys would likely be the primary concern within the timeframe of this analysis.

8.3.3.6.1 Large Whales

²³ Both Presidential Memorandums stated the withdrawals do “not apply to leasing for environmental conservation purposes, including the purposes of shore protection, beach nourishment and restoration, wetlands restoration, and habitat protection.”

As previously mentioned, several large whale species do respond behaviorally and physiologically to noise in the marine environment (see Section 8.3.3.3). Air guns and other seismic activity involved in oil and gas exploration are known to be loud compared to other sources of anthropogenic sound (e.g. pile driving, (Moore et al. 2012)) and sound travels much longer distances underwater than in air and thus has a larger impact radius. Louder sounds are more likely to disrupt behavior (Parks et al. 2011), such as feeding (Blair et al. 2016, Sivle et al. 2016), or could potentially cause physical damage if it occurs in very close proximity to marine mammals. The severity of these behavioral or physiological impacts is based on the species' hearing threshold, the overlap of this threshold with the frequencies emitted by the survey, as well as the duration of time the surveys would operate, as these factors influence exposure rate (Ellison et al. 2011; Ellison et al. 2018; Finneran 2015; Finneran 2016; Madsen et al. 2006; Nelms et al. 2016; Nowacek et al. 2007; Nowacek et al. 2015; NRC 2000; NRC 2003; NRC 2005; Piniak 2012; Popper et al. 2014; Richardson et al. 1995; Thomsen et al. 2006; Weilgart 2013).

The effects of oil exposure can be difficult to study in the wild because oil is metabolized rapidly and therefore it can be a challenge to measure the level of oil exposure. However, there is plenty of evidence showing adverse impacts to marine mammals from oil exposure, including mortality and reproductive or immune impairment (Schwacke et al. 2012, Beyer et al. 2016, Kellar et al. 2017, Farmer et al. 2018). Less is known about larger whales specifically, but these species do share some similarities within the well-established physiological pathway known to respond to oil exposure and subsequent effects (Wise et al. 2014; Angell et al. 2004). There is also a potential of vessel strikes from oil tankers. Thus, oil and gas activities are expected to have a moderate negative impact on large whales and other protected species.

8.3.3.6.2 Other Protected Species

Both sound and oil exposure can similarly impact other protected large whale species, for the same reasons as above, as well as sea turtles (Fraser et al. 2020). For example, after the Deepwater Horizon Oil Spill in the Gulf of Mexico, sperm whale density declined (Ackleh et al. 2012) and exhibited evidence of exposure to genotoxic dispersants and metals associated with the spill and response (Wise et al. 2014). Both oil and noise exposure from oil and gas activity was predicted to have significant negative impacts on sperm whale population reproduction and survival (Farmer et al. 2018). Sea turtles are also impacted by oil and sound exposure. Sea turtles are sensitive to oil exposure during all life stages (Milton et al. 2003) through direct contact, ingestion, or inhalation. An oil spill is far more costly for beginning life stages, which are generally associated with *Sargassum*. Sublethal effects of oil on sea turtles likely includes respiratory damage, metabolic changes, and a general decline in reproductive success (Lamont et al. 2012, Stacy et al. 2017). Loggerheads may be particularly sensitive to exposure through diet since they eat mollusks that can accumulate high levels of oil (Milton et al. 2003). Nesting habitat is shifting with climate change and could be more of an issue in the future, though the impact from any reasonably foreseeable oil and gas activities in the Atlantic to any nesting turtles, eggs, and hatchlings would be negligible within the timeframe of this analysis.

The life stages that occur and are most likely impacted in the Northeast Region are adult and juvenile Kemp's ridley, loggerhead, and leatherback sea turtles. Exposure during this stage can

lead to death, as was observed after the Deepwater Horizon Oil Spill in the Gulf of Mexico when sea turtle strandings increased (Beyer et al. 2016) and over 600 sea turtle mortalities were documented. Deepwater Horizon Natural Resource Damage Assessment Trustees estimated that between 4,900 and 7,600 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and hard-shelled sea turtles not identified to species), and between 55,000 and 160,000 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hard-shelled sea turtles not identified to species) were killed by the Deepwater Horizon oil spill (DWH NRDA Trustees 2016). Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were also injured by response activities, while some were relocated to the Atlantic (DWH NRDA Trustees 2016). Other impacts assessed include reproductive failure and adverse health effects. Air gun activity during prospecting has been shown to impact loggerhead behavior (DeRuiter and Larbi Doukara 2012) and could impact population health by disrupting feeding behavior and increasing stress albeit temporarily. Thus, oil and gas activities are expected to have a moderate negative impact on other protected species.

8.3.3.6.3 Habitat

Habitat is vulnerable to oil and gas activities largely from construction, operation, removal, and release of pollution into the environment. Construction, operation, and removal likely contribute to changes in the local habitat, including changes in substrate, water turbidity, impacts similar to dredging, and other changes similar to constructing and deconstructing renewable energy structures discussed above. However, oil and gas infrastructure functions as an artificial reef (Montagna et al. 2002) and fish attracting device (Hinck et al. 2004). There is likely an increase in contaminants released into the environment from accidental oil releases and other discharged waste (e.g. (Ellis et al. 2012)). An increase in oil released into the environment through oil platform operations or removals, through either through slow seeps or large spills, can impact habitat structure, community composition, and the health or density of benthic organisms (Percy 1977, Suchanek 1993, Bomkamp et al. 2004, Bik et al. 2012, Baguley et al. 2015, Beyer et al. 2016). Oil and gas exploration and operations, including the risk of a major spill, would likely have a moderate negative impact on the habitat, but not continuously and would vary per stage.

8.3.3.6.4 Human Communities

The impacts from oil and gas activities on fisheries can be both positive and negative. Firstly, the physical presence of oil and gas infrastructure functions as an artificial reef (Montagna et al. 2002) and fish attracting device (Hinck et al. 2004). But like wind energy structures, oil and gas infrastructures also create a fishing exclusion zone (Hall 2001, Love et al. 2006) that may reduce fishermen's access to traditional fishing grounds as a sole point source in a vast ocean while also further decreasing the fishing mortality rate. Therefore, the oil and gas infrastructure will most likely have a positive impact on fish population once it finishes construction or is decommissioned (Macreadie et al. 2011). On the other hand, oil spill incidents could be detrimental to both fish population and fishing activities. For example, Smith et al. (2011) assumed a 40 percent reduction in catch in the Gulf of Mexico after the Deepwater Horizon well blowout, from which the loss to the fishing industry was estimated to be \$4.36 billion. The likelihood of a Deepwater Horizon-sized event is not reasonably foreseeable in the Northwest Atlantic. Overall, the potential impacts from oil and gas to fisheries are likely to be moderate

negative from an oil spill, but there are slight positive implications for recreational fisheries and general survival rates.

However, if fishery resources are affected by seismic surveys, then the fishermen targeting these resources would be affected. However, such surveys could increase jobs, which may provide some positive effects on human communities (BOEM 2020b). It is important to understand that seismic surveys for mineral resources are different from surveys used to characterize submarine geology for offshore wind installations, and thus these two types of activities are expected to have different impacts on marine species.

8.3.3.7 Prey Availability

Marine ecosystems are dynamic environments that are constantly shifting in response to local and global changes in climate. The North Atlantic Oscillation contributes to decadal scale regime changes that impact primary productivity and food availability for many top predators. Though it is natural for the North Atlantic ecosystem to experience fluctuations, climate change (as noted in the separate discussion of climate change above) and overfishing contribute to variation in prey species, and these events are expected to increase in number and magnitude in the future. As the climate changes and shifts the distribution of primary prey of some species farther to the north, nutritional stress affecting health and demographics could be more of an issue, particularly for species with less dietary flexibility or that have to travel farther for food (e.g. longer migration distances to optimal habitat). The seasonal movements of right whales in response to shifts in their prey highlight the importance of identifying these resource-rich areas and implementing measures that reduce potential anthropogenic impacts (Gavrilchuk et al. 2021).

8.3.3.7.1 Large Whales

Large whales need to consume large quantities of prey to meet their basic energy requirements and to support population reproduction, migrations, and lactation (Klanjscek et al. 2007, Williams et al. 2013, Meyer-Gutbrod et al. 2015b, Irvine et al. 2017). North Atlantic right whales are specialists primarily relying upon dense seasonal aggregations of *Calanus finmarchicus*, the dominant mesozooplankton in the North Atlantic, to meet energetic demands (van der Hoop et al. 2019, Pershing and Stamieszkin 2020). Climate change has already shifted *C. finmarchicus* abundance and phenology in the Gulf of Maine (Record et al. 2019a, Record et al. 2019b) and model projections suggest resource limitation will likely worsen in the future (Grieve et al. 2017). As prey density and quality shift (namely, reductions in copepod size and nutritional density, while expanding into the northern end of their range), whales need to spend more time foraging and finding areas that have higher quality aggregations of prey. *C. finmarchicus* has declined in the Gulf of Maine, Georges Bank, and Scotian Shelf since 2005. Since 2015, right whales have increased their summertime use of the Gulf of St. Lawrence, with decreased observations in the Gulf of Maine and Bay of Fundy. However, prey biomass in the Gulf of St. Lawrence still may not be enough to support North Atlantic right whales and their reproductive needs. The quantity and quality *C. finmarchicus* in the area fluctuates from year to year (Gavrilchuk et al. 2021, Hayes et al. 2018). Periods of low *C. finmarchicus* abundance coincide with periods of low right whale calving (Meyer-Gutbrod et al. 2015a). Low prey availability also leads to longer interval periods between births (Meyer-Gutbrod and Greene 2018). Lactating females, in particular, appear to be getting less energy than expected, which could contribute to

low reproductive output due to an energy deficit (Fortune et al. 2013). Shifts of prey species farther north suggests longer travel between calving grounds and feeding grounds, and could contribute further to nutritional stress. Reproductively mature females may choose to remain in northern latitudes during the fall, winter, and spring to maximize potential feeding opportunities and improve body condition (Gavrilchuk et al. 2021). Other large whale species, such as humpback and minke whales, have shown greater flexibility in coping with shifting prey availability (Gavrilchuk et al. 2014, Víkingsson et al. 2014). More flexible species may be slightly more resilient to changes in prey than those that are zooplanktivorous specialists, such as right whales, who likely cannot survive on the less lipid rich copepods of the North Atlantic that are smaller in size and population than *C. finmarchicus* (Baumgartner et al. 2017). Overall, data indicate a moderate negative impact on large whales.

8.3.3.7.2 Other Protected Species

Other large whales with more specialized diets, such as sei whales, are also vulnerable to changes in prey availability (Gavrilchuk et al. 2014). Lack of proper nutrition can alter investment in energetically costly activities, such as reproduction (Williams et al. 2013, Meyer-Gutbrod et al. 2015a). Sperm whales feed at a higher trophic level than many baleen whales, maintain more consistent energy stores compared to species that undertake costly seasonal migrations (Irvine et al. 2017), and there is evidence they are evolved to make use of lower quality prey than other toothed whales with higher energy requirements (Spitz et al. 2012). These last two characteristics may mean sperm whales could have some resilience to changes in prey availability and distribution, but there is a lack of sufficient information on diet and health in sperm whales for more accurate predictions.

Sea turtles are also vulnerable to changes in prey availability given the long distances species travel to feed during various life stages. Resource variation can impact reproductive success of leatherback turtles (Wallace et al. 2006). Evidence suggests that the Atlantic leatherback population is less resource limited than the population in the Pacific (Wallace et al. 2006) and the different foraging strategies between these populations has been linked to reproductive success (Bailey et al. 2012). The availability of gelatinous prey is expected to increase with climate-related ecosystem changes in parts of the North Atlantic (Attrill et al. 2007), which suggests resource limitation may not be the most pressing issue for this population. Loggerheads are more of a generalist species (Thomson et al. 2012) and forage in many different types of habitats. The flexibility of a generalist diet may allow loggerheads to adjust to changes in dietary resources. However, they are susceptible to changes in growth rate with regime shifts (Bjorndal et al. 2017), suggesting there could be some physiological consequences to changes in primary productivity. Prey availability will likely have a slight negative impact on other protected species.

8.3.3.8 Vessel Strikes

8.3.3.8.1 Large Whales

All of the large whales included in this VEC have been casualties of vessel strikes. Historically, minke whales have been impacted less than larger species, followed by the humpback whale, right whale, and fin whale (in order of increasing mortality rate between 1970 and 2009 (Van Der Hoop et al. 2013). Right whales in particular spend a lot of time at the surface when feeding

or nursing, making them vulnerable to strikes (Baumgartner et al. 2017). Between 2003 and 2018, 42 percent of stranded right whales where the cause of death was determined to be a vessel strike (Sharp et al. 2019). Not all whales die after a vessel strike, but many can experience serious injury. At least 14 percent of humpback whales in the Gulf of Maine showed signs of one or more strikes, and this is likely an underestimate (Hill et al. 2017). Regulations to reduce vessel strikes were implemented in 2008 and contributed to a decline in lethal vessel strikes along the Atlantic coast of the U.S. (Laist et al. 2014, van der Hoop et al. 2015). However, some of these regulations are not mandatory, and simply shifts the threat of vessel strikes to other areas (Vanderlaan and Taggart 2009) or do not account for changes in whale behavior. Fatal vessel strikes have recently increased in occurrence as right whales shift north to locate their preferred prey species, *C. finmarchicus* into areas that they did not previously frequent and where mitigation measures were not yet in place (see Chapter 2 and (Themelis et al. 2016, Davies and Brilliant 2019, Plourde et al. 2019, Sharp et al. 2019). Vessel strikes have a high negative impact on large whales.

8.3.3.8.2 Other Protected Species

There is limited information on vessel strikes for other large whale species that are infrequently spotted nearshore. Vessel strikes and other incidents are less likely to be reported or discovered when they occur very far offshore. Very little information is available on the size and range of these populations, given the amount of time they spend far offshore and at depth. It is possible that vessel strikes pose at least a threat to these species but it is impossible to tell to what extent this threat would have an impact on the population. It is unlikely to match the same threat as observed in nearshore species where vessel and whale density is higher.

Sea turtles can also be injured or killed by vessels (Denkinger et al. 2013, Barco et al. 2016, Barrios-Garrido and Montiel-Villalobos 2016), including both loggerheads and leatherbacks (Barco et al. 2016, Barrios-Garrido and Montiel-Villalobos 2016) and likely benefit from regulations that reduce vessel speeds (Hazel et al. 2007, Shimada et al. 2017). Though slower speeds do not guarantee a turtle will not get hit, it is more likely to prevent severe damage to the injured sea turtle (Work et al. 2010). A moderate negative impact is likely for protected species.

8.3.3.9 Harmful Algal Blooms

Harmful algal blooms (HABs) impact all U.S. coastlines and have contributed to protected species mortality, fish kills, and human health issues. There are several different species of microalgae that can form blooms and produce toxic compounds. Different species can produce several different classes of neurotoxins, including saxitoxins, domoic acid, brevetoxins, and ciguatoxins. The formation of toxic blooms is linked in part to oceanographic conditions like temperature and pH (Fu et al. 2012). Climate change is already increasing the number and magnitude of blooms and will also likely increase toxicity of some species (Johnk et al. 2008, Fu et al. 2012). This indicates a potential increase in risk for the VECs discussed here in the future. However, proving toxin exposure still has some technical limitations and it is not always possible to link exposure to cause of death.

8.3.3.9.1 Large Whales

Large whales are primarily exposed to the toxins from HABs via their diet (Geraci et al. 1989, Fire et al. 2010). Larger rich copepod species like *C. finmarchicus* tend to accumulate higher levels than smaller species (Turner et al. 2000, Turner et al. 2005), posing a particular threat to right whales (Durbin et al. 2002, Leandro et al. 2010, Doucette et al. 2012). Toxins associated with HABs have been indicated in mortalities of humpback, minke, fin, and southern right whales (Geraci et al. 1989, Fire et al. 2010, Wilson et al. 2016, Savage 2017). Humpback whales that died in Cape Cod Bay in 1987 were exposed to a saxitoxin, a paralytic shellfish toxin, from fish likely exposed in the Gulf of St. Lawrence, suggesting whales are not only susceptible to local blooms (Geraci et al. 1989). Right whales are exposed to both saxitoxin and domoic acid, often concurrently but the potential interacting effects of multiple toxins is unknown (Durbin et al. 2002, Leandro et al. 2010, Doucette et al. 2012). Other toxin classes have not been studied in baleen whales in the North Atlantic. Sublethal concerns include reproductive impacts, maternal transfer, respiration, and disruption of feeding behavior and nutritional health (Durbin et al. 2002, Brodie et al. 2006, Doucette et al. 2012, Fire and Dolah 2012). HABs, and their predicted increase, will likely have a moderate negative effect on large whales.

8.3.3.9.2 Other Protected Species

Similar to the large whale species discussed above, other baleen and toothed whales are susceptible to the negative impacts of HABs. Less is known about the level of exposure of sei and sperm whales in the Northeast Region, but they are likely susceptible to exposure similar to their counterparts in other ocean regions. Sei whales in the southern hemisphere experienced a mass mortality where toxin exposure was suspected (Häussermann et al. 2017). Very little is known about sperm whale exposure in the population off the East Coast. However, both pygmy and dwarf sperm whales in the Southeast and Mid-Atlantic have been exposed to domoic acid, indicating pelagic, deep-diving species are likely still at risk of exposure (Fire et al. 2009). Potential health effects are expected to be similar to those listed for large whales.

Sea turtles are also exposed to toxins from HABs and can experience negative health impacts. Brevetoxin exposure in the Southeast is the primary documented toxin concern for loggerhead populations from the East Coast (Jacobson et al. 2006, Walsh et al. 2010, Manire et al. 2013, Perrault et al. 2016). Ciguatoxins, saxitoxins, and domoic acid were undetectable in loggerheads tested off the south of Florida (Jacobson et al. 2006). Leatherbacks from the Atlantic are not known to be exposed to domoic acid (Harris et al. 2011), but may be exposed to other toxin classes. Additional information on neurotoxins in leatherbacks on the East Coast is limited and more research is necessary to confirm broader exposure levels in these species. Though exposure is primarily documented outside of the Northeast Region, it can still impact the health of the populations present in the Northeast Region. Potential health effects of brevetoxin exposure include immunomodulation (i.e., alteration of the immune system) (Walsh et al. 2010, Perrault et al. 2016), reproductive impacts (Perrault et al. 2016), neurological symptoms (Manire et al. 2013), and death (Fauquier et al. 2013). Thus, HABs will have a moderate negative effect on other protected species.

8.3.3.9.3 Habitat

HABs can impact fish habitat through chemical and ecological changes in the marine environment. Toxic blooms can deplete dissolved oxygen in the water, among other chemical changes, and suffocate fish in the immediate area (Thronson and Quigg 2008). The toxins produced by HABs are also transferred to benthic organisms (Negri et al. 2004, Kvitek et al. 2008) and can change the abundance and diversity of species present in the area for years the bloom dissipates (Olsgard 1993, Kröger et al. 2006). These ecological shifts in the benthic community could indirectly impact the health of benthic habitats. Current evidence suggests that HABs will have a moderate negative effect on the habitat.

8.3.3.9.4 Human Communities

HABs have negative economic impacts on both aquaculture and wild fisheries. Shumway (1990) summarized the estimated economic losses of HABs on shellfish aquaculture around the world. Each HAB caused a loss of millions of dollars. Crustaceans in the Northeast Region can also be affected by HABs, including lobsters and crabs (Anderson et al. 1993, Anderson 1995). Finfish activity during or after a toxic bloom could change as a result of fish kills or from fishing restrictions when species pose a threat to human health. Between 1987 and 1992, HABs cost the commercial fishing industry tens of millions of dollars (Anderson et al. 2000, Hoagland et al. 2002). This suggests the overall impact of HABs on human communities is moderate negative.

8.3.3.10 Canadian Serious Injury and Mortality

8.3.3.10.1 Large Whales

Large whale entanglements and vessel strikes occur in both U.S. and Canadian waters, but there has been a notable increase in serious injuries or mortalities of right whales occurring in Canadian waters since at least 2016, if not earlier. Since 2010, there has been a documented change in right whales' prey distribution that has shifted right whales into new areas where there were previously no risk reduction measures, which contributed to an increase in documented anthropogenic mortality in Canada (see Chapter 2 and Themelis et al. 2016, Davies and Brilliant 2019, Plourde et al. 2019, Record et al. 2019, Sharp et al. 2019). It is impossible to confirm the country of origin for each incident, but several cases had snow crab gear that was identified as Canadian or were hit by vessels in Canadian waters. Given survey biases between species, trends in entanglements are difficult to examine, but there is some evidence that country-specific trends have shifted over the years, possibly in concert with regulatory and ecosystem changes that have shifted human activities and species' distribution (Hayes et al. 2018, Davies et al. 2019, Record et al. 2019). Figure 8.4 shows the recent increase in new reports of right whale vessel strikes and entanglements in Canada.

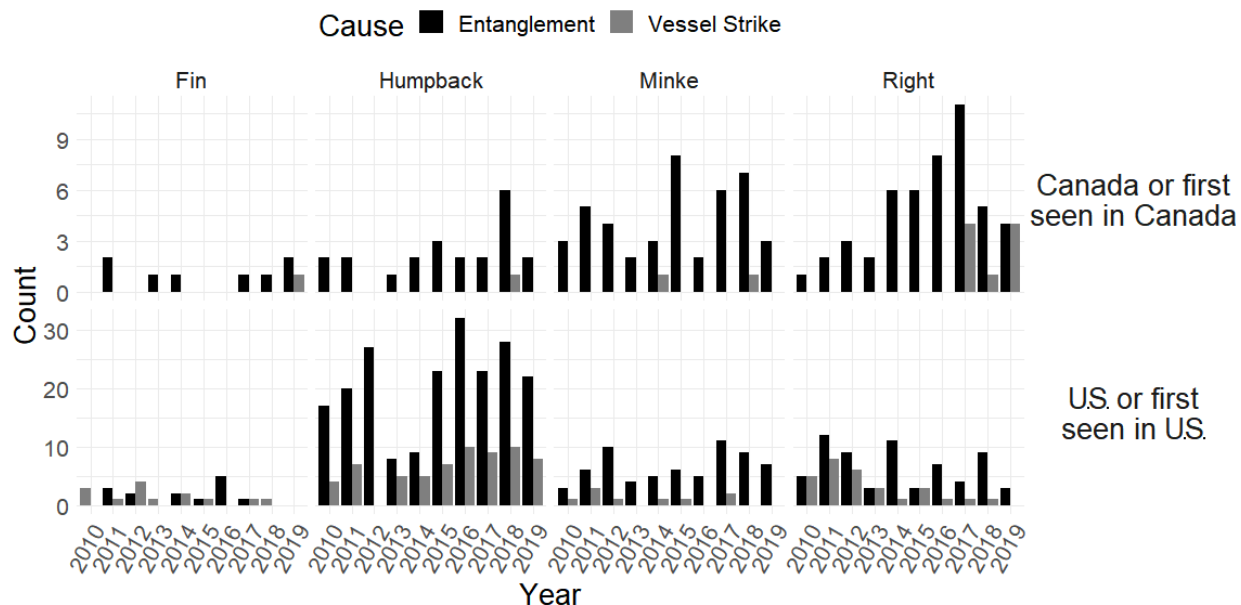


Figure 8.4: Serious injury and mortality cases (including those averted by disentangling response or prorated injuries) caused by entanglements and vessel strikes according to the country where the incident occurred or, in the absence of that information, where the individual was first sighted.

Coast-wide, annual right whale serious injuries and mortalities caused by entanglement far exceed the PBR level for the population (0.8 whales per year) and this remains true when viewing entanglements or vessel strikes, individually, that were first seen in Canada or known to be in Canadian waters. Thus, the levels of human-induced serious injury and mortality that is occurring in each country is unsustainable. Furthermore, these are likely underestimates, given they rely on documented cases and there are additional mortalities where cause of death was not investigated or determined.

Entanglement in fishing gear can have substantial health and energetic costs that affect both survival and reproduction of right whales (Robbins et al. 2015, Pettis et al. 2017, Rolland et al. 2017, van der Hoop et al. 2017, Hayes et al. 2018a, Hunt et al. 2018, Lysiak et al. 2018), which further inhibits recovery of the species even in the absence of mortality. Similarly, not all whales die after a vessel strike, and those that survive may also be more susceptible to reproductive or energetic impacts. As described in Chapter 4 and in Section 8.3.3.8, serious injuries and mortalities by vessel strike in Canada and the U.S. have also been documented in recent years. During a period of lower calving rates and increased mortalities by vessel strike and entanglements in Canadian waters, persistent serious injuries and mortalities of right whales above PBR in U.S. waters is not sustainable.

Human-caused serious injury and mortality of humpback, fin, and minke whales also occurs in Canadian waters, though the five-year rates of serious injuries and mortalities have remained below PBR for these stocks (Hayes et al. 2019). Exposure to additional human-induced mortality outside of U.S. waters could still impact the health of these populations and potentially the recovery of fin whales. Historically, minke whales have been impacted by vessel strikes less than larger species, followed by the humpback whale, right whale, and fin whale (in order of increasing mortality rate between 1970 and 2009; Van Der Hoop et al. 2013) but have higher

entanglement rates than fin whales. Overall, Canadian serious injury and mortality likely have a high negative impact on large whales. Continued bilateral discussions with Canada to identify and resolve information gaps and to support risk reduction range-wide are necessary to reduce mortalities and serious injuries promote recovery of right whales, and protect other Atlantic large whales. In sum, the impact of mortality in Canadian waters is considered to be high negative.

8.3.3.10.2 Other Protected Species

Canadian mortalities and serious injuries for other large whale species can occur in Canadian waters, but the threat likely differs between species. Three of 14 sperm whale strandings between 2008 and 2014 were documented in Canadian pelagic longline or trap/pot fisheries. Sei whales do spend time in Canadian waters, but there have been no confirmed mortalities that occurred within Canadian waters in recent years (Hayes et al. 2019). There was only one documented human-caused mortality of a sei whale in Canadian fishing gear between 2000 and 2018 (NMFS large whale data). During this time frame, eight more died of unknown causes in Canadian waters, one where country of origin was undetermined. Thus, injury and mortality in Canadian waters are likely, whether from entanglements, vessel strikes, or other causes. The level sustained outside of U.S waters may or may not be a threat to these species. It is unlikely to match the same threat observed in nearshore large whale species where whale density is higher, particularly right whale density.

Loggerhead and leatherback sea turtles can also be injured or killed by vessels (Denkinger et al. 2013, Barco et al. 2016, Barrios-Garrido and Montiel-Villalobos 2016) and entanglements in a variety of fishing gear, including pots, gillnets, pelagic longlines, trawls, pound nets, and scallop dredges (NMFS and USFWS 2008). Sea turtles do not spend as much time in Canadian waters, but when they do, it is during summer when fisheries are active. However, Canadian waters likely do not pose the greatest threat to these species. Thus, Canadian mortality is likely a slight negative for other protected species.

8.4 Direct and Indirect Impacts

The direct and indirect impacts of the alternatives were covered in Chapters 5 through 8 and are summarized in Table 8.5.

Table 8.5: The direct and indirect impacts of the alternatives on the four VECs.

<i>Alternatives</i>	<i>Large Whales</i>	<i>Other Protected Species</i>	<i>Habitat</i>	<i>Human Communities</i>
	Risk Reduction			
1 (No Action)	High Negative to Moderate Negative Serious injury and mortality would continue to occur and impact ESA-listed species' population health. More so for right whales and other large whales to a lesser degree other ESA-listed or MMPA protected species.	Moderate Negative Injury and mortality due to entanglement would continue to harm ESA-listed species.	Negligible to Slight Negative Areas with trawls above 15 traps per trawl may have a short-term impact.	Slight Negative to Moderate Positive Positive in that there are no new impacts or costs to harvesters and markets, but the lack of recovery of whale species has a slight negative impact on public welfare benefits due to whale population declines.
2 (Preferred)	Moderate Negative to Slight Negative Would reduce entanglement risk for ESA-listed and MMPA protected species. However risk of interactions will not be entirely eliminated.	Slight Negative Would reduce entanglement risk for ESA-listed species. However risk of interactions will not be entirely eliminated.	Negligible to Slight Negative Trawling up to trawls above 15 traps per trawl may have a short-term impact.	Slight Negative Fisheries would experience extra costs and catch reduction in the short term that could ease over the long term.
3 (Non-preferred)	Moderate Negative to Slight Negative Would reduce entanglement risk for ESA-listed and MMPA protected species. However risk of interactions will not be entirely eliminated.	Slight Negative Would reduce entanglement risk for ESA-listed species. However risk of interactions will not be entirely eliminated.	Negligible to Slight Negative Areas with trawls above 15 traps per trawl may have a short-term impact.	Moderate Negative Costs of gear modifications and catch reduction would be significant.
	Gear Marking			
1 (No Action)	Negligible	Negligible	Negligible	Slight Negative Current gear marking costs would have a slight economic burden on fishermen.
2 (Preferred)	Negligible	Negligible	Negligible	Slight Negative Gear marking requirements would generate economic burden to fishermen, but could lower the future regulatory costs.
3 (Non-preferred)	Negligible	Negligible	Negligible	Slight Negative to Negative Gear marking requirements would generate high economic burden to fishermen, but could lower the future regulatory costs.

8.5 Cumulative Impacts of Alternatives

A summary of the cumulative impacts on all VECs for Alternative 2 (Preferred Alternative) is summarized in Table 8.6.

Table 8.6: A summary of the final cumulative impacts analysis of the Preferred Alternative (Alternative 2) on all four VECs

Alternatives	Direct and Indirect Impacts	Existing Conditions	All Management Actions and Stressors	Cumulative Impacts
<i>Large Whales</i>	Slight to Moderate Negative Would reduce entanglement risk for ESA-listed and MMPA protected species. However interaction risk will not be entirely eliminated.	Negative Several protected species are still listed as endangered or threatened. Habitats have experienced degradation from human activities and are shifting as a result of climate change.	Moderate Negative to Slight Positive Fisheries negatively impact large whale species, though some management actions may have mitigated the risk. Non-fishery management actions likely improved ocean quality and reduced gear encounters, which benefitted large whales. Anthropogenic and natural stressors have had negative impacts on the VECs and likely will continue to do so in the future.	Slight Negative to Negligible Continued catch and effort controls, is likely to reduce gear encounters through effort reductions. Additional management actions taken under ESA/MMPA should also help mitigate the risk of gear interactions
<i>Other Protected Species</i>	Slight Negative Would reduce entanglement risk for ESA-listed species. However risk of interactions will not be entirely eliminated.	Negative Commercial fisheries are also shifting as a result of climate change.	Moderate Negative to Slight Positive Fisheries negatively impact large whale species, though some management actions may have mitigated the risk. Non-fishery management actions likely improved ocean quality and reduced gear encounters, which benefitted large whales. Anthropogenic and natural stressors have had negative impacts on the VECs and likely will continue to do so in the future.	Slight Negative to Negligible Continued catch and effort controls, is likely to reduce gear encounters through effort reductions. Additional management actions taken under ESA/MMPA should also help mitigate the risk of gear interactions
<i>Habitat</i>	Negligible to Slight Negative Areas with trawls above 15 traps per trawl may have a short-term impact		Slight Negative to Slight Positive Fishery management actions likely have negligible to slight negative impacts on habitat. Non-fishery management actions likely improved ocean quality, which benefitted habitats. Anthropogenic and natural stressors have had moderate negative impacts on habitats.	Negligible to Slight Positive Continued management is not expected to measurably change habitat quality and existing cumulative impacts.
<i>Human Communities</i>	Slight Negative – Fisheries would experience extra costs and catch reduction in the short term.		Slight Negative to Slight Positive Overall, fisheries management positively impacts human communities, though certain management actions may have had a short term negative effect. Non-fishery management actions likely improved fisheries. Anthropogenic and natural stressors have had negative impacts.	Slight Negative to Slight Positive Continued fishery management is expected to positively benefit Human Communities but conservation measures will likely negatively impact human communities, except for the positive social benefits expected from protecting whale species.

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CHAPTER 9 REGULATORY IMPACT REVIEW & FINAL REGULATORY FLEXIBILITY ANALYSIS

9.1 Introduction

Actions taken to amend fisheries management plans or implement other regulations governing U.S. fisheries are subject to the requirements of several federal laws and executive orders, including conducting a Regulatory Impact Review (RIR) and an Initial Regulatory Flexibility Analysis (IRFA). An RIR evaluates the costs and benefits of modifications to the Atlantic Large Whale Take Reduction Plan (Plan) that the National Marine Fisheries Service (NMFS) is considering. This includes the justifications for modifications, a cost benefit analysis of the alternatives, and the potential social impacts of the proposed rule. The Regulatory Flexibility Act (RFA) requires federal regulatory agencies to develop an Initial Regulatory Flexibility Analysis (IRFA) and a Final Regulatory Flexibility Analysis (FRFA) to evaluate the impact that the regulatory alternatives would have on small entities and examine ways to minimize these impacts. Although the RFA does not require that the alternative with the least impact on small entities be selected, it does require that the expected impacts be adequately characterized. This chapter includes both the RIR and FRFA of the proposed modifications to the Plan.

9.2 Objectives and Legal Basis of Proposed Rules

The revisions to the Plan that NMFS is considering are designed to improve the effectiveness of commercial fishing regulations implemented to conserve and protect two endangered species – North Atlantic right whales (*Eubalaena glacialis*) and fin whales (*Balaenoptera physalus*) – thereby fulfilling NMFS' obligations under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). The need for the proposed revisions is demonstrated by the continuing risk of mortality and serious injury of Atlantic large whales due to entanglement in commercial fishing gear (see Chapter 2 for a detailed analysis).

The MMPA of 1972 provides protection for species or stocks that are, or may be, in danger of extinction or depletion as a result of human activity. The MMPA states that measures should be taken immediately to replenish the population of any marine mammal species or stock that has diminished below its optimum sustainable level. With respect to any stock or species, the “optimum sustainable population” is the number of animals that will result in the maximum productivity of the stock or species, taking into account the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element.

Under the MMPA, the Secretary of Commerce is responsible for the conservation and management of pinnipeds (other than walruses) and cetaceans (including whales). The Secretary of Commerce has delegated MMPA authority to NMFS.

In 1994, Congress amended the MMPA, establishing new provisions to govern the incidental taking of marine mammals in commercial fishing operations. These new provisions include the preparation of stock assessments for all marine mammal stocks in waters under U.S. jurisdiction

and development and implementation of take reduction plans for stocks that are reduced or remaining below their optimum sustainable population due to commercial fisheries interactions.

Take reduction plans are required for all "strategic stocks." Under the MMPA, a "strategic stock" is a stock: (1) for which the level of direct human-caused mortality exceeds the Potential Biological Removal (PBR) level; (2) that is declining and is likely to be listed under the ESA in the foreseeable future; or (3) that is listed as a threatened or endangered species under the ESA or as a depleted species under the MMPA. The immediate goal of a take reduction plan is to reduce the mortality and serious injury of strategic stocks being taken during U.S. commercial fishing operations to below PBR levels within six months of its implementation. The long-term goal of a take reduction plan is to reduce, within five years of its implementation, the incidental mortality and serious injury of strategic marine mammals taken in the course of commercial fishing operations to insignificant levels approaching a zero mortality and serious injury rate, taking into account the economics of the fishery, the availability of existing technology, and existing state or regional fishery management plans.

Right and fin whales are listed as endangered species under the ESA and are considered strategic stocks under the MMPA. Pursuant to its obligations under the MMPA, NMFS in 1996 established the Atlantic Large Whale Take Reduction Team (Team), an advisory group empaneled to develop recommendations for reducing the incidental take of large whales in commercial fisheries along the Atlantic coast. The Team includes representatives of the fishing industry, state and federal resource management agencies, the scientific community, and conservation organizations. The purpose of the Team is to provide guidance to NMFS in developing and amending the Plan to meet the goals of the MMPA with respect to Atlantic large whales.

In addition to the MMPA, the ESA provides a legal foundation for measures to protect right and fin whales. The ESA provides for the conservation of species that are in danger of extinction throughout all or a significant portion of their range in addition to the conservation of the ecosystems on which these species depend. North Atlantic right whales and fin whales stocks in the Northeast Region are federally listed as endangered and are therefore subject to protection under the ESA.

Section 7 of the ESA directs all federal agencies to use their existing authorities to conserve threatened and endangered species and to ensure that their actions do not jeopardize listed species or adversely modify the critical habitat of those species. When a proposed federal action may affect an ESA-listed marine species, Section 7 directs that the "Action agency" consult with the Secretary of Commerce; this is referred to as a Section 7 consultation.

Many of the trap/pot and gillnet fisheries regulated under the Atlantic Large Whale Take Reduction Plan are also regulated under federal authorizations and rulemaking that undergoes review under the ESA Section 7 requirements. If it is determined through the Section 7 process that a federally permitted fishery (or fisheries) is likely to adversely affect listed species and/or critical habitat, then a formal consultation is initiated to determine whether the proposed action is likely to jeopardize the continued existence of a listed species and/or destroy or adversely modify

critical habitat. Formal consultation concludes with the issuance of a NOAA Fisheries Biological Opinion (Opinion).

To assess impacts on large whale and sea turtle species protected under the ESA, NMFS has prepared Biological Opinions for the continued authorization of federal fisheries under federal regulations for the deep-sea red crab and lobster fishery, amongst others as well as consultations on rulemakings to modify the Atlantic Large Whale Take Reduction Plan. Section 7 consultations were first initiated for each of these fisheries either at the time the FMP was developed or, in the case of lobster, when a significant amendment (Amendment 5) to the Interstate Fishery Management Plan (FMP) for American Lobster (Lobster FMP) was under consideration. Formal consultation was first initiated for lobster on March 23, 1994. Subsequent ESA Section 7 consultations on those fisheries incorporated ALWTRP measures as a Reasonable and Prudent Alternative (RPA) to avoid jeopardy to right whales. NMFS reinitiated consultation on June 22, 2000 for the lobster fishery following new whale entanglements resulting in serious injuries to right whales, new information indicating a declining status for right whales, and revisions to the Plan.

The Biological Opinions from the 2000 Section 7 consultations, finalized June 14, 2001, found that NMFS' authorization of these federal fisheries, as modified by the Plan requirements in effect at that time, was likely to jeopardize the continued existence of the western North Atlantic right whale. The Biological Opinions identified a set of RPAs designed to avoid the likelihood of jeopardy to right whales. These measures included:

- Seasonal Area Management (SAM);
- Dynamic Area Management (DAM);
- An expansion of gillnet gear modification requirements and restrictions to Mid-Atlantic waters and modification of fishing practices in Southeastern waters;
- Continued gear research and modifications; and
- Additional measures that implement and monitor the effectiveness of the RPAs.
- These measures were intended, in combination, to reduce the risk of serious injury or mortality of large whales from entanglements in commercial fishing gear, and to minimize adverse impacts if entanglements occur.

Following implementation of the measures described above, entanglements leading to serious injury or death of protected whales, including the right whale, continued to occur. Accordingly, NMFS reinitiated consultation on the continued authorization of a number of fisheries and began to develop modifications to the Plan. At its 2003 meeting, the Team agreed to manage entanglement risks by focusing first on reducing the risk associated with groundlines, then reducing the risk associated with buoy lines. In October 2007, NMFS issued a final rule that replaced the SAM and DAM programs with broad-based gear modification requirements, including the use of sinking groundline; expanded weak link requirements; additional gear marking requirements; changes in boundaries; seasonal restrictions for gear modifications; expanded exempted areas; and changes in regulatory language for the purposes of clarification and consistency (72 FR 57104, October 5, 2007). The broad-based sinking groundline requirement became fully effective on April 5, 2009. This final rule also incorporated an amendment to the ALWTRP (72 FR 34632, June 25, 2007) that implemented, with revisions,

previous ALWTRP regulations by expanding the Southeast U.S. Restricted Area to include waters within 35 nm (64.82 km) of the South Carolina coast, dividing the Southeast U.S. Restricted Area into Southeast U.S. Restricted Areas North and South, and modified regulations pertaining to gillnetting within the Southeast U.S. Restricted Area.

Following implementation of these measures, NMFS and the Team turned their collective focus to buoy line risk reduction. At the 2009 ALWTRT meeting, the Team agreed on a schedule to develop a management approach to reduce the risk of mortality and serious injury due to buoy lines. As a result of this schedule, NMFS committed to publishing a final rule to address buoy line entanglement by 2014. NMFS also reinitiated consultation on continued authorization of FMPs for a number of trap/pot fisheries (American lobster, scup, and Northern black sea bass). These consultations concluded in October 2010. After identifying the steps being taken by NMFS to develop, analyze and implement a buoy line reduction rule, the agency concluded new consultation and issued the resulting Biological Opinions in 2013 (scup and black sea bass) and 2014 (Lobster), that concluded that continued operation of the fisheries noted above would be likely to adversely affect, but not jeopardize, the continued existence of right, humpback, and fin whales. The Opinion on the lobster fishery concluded that the continued operation of the American lobster fishery may adversely affect, but would not jeopardize the continued existence of, right whales, fin whales, and sei whales; or loggerhead (northwest Atlantic distinct population segment) and leatherback sea turtles. The Opinion also concluded that the continued operation of the American lobster fishery would not destroy or adversely modify designated critical habitat for right whales or loggerhead sea turtles. An incidental take statement for loggerhead and leatherback sea turtles was issued along with the Opinion exempting a level of annual take for the Lobster FMP. Reasonable and Prudent Measures and accompanying Terms and Conditions to minimize the impacts of incidental take were also provided in the ITS.

The confirmation that the right whale population had been in decline since 2010 (Pace et al. 2017) and the mortality of 17 right whales in 2017, including many whales showing signs of shipstrike and entanglement, caused NMFS to declare an Unusual Mortality Event, which continues through 2021. Although most of the mortalities occurred in the Gulf of St. Lawrence, three mortalities first seen in U.S. waters exhibited signs of entanglement. As a result of evidence of a declining population exacerbated by 2017's high mortalities, in 2018, NMFS reconvened the Atlantic Large Whale Take Reduction Team to further reduce the risk of large whale entanglement in buoy lines. As discussed in Section 2.1.3, over 95 percent of buoy lines fished along the U.S. East Coast in waters not exempt from Plan requirements are fished by the lobster trap/pot fishery, 93 percent within the Northeast Management Area. For this reason NMFS focused the scope of the proposed Plan Modifications on developing recommendations for the Northeast lobster and crab trap/pot fisheries. In addition to reconvening the ALWTRT because new information about the right whale population is different from that considered and analyzed in Section 7 Biological Opinions, per an October 17, 2017, ESA 7(a)(2)/7(d) memo issued by NMFS, consultation has been reinitiated on the federal permitted Atlantic deep sea red crab and American lobster fisheries as well as other fisheries that use fixed gillnet and trap/pot gear. In January and February of 2018, four environmental organizations filed two lawsuits in the U.S. District Court for the District of Columbia alleging violations of the ESA and the Marine Mammal Protection Act, and the two lawsuits were consolidated into a single case. On April 9, 2020, the Court ruled against NMFS on the parties' cross motions for summary judgment,

finding that the 2014 Biological Opinion on the lobster fishery was legally deficient. On August 19, 2020, the Court issued an order on remedy that vacated the 2014 Biological Opinion, but stayed the vacatur until May 31, 2021, by which date NMFS anticipated issuing a new final Biological Opinion concluding the consultation that was initiated in 2017 for the federal American lobster fishery and other federal fisheries.

Pursuant to section 7 of the Endangered Species Act (ESA), NOAA's National Marine Fisheries Service (NMFS) issued a Biological Opinion (Opinion) on May 27, 2021, that considered the effects of the NMFS' authorization of ten fishery management plans (FMP), NMFS' North Atlantic Right Whale Conservation Framework, and the New England Fishery Management Council's Omnibus Essential Fish Habitat Amendment 2, on ESA-listed species and designated critical habitat. The ten FMPs considered in the Opinion include the: (1) American lobster; (2) Atlantic bluefish; (3) Atlantic deep-sea red crab; (4) mackerel/squid/butterfish; (5) monkfish; (6) Northeast multispecies; (7) Northeast skate complex; (8) spiny dogfish; (9) summer flounder/scup/black sea bass; and (10) Jonah crab FMPs. The American lobster and Jonah crab FMPs are permitted and operated through implementing regulations compatible with the interstate fishery management plans (ISFMP) issued under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (ACA), the other eight FMPs are issued under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

The 2021 Opinion determined that the proposed action may adversely affect, but is not likely to jeopardize, the continued existence of North Atlantic right, fin, sei, or sperm whales; the Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead, leatherback, Kemp's ridley, or North Atlantic DPS of green sea turtles; any of the five DPSs of Atlantic sturgeon; Gulf of Maine DPS Atlantic salmon; or giant manta rays. The Opinion also concluded that the proposed action is not likely to adversely affect designated critical habitat for North Atlantic right whales, the Northwest Atlantic Ocean DPS of loggerhead sea turtles, U.S. DPS of smalltooth sawfish, Johnson's seagrass, or elkhorn and staghorn corals. An Incidental Take Statement (ITS) was issued in the Opinion. The ITS includes reasonable and prudent measures and their implementing terms and conditions, which NMFS determined are necessary or appropriate to minimize impacts of the incidental take in the fisheries assessed in this Opinion.

In addition to consulting on the fishery management plans that authorize the fisheries managed under the ALWTRP, consultation on the Plan was reinitiated on May 3, 2021. The consultation considered the potential impacts of measures in the proposed rule and analyzed in the DEIS on ESA-listed species. As detailed in Chapter 5, the preferred alternative in the FEIS achieves more risk reduction than the proposed rule. Consultation on the ALWTRP and proposed amendment concluded on May 25, 2021, finding that the Plan operates as a mechanism to reduce fisheries related impacts on Atlantic large whales. It does not authorize any fishery. The effects of federal fisheries regulated under the Plan are fully considered under section 7 consultations conducted for the fishery management plans as described above, and incidental take attributed to federal fisheries is authorized under those consultations. Based on all of the above information, the gear regulations implemented by the Plan for U.S. fixed gear fisheries will have wholly beneficial effects to ESA-listed species or their critical habitat. As a result, it was determined that the Plan is not likely to adversely affect ESA-listed species or designated critical habitat under NMFS jurisdiction.

9.3 Problem Addressed by Plan

Right and fin whales are listed as endangered species under the ESA, and are thus considered strategic stocks under the MMPA. Until recently, humpback whales were also listed as endangered. While no longer a strategic stock, they are caught in Category I and II fisheries and considered in the Plan. The measures that the ALWTRP requires focus on the conservation of these species, and also benefit minke whales. The current status of these species is summarized below:

- **Right Whale:** The western North Atlantic right whale (*Eubalaena glacialis*) is one of the rarest of all large cetaceans and among the most endangered species in the world. The most recent population model estimates a population size of 368 in 2019 (Pace 2021). Pettis et al. (2021) gives an estimate of 356 as of 2020 removing known mortalities since the latest population estimate used in the report (366). Since 2019 there have been 10 additional documented serious injuries and mortalities. NMFS believes that the stock is well below the optimum sustainable population, especially given apparent declines in the population; as such, the stock's PBR level has been set to 0.8 (Pace et al. 2017, Hayes et al. 2020, Pettis et al. 2021, Pace 2021).
- **Humpback Whale:** As noted above, the North Atlantic humpback whale (*Megaptera novaeangliae*) is no longer listed as an endangered species under the ESA but is still protected under the MMPA. For the Gulf of Maine stock of humpback whales, the best population size is 1,396 and the minimum population size is 1,380 at the end of 2017, and has established a PBR level of 22 whales per year (Hayes et al. 2020).
- **Fin Whale:** NMFS has designated one population of fin whale (*Balaenoptera physalus*) as endangered for U.S. waters of the North Atlantic, although researchers debate the possibility of several distinct subpopulations. NMFS estimates a best population size of 7,418 at the end of 2017, a minimum population size of 6,029, and PBR of 12 (Hayes et al. 2020).
- **Minke Whale:** As previously noted, the minke whale (*Balaenoptera acutorostrata*) is not listed as endangered or threatened under the ESA. The best estimate of the population of Canadian east coast minke whales is 24,202 at the end of 2017, with a minimum population estimate of 18,902 and PBR of 189 (Hayes et al. 2020).

Atlantic large whales are at risk of becoming entangled in fishing gear because the whales feed, travel, and breed in many of the same ocean areas utilized for commercial fishing. Fishermen typically leave fishing gear such as gillnets and traps/pots in the water for a discrete period, after which time the nets/traps/pots are hauled and their catch retrieved. While the gear is in the water, whales may become entangled in the lines and nets that comprise trap/pot and gillnet fishing gear. The effects of entanglement can range from no permanent injury to death.

A scarification analysis conducted by the New England Aquarium (Knowlton et al. 2012) found that juvenile right whales are entangled with greater frequency than adults. Juvenile animals may

not have sufficient strength to break free from entangling lines, which can lead to serious injury and infection resulting from the animal "growing into" the lines.

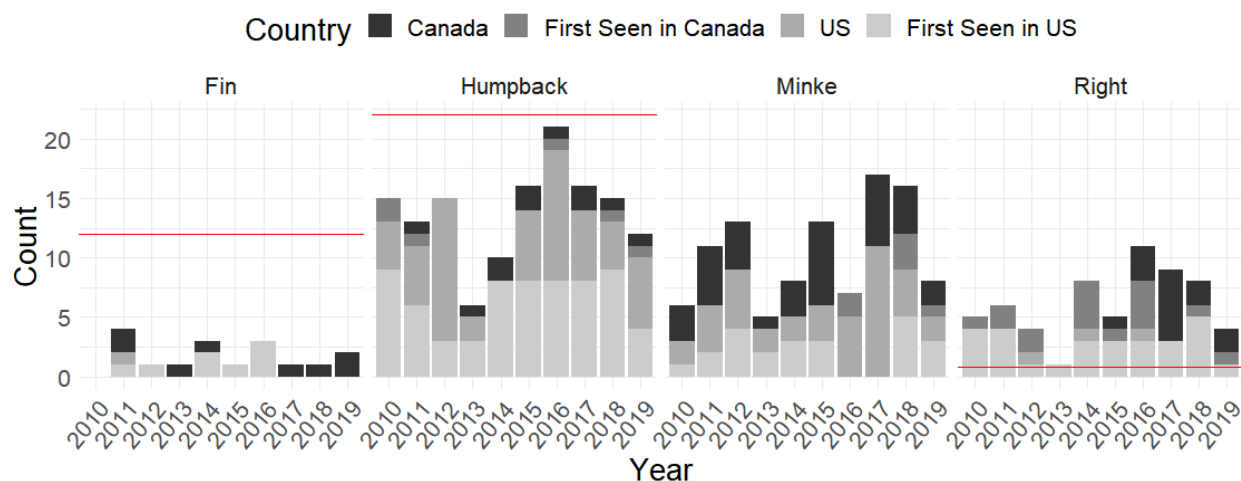


Figure 9.1: Entanglements that resulted in serious injury or mortality, according to the country of origin or country where the incident was first sighted. Incidents with prorated injuries and where serious injury was averted by disentanglement response are included as serious injuries and mortalities. The red line represents the current potential biological removal for the stock (PBR for minke whales is 189 and not pictured due to scale).

A study of right whale and humpback whale entanglements (Johnson et al. 2005) found that in cases where the point of gear attachment was known, right whale entanglements frequently (77.4 percent; 24 of 31 entanglement events) involved the mouth, which may indicate that many entanglements occur while whales are feeding. The study also found that humpback whales are more commonly reported with entanglements in the tail region (53 percent; 16 of 30 entanglement events), in cases where the point of attachment was known. The number of entanglements for which gear type can be identified is too small to detect any trends in the type of gear involved in lethal entanglements. Trap/pot and gillnet gear, however, seem to be the most common, as in 89 percent of the cases the gear was identified as or consistent with trap/pot or gillnet gear (Johnson et al. 2005). The study confirmed that buoy lines and floating groundlines posed risks for large whales but concluded that any type and part of fixed gear is capable of entangling a whale and several body parts of the whale can be involved.

Figure 9.1 summarizes all known serious injury and mortalities due to entanglement of right, humpback, fin, and minke whales from 2010 through 2019, the most recent year that data is available for all species. Humpback whales account for the greatest number of serious injury and mortalities from entanglements (135), followed by minke whales (104), right whales (61), and fin whales (17).

9.4 Affected Fisheries

As required by the MMPA, NMFS maintains a List of Fisheries that places each commercial fishery into one of three categories. Fisheries are categorized according to the level of mortality and serious injury of marine mammals that occurs incidental to that fishery. The categorization of a fishery in the List of Fisheries determines whether participants in that fishery are subject to

certain provisions of the MMPA such as registration, observer coverage, and take reduction plan requirements. Individuals fishing in Category I or II fisheries must comply with requirements of any applicable take reduction plan.

Category I fisheries are associated with frequent incidental mortality and serious injury of marine mammals. These fisheries have a serious injury/mortality rate of 50 percent or more of a stock's potential biological removal rate. Category II fisheries are associated with occasional incidental mortality and serious injury of marine mammals, and have a serious injury/mortality rate of more than 1 percent but less than 50 percent of a stock's PBR. Category III fisheries rarely cause serious injury or mortality to marine mammals. Category III fisheries have a serious injury/mortality rate of 1 percent or less of a stock's PBR (NOAA 2002).

The List of Fisheries indicates which fisheries NMFS may regulate under the Plan. Specific fisheries were initially identified for inclusion under the Plan based on documented whale interactions. In 1996, NMFS announced its intention to regulate the Gulf of Maine, U.S. Mid-Atlantic lobster trap/pot fishery, U.S. Mid-Atlantic coastal gillnet fishery, New England multispecies sink-gillnet fishery, and Southeastern U.S. Atlantic shark gillnet fishery (61 FR 40819-40821).

This list has evolved since 1996, reflecting both changes in nomenclature and modification of the Plan to address additional fisheries. As previously mentioned, NMFS is focusing scope of the proposed Plan modifications to the Northeast Region lobster and Jonah crab trap/pot fisheries given these represent the vast majority of buoy lines in the region where entanglements are currently of most concern.

The fisheries regulated under the Plan that will be included in this rulemaking and that are therefore considered in this analysis include northeast American lobster trap/pot fishery and the Jonah crab trap/pot fishery. Only measures that will be implemented through federal Plan amendment rulemaking are analyzed; Lobster management and state regulations are not included.

9.5 Regulatory Alternatives

NMFS has identified three regulatory alternatives for consideration. The first of these (Alternative 1) is the No Action Alternative, which would make no changes to the Plan. Table 9.1 provides an overview and comparison of the two action alternatives. These alternatives propose modifications to the Plan that include some combination of the following:

- **Gear Modifications** – Both of the action alternatives include area-specific minimum trawl lengths for lobster and Jonah crab trap/pot fisheries in the Northeast Region. The minimum trawl length specified varies by alternative (see below). Additional provisions set a maximum number of buoy lines allowed to be set at any one time by the trap/pot fishery.
- **Seasonal Buoy Line Closures** – Both of the action alternatives would prohibit Plan lobster trap/pot vessels from fishing in designated areas during designated periods (see

below).

- **Weak Line** – Both of the action alternatives convert a portion of line to “weak rope”, whether by using full weak line or weak inserts into the line at a particular distance from the top.
- **Gear Marking** – Each of the action alternatives includes revised gear marking requirements for lobster trap/pot vessels subject to the Plan. All lobster trap/pot vessels in the Northeast Region will be required to have state specific markings on their buoy line. The proposed gear marking scheme expands the use of three 12-inch marks per buoy line in currently exempt waters of New Hampshire and Maine. It further requires an additional 3-foot mark representing the state of origin near the buoy and an additional color representative of all northeast trap/pot fisheries. Alternative 3 would further require the addition of identification tape woven through the core of the line.

As noted, some of the alternatives under consideration would introduce the seasonal closure of designated areas to lobster and Jonah crab trap/pot buoy lines. Table 9.2 summarizes the basic parameters of each closure, while Figures 9.2 and 9.3 presents a series of maps illustrating the location of the areas in which fishing would be restricted. The objective of these provisions is to reduce the concentration of fishing gear when whales are likely to congregate in the areas designated for a restricted area, thus reducing the risk of entanglement. Chapter 3 provides additional detail on the rationale for each restricted area.

Table 9.1: A summary of the regulatory elements of the risk reduction alternatives analyzed in the FEIS, arranging the requirements by lobster management area and geographic region (where appropriate). The dark gray highlighted text represents regulations that will be implemented by a state or through ongoing or upcoming fishery management practices. OC = Outer Cape

Component	Area	Alternative 2	Alternative 3
Restricted Areas	All existing and new closures become closed to buoy lines	Allow trap/pot fishing without buoy lines. Will require exemption from fishery management regulations requiring buoys and other devices to mark the ends of the bottom fishing gear. Exemption authorizations will include conditions to protect right whales such as area restrictions, vessel speed, monitoring, and reporting requirements. All restricted areas listed here would require an exemption. Federal waters in the Outer Cape LMA would remain closed to all lobster fishing consistent with the ASMFC lobster FMP.	Allow trap/pot fishing without buoy lines. Will require exemption from fishery management regulations requiring buoys and other devices to mark the ends of the bottom fishing gear. Exemption authorizations will include conditions to protect right whales such as area restrictions, vessel speed, monitoring, and reporting requirements. All restricted areas listed here would require an exemption. Federal waters in the Outer Cape LMA would remain closed to all lobster fishing consistent with the ASMFC lobster FMP.
	LMA 1 Restricted Area, Offshore ME LMA 1/3 border, zones C/D/E	Oct – Jan	Oct – Feb
	South Island Restricted Area	Feb – April: Area from Non-preferred A in DEIS.	Feb – May: L-shaped area closed to buoy lines.
	Massachusetts Restricted Area	Credit for Feb-Apr, state water in MRA have a soft opening until May 15th, until no more than three whales remain as confirmed by surveys	Federal extensions of restricted area throughout MRA and LMA 1/OC state waters unless surveys confirm that right whales have left the area.
	Massachusetts Restricted Area North	Feb-Apr: Expand MRA north in MA state waters to NH border	Feb-Apr: Expand MRA north in MA state waters to NH border
Line Reduction	Georges Basin Restricted Area	-	Closed to buoy lines May through August.
	ME exemption line – 3 nm (5.6 km), Zones A, B, F, G	3 traps/rawl	-
	ME exempt area – 3 nm (5.6 km), Zones C, D, E	Status quo (2 traps/rawl)	-
	ME 3 (5.6 km) – 6 nm*, Zone A West**	8 traps/rawl per two buoy lines or 4 traps/rawl per one buoy line	Line allocations capped at 50 percent of average monthly lines in federal waters
	ME 3 (5.6 km) – 6 nm*, Zone B	5 traps/rawl per one buoy line	
	ME 3 (5.6 km) – 6 nm*, Zones C, D, E, F, G	10 traps/rawl per two buoy lines or 5 traps/rawl per one buoy line	Same as above
	ME 3 (5.6 km) – 12 nm (22.2 km), Zone A East**	20 traps/rawl per two buoy lines or 10 traps/rawl per one buoy line	Same as above
	ME 6* – 12 nm (22.2 km), Zone A West**	15 traps/rawl per two buoy lines or 8 traps/rawl per one buoy line	Same as above
	Buoy Line	ME 6* – 12 nm (22.2 km),	Same as above
		10 traps/rawl per two buoy lines or 5 traps/rawl per	Same as above

Component	Area	Alternative 2	Alternative 3
Reduction Continued	Zone B, D, E, F	one buoy line (status quo in D, E, & F)	
	ME 6* – 12 nm (22.2 km), Zone C, G	20 traps/trawl per two buoy lines or 10 traps/trawl per one buoy line	Same as above
	MA LMA 1, 6* – 12 nm (22.2 km)	15 traps/trawl	Same as above
	LMA 1 & OC 3 – 12 nm (5.6 – 22.2 km)	15 traps/trawl	Same as above
	LMA 1 over 12 nm (22.2 km)	25 traps/trawl	Same as above
	LMA 3, north of 50 fathom line on the south end of Georges Bank	Year-round: 45 traps/trawl, increase maximum trawl length from 1.5 nm (2.78km) to 1.75 nm (3.24 km)	May - August: 45 trap trawls; Year-round increase of maximum trawl length from 1.5 nm (2.78 km) to 1.75nm (3.24 km)
	LMA 3, south of 50 fathom line on the south end of Georges Bank	Year-round: 35 traps/trawl, increase maximum trawl length from 1.5 nm (2.78km) to 1.75 nm (3.24 km)	Same as above
	LMA 3, Georges Basin Restricted Area	Year-round: 50 traps/trawl, increase maximum trawl length from 1.5 nm (2.78km) to 1.75 nm (3.24 km)	Same as above
Other Line Reduction	LMA 2	Existing 18% reduction in the number of buoy lines	-
	LMA 3	Existing and anticipated 12% reduction in buoy lines	-
Buoy Weak Link	Northeast Region	For all buoy lines incorporating weak line or weak insertions, remove weak link requirement at surface system	Retain current weak link/line requirement at surface system but allow it to be at base of surface system or, as currently required, at buoy
Weak Line	ME Exempt State Waters	1 weak insertion 50% down the line	Full weak rope in the top 75% of both buoy lines
	ME exemption line – 3 nm (5.6 km)	1 weak insertion 50% down the line	Same as above
	MA State Waters	Weak inserts every 60 ft (18.3 m) or full weak line in top 75% of line	Same as above
	NH State Waters	1 weak insertion 50% down the line	Same as above
	RI State Waters	Weak inserts every 60 ft (18.3 m) in top 75% of line or full weak line	Same as above
	ME Zone A West**, B, C, D, E; federal waters 3 – 12 nm (5.6 – 22.2 km)	2 weak insertions, at 25% and 50% down line	Same as above
	ME Zone A East**, F, and G; federal waters 3 – 12 nm (5.6 – 22.2 km)	1 weak insertion 33% down the line	Same as above
	MA and NH LMA 1, OC; federal waters 3 – 12 nm (5.6 – 22.2 km)	2 weak insertions, at 25% and 50% down line	Same as above
	LMA 1 & OC over 12 nm	1 weak insertion 33% down the line	Same as above

Component	Area	Alternative 2	Alternative 3
	(22.2 km)		
	LMA 2	Weak inserts every 60 ft (18.3 m) or full weak line in top 75% of line	Same as above
	LMA 3	One buoy line weak year round to 75%	May - August: one weak line to 75% and 20% on other end. Sep – Apr: two weak “toppers” down to 20%

*Note that the 6 nautical mile line refers to an approximation, described in 50 CFR 229.32 (a)(2)(ii) and a similar approximation of the 50 fathom lines would be included in the final rule implementing the Preferred Alternative at 50 CFR 229.32 (a)(2)(iv).

**Maine Zone A East is the portion of Zone A that is east of 67°18.00' W and Maine Zone A is west of this longitude.

Table 9.2: The length and size of the proposed restricted areas included in both alternatives.

Restricted Area	Alternative	Time Period	Size (Square Miles)
Offshore Maine	2	October - January	967
Cape Cod Bay	2	May, until only 3 whales remain	644
Outer Cape State Waters	2	May, until only 3 whales remain	260
Large South Island Restricted Area	2	February - April	5,468
Massachusetts Restricted Area North	2 & 3	Feb – Apr, soft opening into May	497
Offshore Maine	3	October - February	967
Georges Basin Core Area	3	May - August	557
Massachusetts Restricted Area	3	May, possible early open	3,069
L-shaped South Island Restricted Area	3	February - May	3,506

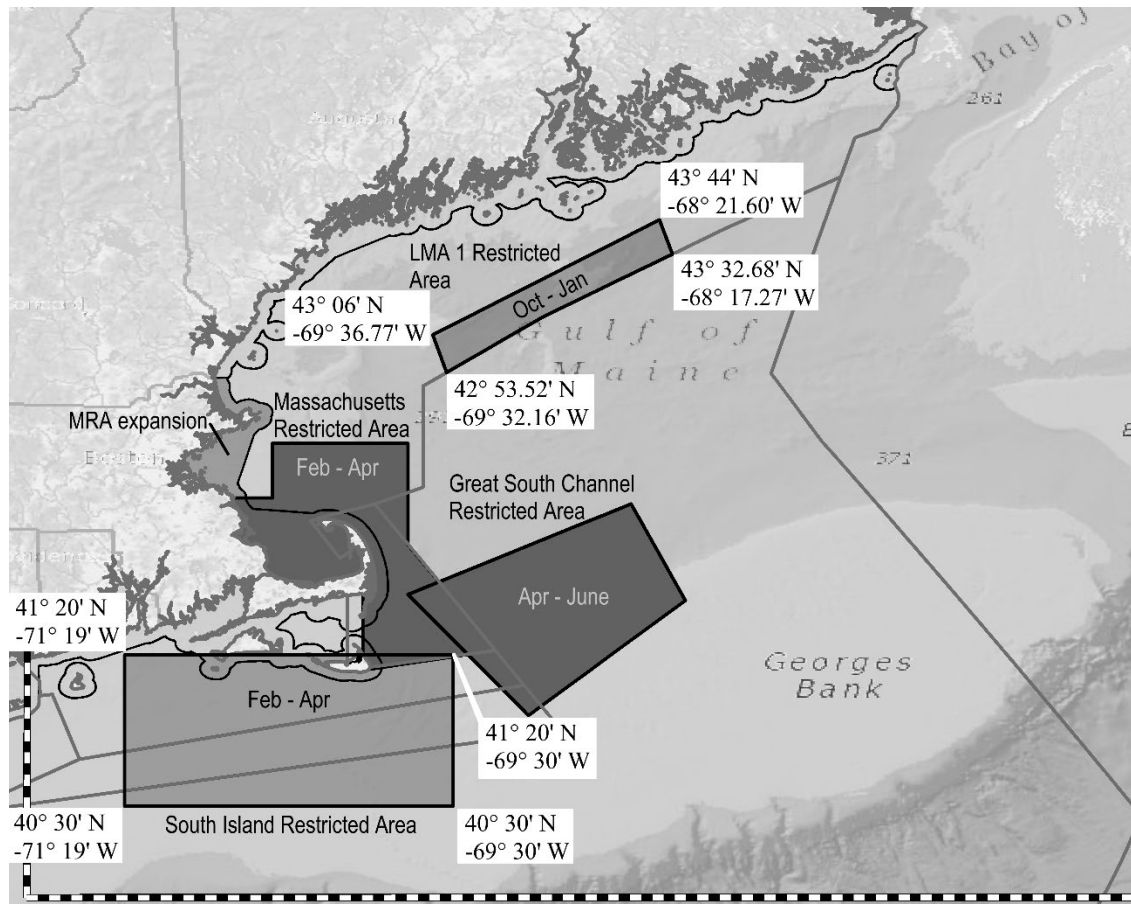


Figure 9.2: The lobster and Jonah crab trap/pot buoy line restricted areas proposed in Alternative 2 (Preferred) shaded in light gray. LMAs are delineated by the grey lines. The new South Island Restricted Area is proposed as closed to trap/pot buoy lines from February through April and the LMA 1 Restricted area is proposed from October through January. An expansion of the MRA into Massachusetts state waters to the New Hampshire border and extended in state waters in LMA 1 and the Outer Cape through at least May 15th, with a potential opening if whales are no longer present, is also included. In dark gray are existing seasonal restricted areas that would become areas with restrictions to fishing with buoy lines, with the exception of the Outer Cape LMA.

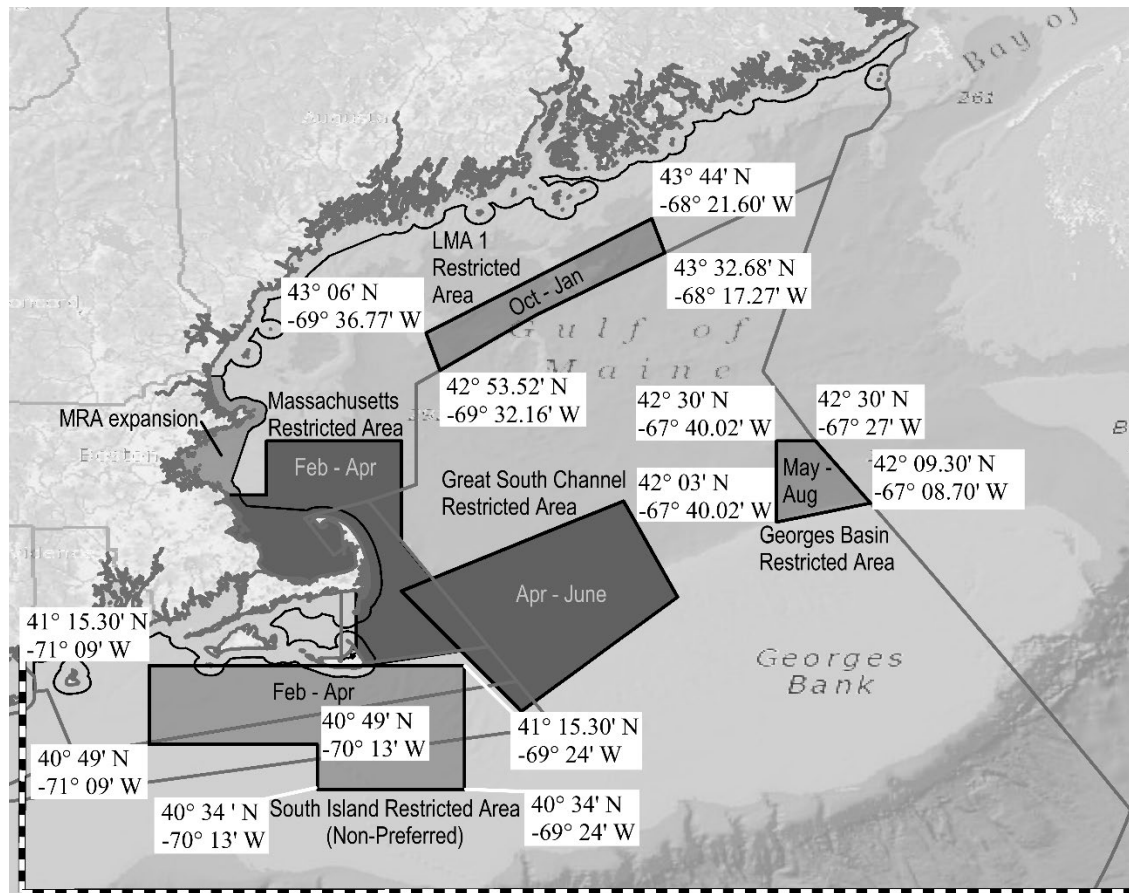


Figure 9.3: The restricted area options proposed in Alternative 3 (Non-preferred) shaded in light gray. The L-shaped South Island Restricted Area from February through April. The LMA 1 Restricted Area is proposed from October through February. The Georges Basin Restricted Area is proposed from May through August. An expansion of the MRA into Massachusetts state waters to the New Hampshire border and extended through at least May 15th, with a potential opening if whales are no longer present, is also included. In dark gray are existing seasonal restricted areas that would become areas with restrictions to fishing with buoy lines, with the exception of the Outer Cape LMA.

9.6 Regulatory Impact Review

9.6.1 Baseline for Comparison

The baseline for the economic analysis is the Alternative 1, which requires no action, and the baseline year is 2017.

9.6.2 Time Horizon

The rule is expected to be published in Oct 2021, and last for six years based on the average time for a round of rulemaking in the past. Therefore, the stream of costs and benefits would start in year 2021, and end in year 2026.

9.6.3 Benefit-Cost Framework

Benefit-cost analysis (BCA) is the preferred method for analyzing the consequences of a regulatory action such as modifying the requirements of the ALWTRP. BCA is a well-established procedure for assessing the "best" course or scale of action, where "best" is that course which maximizes net benefits (i.e., benefits minus costs). Because BCA assesses the value of an activity in net benefit terms, it requires that a single metric, most commonly dollars, be used to gauge both benefits and costs. The data and economic models necessary to estimate costs may be difficult or costly to gather and develop, and a comprehensive analysis of the costs associated with a regulatory action is not always feasible. Nonetheless, the principle is straightforward, and it is generally possible in practice to develop a monetary estimate of at least some portion of regulatory costs. This is the case for costs stemming from changes to the ALWTRP, which would impose additional restrictions on commercial fishing operations.

Assessing the benefits of changes to the ALWTRP in a BCA framework is also straightforward in principle but much more difficult in practice. To the extent that new regulations would reduce the risk that whales will suffer serious injury or mortality as a result of entanglement in commercial fishing gear, they would produce real benefits. Ideally, these benefits would be measured first by a biological metric, and then by a dollar metric. A biological metric could take the form of the percentage of risk reduction, the associated expected decrease in extinction risk, increase in the annual growth of the population, or similar measures. A BCA would then value these quantified biological benefits in terms of willingness-to-pay, the standard economic measure of economic value recommended by the Office of Management and Budget (OMB 2003). This would produce a dollar estimate of the benefits of the change in regulations, which could then be compared directly to the costs. In the case of the ALWTRP, however, the data required to complete such an analysis are not available. Estimation of the economic benefits attributable to each of the regulatory alternatives that NMFS is considering would require a more detailed understanding of the biological impacts of each measure than current models can provide. It also would require more extensive research than economists have conducted to date on the relationship between conservation and restoration of these species and associated economic values.

In the absence of the information required to conduct a full BCA, the discussion that follows presents qualitative information on the benefits that may stem from improved protection of endangered whales, coupled with a quantitative indicator of the potential impact of each alternative. It then presents estimates of the costs attributable to each alternative. As discussed later in this chapter, the analysis uses this information to evaluate the cost-effectiveness of the regulatory alternatives under consideration. Because the alternatives vary with respect to the benefits they would achieve, it is not possible to identify a superior option based on cost-effectiveness alone. Nonetheless, the cost-effectiveness figures provide a useful means of comparing the relative impacts of the regulatory provisions that each alternative incorporates.

9.6.4 *Economic Analysis of Alternatives*

9.6.4.1 **Benefits of Large Whale Protection**

Since the suspension of commercial whaling in the United States, there has been no conventional market for the consumptive use of products derived from whales. While it is difficult to establish

the full value of reducing risks to large whales, whale protection and associated increases in whale populations can be described in terms of two types of benefits: (1) non- consumptive use benefits; and (2) non-use benefits.

9.6.4.1.1 Non-Consumptive Use Benefits

A variety of recreational activities involve the non-consumptive use of natural resources, either in a market or non-market context. The opportunity to enjoy one such activity, whale watching, has fostered the development of the commercial whale watching industry. Although current data on the industry are lacking, a study by Hoyt (2000) suggests that roughly half of all commercial whale watching worldwide occurs in the U.S., and that much of this activity is centered in New England. As shown in Table 9.3, the Hoyt study identified 36 whale watching businesses in New England, with most operating multiple vessels. Hoyt estimated that over one million individuals each year take whale watching tours in the region, generating over \$30 million in annual revenue for the industry. Because these figures only apply to permitted and registered operations, the full scale and economic impact of whale watching activity is likely to be greater.

Another study by Cisneros-Montemayor et al. (2010) suggests that global whale watching industry would generate over \$2.5 billion (2009) in yearly revenue and about 19,000 jobs around the world. The U.S. and Canadian whale watching industry could create 3,657 jobs yearly from six marine mammal species within their Exclusive Economic Zones.

Ralph et. al.(2019) from International Monetary Fund point out whales have a multiplier effect of increasing phytoplankton production wherever they go, and these microscopic creatures not only contribute at least 50 percent of all oxygen to our atmosphere, they do so by capturing about 37 billion metric tons of CO², an estimated 40 percent of all CO² produced. Therefore, enhancing protection of whales from human-made dangers would deliver multiple benefits to the human beings as well as the planet. Their conservative estimates put the value of the average great whale, based on its various activities, at more than \$2 million, and easily over \$1 trillion for the current stock of great whales.

Table 9.3: New England whale watching industry

State	Number of Operations	Number of Vessels	Annual Ridership	Annual Revenue (millions \$)
Maine	14	18-24	137,500	\$4.4
New Hampshire	4	6-10	80,000	\$1.9
Massachusetts	17	30-35	1,000,000	\$24.0
Rhode Island	1	1	12,500	\$0.3
TOTAL	36	55-70	1,230,000	\$30.6

Source: Hoyt 2000

A special report from the International Fund for Animal Welfare (O'Connor et al. 2009) pointed out that whale watchers in the New England area decreased by 3 percent per year from 1998 to 2008 (Table 9.4). This negative annual growth rate was very likely in relation to poor numbers of whale sightings. The Stellwagen Bank National Marine Sanctuary Draft Management Plan

quotes various reports suggesting a decline of one of the main food sources for fin and humpback whales was causing the decline in whale sightings. Several studies have linked whale sightings to concentrations of a small, semi-pelagic fish called sand lance (NOAA 2008). Although the number of whale watch operators and passengers decreased from 1998 to 2008, average passenger fees increased from \$25 to \$38 resulting in an increase of 14 percent in direct sales to whale watch operators and an increase of 17 percent in sales in the economy.

Table 9.4: Change in the number of whale watchers and expenditures (Gross Sales) from 1998 to 2008 in New England

Year	Number of Whale Watchers	Number of Operators	Direct Expenditure	Indirect Expenditure	Total Expenditure
1998	1,240,000	36	\$30,600,000	\$76,650,000	\$107,250,000
2008	910,071	31	\$35,000,000	\$91,000,000	\$126,000,000

It is not feasible at present to estimate the impact of potential modifications to the Plan on the values in the whale watching market. Estimation of these impacts would require the ability to forecast the impact of various management measures on the population of whales, coupled with a far more detailed understanding of the relationship between an increase in this population and demand for viewing opportunities. Given the level of activity in the industry, however, it is reasonable to assume that the benefits associated with additional opportunities to see, photograph, and otherwise experience whales in their natural environment could be substantial.

9.6.4.1.2 Non-Use Benefits

The protection and restoration of populations of endangered whales may also generate non-use benefits. Economic research has demonstrated that society places economic value on (relatively) unique environmental assets, whether or not those assets are ever directly exploited. For example, society places real (and potentially measurable) economic value on simply knowing that large whale populations are flourishing in their natural environment (often referred to as “existence value”) and will be preserved for the enjoyment of future generations. Using survey research methods, economists have developed several studies of non-use values associated with protection of whales or other marine mammals. Table 9.5 summarizes these studies. In each, researchers surveyed individuals on their willingness to pay (WTP) for programs that would maintain or increase marine mammal populations. The most recent of the studies (Wallmo and Lew 2012) employed a stated preference method to estimate the value of recovering or down-listing eight ESA-listed marine species, including the right whale. Through a survey of 8,476 households, the authors estimated an average WTP (per household per year, for a 10-year period) of \$71.62 for full recovery of the species and \$38.79 for recovery sufficient to down-list the species from “endangered” to “threatened.” While the other studies noted do not focus specifically on the North Atlantic populations of right, humpback, fin, or minke whales, they do demonstrate that individuals derive significant economic value from the protection of marine mammals.

9.6.4.2 Costs of Large Whale Protection

9.6.4.2.1 Cost Savings on Disentanglement Effort

In addition to federal and state protective measures, disentanglement efforts have been extensively applied to large whale conservation after sightings of entangled whales. Despite life-threatening risks for disentangling team members, it is also extremely time consuming and costly to conduct consistent monitoring and disentanglement. According to the Center of Coastal Studies based in Provincetown, Massachusetts, the largest disentanglement team in the Northeast, the annual cost for the team is about \$400,000. There are about ten similar teams including both federal, state, and local organizations within the Atlantic Large Whale Disentanglement Network in the United States, and more efforts from the Canadian counterparts. Fewer encountering of whales and the fishing gear could potentially save these high costs.

Table 9.5: Studies of non-use value associated with marine mammals

Author	Title	Findings
Lew (2015)	Willingness to Pay for Threatened and Endangered Marine Species: A Review of the Literature and respects for Policy Use	Comprehensive literature review on the methods and case studies on WTP for threatened and endangered marine species.
Wallmo and Lew (2012)	Public Willingness to Pay for Recovering and Downlisting Threatened and Endangered Marine Species	Per-household mean WTP annually over 10 years for increase in right whale populations estimated to be \$71.62 (for recovery) and \$38.79 (for down-listing to threatened status) (2010 dollars).
Giraud et al. (2002)	Economic Benefit of the Protection of the Steller Sea Lion	Estimated WTP for an expanded Steller sea lion protection program. The average WTP for the entire nation amounted to roughly \$61 per person.
Loomis and Larson (1994)	Total Economic Values of Increasing Gray Whale Populations: Results From a Contingent Valuation Survey of Visitors and Households	Mean WTP of U.S. households for an increase in gray whale populations estimated to be \$16.18 for a 50-percent increase and \$18.14 for a 100 percent increase.
Samples and Hoyler (1990)	Contingent Valuation of Wildlife Resources in the Presence of Substitutes and Complements	Respondents' average WTP (lump sum payment) to protect humpback whales in Hawaii ranged from \$125 to \$142 (1986 dollars).
Samples et al. (1986)	Information Disclosure and Endangered Species Valuation	Estimated individual WTP for protection of humpback whales of \$39.62 per year.
Day (1985), cited in Ramage (1990)	The Economic Value of Whalewatching at Stellwagen Bank. The Resources and Uses of Stellwagen Bank	Non-use value of the presence of whales in the Massachusetts Bays system estimated to be \$24 million.
Hageman (1985)	Valuing Marine Mammal Populations: Benefit Valuations in a Multi-Species Ecosystem	Per-household WTP for Gray and Blue Whales, Bottlenose Dolphins, California Sea Otters, and Northern Elephant Seals estimated to be \$23.95, \$17.73, \$20.75, and \$18.29 per year, respectively (1984 dollars).

9.6.4.2.2 Relative Ranking of Alternatives

As noted above, it is not feasible at present to estimate the economic benefits attributable to each of the regulatory alternatives that NMFS is considering. It is possible, however, to develop a relative ranking of the alternatives with respect to potential benefits, based on the estimated

impact of each alternative on the potential for whales to become entangled in commercial fishing gear.

The biological impacts analysis presented in Chapter 5 relies primarily on NMFS' Vertical Line Model to examine how the regulatory alternatives might reduce the possibility of interactions between whales and fishing gear. As discussed in that chapter, the model integrates information on fishing activity, gear configurations, and whale sightings to provide indicators of the potential for entanglements to occur at various locations and at different points in time. The fundamental measure of entanglement potential is co-occurrence. The co-occurrence value estimated in the model is an index figure, integrated across the spatial grid, indicating the degree to which whales and the buoy line employed by the Northeast Region lobster and Jonah crab trap/pot fisheries coincide in the waters subject to the ALWTRP. Biological impacts are characterized with respect to the percentage reduction in the overall co-occurrence indicator each alternative would achieve.

Table 9.6 summarizes the estimated change in co-occurrence under each action alternative relative to the no action alternative (Alternative 1). Alternative 2 (Preferred), which includes trawl length requirements, weak rope or weak inserts, and restricted areas, is estimated to yield a reduction in co-occurrence of approximately 65 percent (54 percent without the MRA credit). Alternative 3 proposes a 50-percent line cap reduction in federal waters, seasonal trawl length requirements, more extensive weak rope, and restricted areas, yielding a 60 percent reduction in co-occurrence. Though Alternative 3 reaches a high reduction score, the compliance costs of large restricted areas and line reduction measures are higher compared to Alternative 2.

Table 9.6: Annual Change in Co-Occurrence between right whales and buoy lines in the Northeast Region

Alternative	Percent Reduction in Co-Occurrence
Alternative 1 (No Action)	0
Alternative 2 (with MRA credit)	65
Alternative 2 (without MRA credit)	54
Alternative 3	60

The costs attributable to the introduction of new regulations on the fisheries subject to the Plan would be borne primarily by commercial fishermen, particularly those in the lobster fishery. This fishery includes thousands of licensed participants, none of whom account for a substantial share of the market. As a result, those in the harvest sector lack the ability to raise prices to cover any increase in their operating costs; the price they receive for their landed catch is dictated by market conditions, which can vary considerably from season to season. Thus, the costs of complying with new regulatory requirements are likely to be reflected in changes in fishing behavior or reductions in fishing effort.

The economic impact analysis developed for this document provides detailed estimates of the compliance costs associated with potential changes to the ALWTRP. The analysis estimates compliance costs for model vessels and extrapolates from these findings to estimate the overall

cost to the commercial fishing industry of complying with the regulatory changes under consideration. The analysis measures the cost of complying with new requirements relative to the status quo – i.e., a baseline scenario that assumes no change in existing Plan requirements. Thus, all estimates of compliance costs are incremental to those already incurred in complying with the ALWTRP. All costs are presented on an annualized basis and reported in 2020 dollars where annualized costs reflect initial and replacement costs over time. The calculation of annualized costs is based on a discount rate of 7 percent, consistent with current OMB guidelines. We also use a discount rate of 3 percent to test the sensitivity of the analysis. The timeline for the rulemaking is assumed to be six years, which has been the interval between Plan modifications.

The discussion that follows summarizes the estimated cost of complying with each of the regulatory alternatives that NMFS is considering. Additional detail on the methods and results of the economic impact analysis can be found in Chapter 6.

9.6.4.2.3 Compliance Cost Estimation Methods

As discussed above, Alternatives 2 (Preferred) and 3 propose modifications to the ALWTRP that include some combination of trawling requirements, weak rope, the seasonal restricted areas, and gear marking requirements. The methods employed to estimate the costs attributable to these requirements are described below.

9.6.4.2.3.1 Trawling Requirements

A major component of Alternative 2 is a minimum trawl length requirement – i.e., prohibiting trawls of less than a specified number of traps or pots – for lobster and Jonah crab trap/pot fisheries in the Northeast Region. The exact nature of this requirement varies by alternative and location. The costs that fishermen are likely to incur in complying with such requirements are primarily composed of gear conversion costs and landed catch impacts.

Vessels fishing fewer traps/trawl configurations (e.g., singles, doubles) would need to reconfigure their gear to comply with trawling requirements. These changes may require expenditures on new equipment as well as investments of fishermen's time. Analysis of the economic impact of the trawling requirements entails comparing the baseline configuration of gear assigned to model vessels in NMFS' Vertical Line Model with the minimum trawl length that would be required under each regulatory alternative. The analysis identifies instances in which the reconfiguration of gear would be required, estimates the material and labor necessary to bring all gear into compliance, and calculates the resulting cost. Equipment costs are a function of the quantity of gear to be converted and the unit cost of the materials needed to satisfy the trawling requirement. Labor costs are a function of the time required to implement a specific modification, the quantity of gear to be converted, and the implicit labor rate. All costs are calculated on an incremental basis, taking into account any savings in material or labor costs that might result from efforts to comply with new ALWTRP regulations.

In addition to the direct cost of gear conversion, catch rates (in these analyses referring to the catch brought back to port and sold, also known as landed catch or landings) may decline for vessels that are required to convert from shorter sets to longer trawls, reducing the revenues of affected operations. To estimate impacts in the lower bound, the analysis assumes that vessels

implementing a major increase in trawl length (an increase of a factor of three or more in the number of traps in each set) would experience a 5-percent reduction in their annual catch. In the upper bound, the analysis assumes that these vessels would experience a 10 percent reduction in catch. Vessels with an increase of less than three traps per trawl would experience a 0-5 percent catch reduction for lower and upper bound estimates. The resulting impact on each vessel's annual revenues is based on prevailing ex-vessel prices for lobster.

9.6.4.2.3.2 Weak Rope Requirements

All vessels in federally regulated Northeast waters are required to comply with weak rope requirements. Some state waters have their own regulations and some mirror the federal regulation. To comply with the new weak rope requirement, vessels in different areas need to add one or more weak insertions into their buoy lines, or replace their entire line with weak line if they are stronger than 1,700 lb (771 kg) strength.

Alternative 2 requires areas except for LMA 3 to insert weak points into the original ropes to make them weak. LMA 3 gears are required to have 75 percent of one buoy line to be fully engineered weak rope. In Alternative 3, all areas but LMA 3 are required to have both buoy lines to be 75 percent weak, and LMA 3 to have one buoy line 75 percent weak during May to August and the other buoy line 20 percent weak year round.

The cost of weak rope consists of material and labor cost. The South Shore sleeve is the most widely available weak insert available for purchase. The sleeve costs \$2 a piece and five minutes to install. The labor rate is the same as calculated in trawling requirements. Fully engineered weak rope is not available in the market right now, but a price quote from a gear manufacturer was used for this analysis.

9.6.4.2.3.3 Seasonal Buoy Line Closure Requirements

The analysis of the costs associated with the seasonal restricted areas begins by using the Vertical Line Model to estimate the number and type of vessels ordinarily active in each area during the proposed restricted area period. Depending on the location of the restricted area, fishermen could react in two ways: they may relocate their traps outside the restricted area if they have an available permit and their vessels allow them to do so; or they may remove buoy lines from the area by either fishing ropelessly or suspending fishing if their permit or vessel characteristics would not allow them to move to an alternative location to set their gear. For relocated vessels, we calculate the change in travel related costs, which could be an extra fuel cost or some savings on fuel cost, depending on feasible relocation areas. We also assume a 5-10 percent catch reduction because fishermen have to move out from their preferred fishing grounds. This takes into account possible saturation effects associated with setting gear in areas they do not normally fish and/or areas that are already being fished by other vessels. To evaluate removal of buoy lines, we calculated the cost of suspending fishing including both forgone fishing revenue and saved operating costs. The cost of ropeless fishing, which could provide access to buoy line closure areas, was not estimated. The technology as currently available costs a minimum of \$5,000 per buoy line. Fishing fixed gear without buoy lines would require exemptions under other fishery management regulations. Unless purchase of ropeless gear is subsidized and until surface system requirements are modified to allow fishing without an

exempted fishing permit, ropeless fishing is likely to occur on a very low scale by fishermen interested in improving the technology under commercial fishing conditions.

9.6.4.2.3.4 Gear Marking Requirements

The proposed action would implement additional gear marking requirements compared to no action. Under Alternative 2 (Preferred), NMFS would mirror the Maine state regulations for all non-exempted waters, and would implement analogous marking for the other New England states. In state waters, the gear marking requirement would include one state-specific 3-foot (91cm) colored mark within 2 fathoms (3.7 m) of the buoy and at least two additional 1-foot (30 cm) marks in the top and bottom half of the gear. In federal waters, in addition to the top 3-foot (91 cm) mark, an additional green 1-foot (30 cm) mark would be required in the top 2 fathoms (3.7 m) of line, and at least three 1-foot (30 cm) marks would be required in the top, middle, and bottom of the buoy line below the surface system. Within 6 inches of each 1-foot state-colored mark, another 1-foot green mark would also be required to distinguish lines in federal waters from state waters. This Alternative would continue to allow multiple methods for marking line below the surface system (paint, tape, rope twine inserts, etc), with highly visible paint required for the 3-foot mark in the surface system. Under Alternative 3 (Non-preferred) the 3-foot (91 cm) state-specific color would be marked on the buoy line within two fathoms (3.7 m) of the buoy, as in the Preferred, but the entire line would also have to be replaced with a line woven with identification tape with the home state and fishery (for example Maine, lobster/crab trap/pot) repeated in writing along the length of the buoy line.

ID tape ropes are not available at this time. Suppliers that have produced it in small batches could not provide an estimate of the price range. On a conservative basis, here we assume that cost of ID tape rope will be twice as much as conventional rope, which costs \$0.11 per foot for 3/8-inch (0.95 cm) diameter rope and \$0.26 per foot for 3/4-inch (1.9 cm) diameter rope. Table 6.20 describes the gear marking cost for Alternative 2 and 3.

9.6.4.2.4 Compliance Costs

As noted in Chapter 6, the economic analysis is designed to measure regulatory compliance costs on an incremental basis i.e., to measure the change in costs associated with a change in regulatory requirements. If no change in regulatory requirements is imposed as would be the case under Alternative 1 the economic burden attributable to the ALWTRP would be unaffected. Thus, Alternative 1 would impose no additional costs on the regulated community.

The present value and annualized value of cost changes in Alternative 2 and Alternative 3 are presented in Table 9.7. In general, the largest cost changes originate from the assumed catch impacts associated with the gear configuration change. If using 7 percent discount rate, in Alternative 2, trawling up measures were estimated to cost between \$2.5 million and \$8.3 million per year. Under Alternative 3, a 50-percent buoy line reduction would cost \$5.5 million to \$14.4 million per year.

Weak rope requirements cost \$0.5 million per year in Alternative 2, but cost around \$2.2 million per year in Alternative 3 because fully engineered weak ropes are required for most buoy lines. Alternative 2 gear marking measures would cost \$5.8 million to \$7.8 million per year, while ID

taped rope required in Alternative 3 cost \$18.2 million per year. The compliance costs of the Alternative 2 restricted areas range from \$1.6 million to \$2.5 million. Restricted areas in Alternative 3 cost \$3.7 million to \$5.1 million per year for fishermen due to the large coverage and extended time period.

The total annualized cost of all proposed measures for Alternative 2 including gear marking, weak rope, restricted area, and gear conversion costs range from \$10.5 million to \$19.1 million, much lower than the Alternative 3, which range from \$29.6 million to \$40 million.

9.6.4.2.4.1 Transfers

There are no benefits or costs transferred to other fisheries as a result of this rule.

9.6.4.2.4.2 Uncertainties

A few assumption are made for this analysis. The first one is the effective time for the new rules would be six years. This assumption could affect the distribution of compliance costs as well as total value and annualized value.

Another key assumption is the catch reduction caused by trawl length. We assume the catch reduction impact is likely to decrease in magnitude after six years. Although no available data have shown a definitive relationship between trawl length and catch rate, an analysis by NEFSC lobster stock assessment group suggests that gear configuration change may lead to change in fishing effectiveness and efforts and then cause landing reduction. However, this is a dynamic process: landings drop in the first year that effort reductions are implemented, and then increase after a few years when fishermen adapt to the new regulations, reaching baseline landings between five and seven years after implementation and exceeding baseline catch in subsequent years.

VTR data have been used extensively in the calculation of catch per trap and trip percentage during the closed period. We are aware of that VTR are self-reported data and the catch and location data are limited in accuracy and variation for some vessels. However, the geographic information and gear configuration data could not be found in any other data sources consistently for trap and pot fisheries. In addition, the data quality has been largely improved in recent years due to the use of new technology like electronic reporting. Therefore, we decided to use the recent years' data after carefully reviewing and the removal of outliers. (See Appendix 6.2 for documentation)

It is also important to note that the analysis of the revenue losses associated with suspending fishing assumes that fishermen lose all the catch they would ordinarily harvest during the restricted period. The loss in landings may actually be less, depending on lobster movements and behavior. Specifically, some of the lobsters not caught during the restricted area may simply be harvested once the closed area is reopened (i.e., catch rates may be higher than normal following the restricted area). To the extent that this occurs, the analysis may overstate the economic losses associated with suspending fishing.

As previously noted, the inability to quantify and value the benefits of potential changes to the ALWTRP prohibits the use of BCA to identify the regulatory alternative that would provide the greatest net benefit. Instead, Table 9.7 summarizes the estimated cost of complying with each regulatory alternative, coupled with the estimated impact of each alternative on the Vertical Line Model's co-occurrence indicator.

9.6.4.2.4.3 Results

As taken from the Executive Order, the purpose of Executive Order 12866 is to enhance planning and coordination with respect to new and existing regulations. This E.O. requires the Office of Management and Budget (OMB) to review regulatory programs that are considered to be "significant." E.O. 12866 requires a review of proposed regulations to determine whether or not the expected effects would be significant, where a significant action is any regulatory action that may:

- Have an annual effect on the economy of \$100 million or more, or adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, priorities of the President, of the principles set forth in the Executive Order.

In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, include the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider.

As described in this section, from an economic perspective, the proposed action does not have an effect on the economy of \$100 million, however it does adversely affect fishermen and fishing businesses, and their ports and can be considered to raise novel legal or policy issues arising out of MMPA mandates. As such, the Proposed Action is considered significant as defined by EO 12866 and has undergone OMB review. NMFS has considered the cost information presented above and believes that Alternative 2 (Preferred) offers the best option for achieving compliance with MMPA and ESA requirements. In addition, Alternative 2 (Preferred) provides most of the benefits that would be achieved under more stringent alternatives, sacrificing only the relatively costly additional reduction in co-occurrence that would be achieved by extending the South Island Restricted Area into May. Based on these considerations, NMFS has identified Alternative 2 (Preferred) as its proposed approach to achieving the goals of the ALWTRP.

Table 9.7: Summary of Annualized Value and Present Value of Compliance Costs by Alternatives (2020 U.S. dollars, in millions)

	Discount Rate	Gear Marking Lower	Gear Marking Upper	Weak Rope	Trawling up Lower	Trawling up Upper	Restricted Area Lower	Restricted Area Upper	Line Cap Lower	Line Cap Upper	Total Lower	Total Upper
Alt 2 Total		27.8	37.1	2.2	12.1	39.8	7.8	12.0	0.0	0.0	50.0	91.1
Alt 2 AV	3%	5.1	6.8	0.4	2.2	7.3	1.4	2.2	0.0	0.0	9.2	16.8
Alt 2 AV	7%	5.8	7.8	0.5	2.5	8.3	1.6	2.5	0.0	0.0	10.5	19.1
Alt 3 Total		86.8	0.0	10.6	3.1	7.4	17.8	24.5	23.0	61.3	141.3	190.5
Alt 3 AV	3%	16.0	0.0	2.0	0.6	1.4	3.3	4.5	4.2	11.3	26.1	35.2
Alt 3 AV	7%	18.2	0.0	2.2	0.6	1.5	3.7	5.1	4.8	12.9	29.6	40.0

Notes:

1. Total values are in 2020 dollars, representing net present value of year 1 to year 6, in 2020 dollars.
3. AV represents annualized value of the net present value. It is an equalized yearly cost during the 6-year time period with 3% and 7% discount rate.

9.7 Final Regulatory Flexibility Analysis

The purpose of the Regulatory Flexibility Act (RFA) is to reduce the impacts of burdensome regulations and recordkeeping requirements on small businesses. To achieve this goal, the RFA requires federal agencies to describe and analyze the effects of proposed regulations, and possible alternatives, on small entities. Ultimately, the goal of the RFA analysis is to understand to what extent the action induces significant economic impacts on small entities. To this end, this document contains a Final Regulatory Flexibility Analysis (FRFA) prepared under §604 of the RFA, which includes an assessment of the effects that the proposed action and other alternatives are expected to have on small entities.

9.7.1 *Basis For and Purpose of the Rule*

9.7.1.1 **Description of Projected Reporting, Recordkeeping, and other Compliance Requirements of the Rule**

Requirements of the Action, including an estimate of the classes of small entities, will be subject to the requirement and the type of professional skills necessary for the required reporting and record keeping requirements.

This Final Rule contains a collection-of-information requirement subject to review and approval by OMB under the Paperwork Reduction Act (PRA), specifically the marking of fishing gear. This rule changes the existing requirements for the collection of information 0648-0364 by modifying gear marking for all buoy lines with the exemption of those fishing in Maine exempted waters in the Northeast Region Trap/Pot Management Area. As described in this preamble, mark colors will be changed for vessels identifying principal ports from Maine through Rhode Island to state-specific marks. Under the new marking scheme, a large 3-foot (91 cm) mark would be required within the top 2 fathoms (3.7 m) of the buoy in state and federal waters. Within state waters, at least two additional 12-inch (30.5 cm) marks would be required in the top and bottom of the main buoy line. In federal waters, at least three 12-inch (30.5 cm) marks would be required at the top, middle, and bottom of the main buoy line. In federal waters, an additional 12-inch (30.5 cm) green mark is required within 6 inches (15.3 cm) of each state specific mark (at least four in total, including the large mark in the surface system and at least three marks in the main buoy line). Each color mark must be permanently affixed on or along the line, and each color mark must be clearly visible when the gear is hauled or removed from the water. Paint and tape will be required for the surface system marks, and the commonly used colored ties and twine can be used within the main buoy lines. The changes from current gear marking include: The state color, the addition of a surface system mark, one less mark required in the main buoy line in state waters, and four additional marks required to distinguish federal waters. While Maine fishermen in non-exempt state waters have already marked their gear under Maine regulations, we include the costs of that effort in our calculation in response to comments that noted that the Maine regulations were implemented in anticipation of this rule. Additionally, we had previously assumed that about 20 percent of the gear marks were reapplied each year, but new information suggests they are applied annually. Using these assumptions, the public reporting burden for the Northeast Region lobster and Jonah crab gear marking requirements are estimated to affect 3,970 vessels that need to remark an average of 389 marks each year. Each

mark takes approximately 6.7 to 8.6 minutes to apply, depending on the size of the mark and method used. Applying the annual hourly wage rate for fishermen of \$26.5 results in a total estimated annual wage burden cost of \$4.5 to 5.9 million dollars. Approximately 3,086 of the total entities, as described in Section 9.7.3, are considered small entities that would be impacted during this rulemaking. This Final Rule includes conservation equivalencies that aim to minimize the impact of the measures on small entities.

We invite the general public and other federal agencies to comment on proposed and continuing information collections, which helps us assess the impact of our information collection requirements and minimize the public's reporting burden. Written comments and recommendations for this information collection should be submitted at the following website www.reginfo.gov/public/do/PRAMain. Find this particular information collection by using the search function and entering either the title of the collection or the OMB Control Number 0648-0364.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

9.7.1.2 Federal Rules Which May Duplicate, Overlap, or Conflict with the Rule

No duplicative, overlapping, or conflicting federal rules have been identified.

9.7.2 *Changes from Initial Regulatory Flexibility Analysis*

9.7.2.1 Significant Issues Raised by the Public in Response to the IRFA and Summary of the assessment of the agency of such issue

The Final Rule analyzed within this FRFA benefitted from substantial input from the public. NMFS' scoping and public outreach efforts are fully described in Section 1.5 of the FEIS prepared for this rulemaking. In addition to NMFS' efforts, gear configuration changes within the rule are largely informed by the Maine Department of Marine Resources and Massachusetts Department of Marine Fisheries proposals, as well as the Rhode Island Department of Environmental Management. These states also conducted substantial outreach with fishermen through local management councils and fishery associations.

After publication of the proposed rule and Draft Environmental Impact Statement, we received over 1,100 unique submissions and many submissions generated by non-governmental organization campaigns including some submissions with multiple signatures representing over 200,000 people. Many commenters including general public, fishermen, fishing industry representatives and state and federal regulators and legislators expressed concern that this rule would cause them extreme economic hardship, with some stating that this rule would put them out of business. Many commenters expressed concerns about the effects of this rule on the economic health of their communities, the supply chain, and on the state of Maine. Some of these commenters suggested that subsidies to fishermen should be provided to assist fishermen

impacted by this rulemaking. Appendix 1.1 of the FEIS lists these comments under Section 2 Economics and all received comments are represented in Appendix 3 of the FEIS.

Given the vast amount of industry input into the development of weak insertions, which would not require fishermen to replace buoy lines, and trawling up measures, many gear modifications implemented in the Final Rule were to control costs. However, the economic analysis in Chapter 6 indicates the cost of this rulemaking is up to \$19.2 million for the first year, which is 3 percent of the landings value of the lobster fishery in 2019.

NOAA reprogrammed some funds to support fishermen in complying with gear modification changes, but at this time funds have not been appropriated by Congress or further reprogrammed to reimburse fishermen. In December 2019, \$1.6 million in federal funds were reprogrammed from National Environmental Satellite, Data, and Information Service Procurement, Acquisition and Construction funds to support recovery actions for the right whale in the lobster/Jonah crab fishery. The funds were made available to fishermen through our partnership with the Atlantic States Marine Fisheries Commission (Commission). The funds were obligated to the Commission to collaborate with Maine, New Hampshire, Massachusetts, and Rhode Island to assist the lobster/Jonah crab fishery in adapting to and comply with the measures in this Final Rule and help to defray costs to support affected fishermen broadly.

9.7.2.2 Changes Made in the Rule as a Result of Comments

Major changes in the proposed rule include conservation equivalencies in Maine LMA 1 waters, LMA 2 waters and LMA 3 waters to mitigate the potential economic costs caused by the regulation.

Where risk reduction benefits were sufficient, conservation equivalencies requested through public comments on the DEIS and proposed rule to mitigate operational and safety concerns were accepted and are included in this final rule. These include conservation equivalencies in Maine LMA 1 waters, LMA 2 and LMA 3. To enable the Maine LMA 1 conservation equivalencies, this rule also modifies regulations implementing the Atlantic Coastal Fisheries Cooperative Management Act at 50 CFR 697.21(b)(2), increasing the maximum number of traps on a trawl with a single buoy line from three to ten in some Maine Zones. This would allow vessel operators to trawl up to a 20-trap trawl or to use two ten trap trawls with one buoy line. Additional changes made to accommodate conservation equivalency measures offered by the Maine Department of Marine Resources and supported by commenters from the Maine fishing industry, including modifications to the number of traps on a trawl or the number of weak insertions based on Maine fishery zones and distance from shore out to 12 nm (22.2 km). This rule also implements conservation equivalency recommendations submitted by Rhode Island and supported by Rhode Island fishermen, modifying the LMA 2 measures with more expansive weak insert requirements throughout the LMA rather than trawling up requirements that challenged the capacity of some Rhode Island vessels. Additionally, this rule implements some of the conservation equivalency recommendations submitted by the Atlantic Offshore Lobstermen's Association as public comments on the DEIS and Proposed Rule for LMA 3. F This rule implements three management areas in LMA 3 with three different trawling up requirements, requiring more traps/trawl in the Georges Basin area where there is more risk to right whales. This increase in number of traps per trawl off of Georges Basin was offset by a

lower number of traps required with in the Northeast Regions south of the 50 fathom depth contour on the south end of Georges Bank.

All these conservation equivalencies were created with input from fishermen from these areas, informed by their knowledge of measures that would best fit their economic, operational or safety needs. For LMA 2 vessels, the weak rope alternative implemented has less impact on catch and landings and therefore could have a lower economic impact compared to the LMA 2 measures analyzed in the IRFA..

This rule also modifies existing seasonal restricted areas that were closed to lobster and Jonah crab trap/pot fishing to allow ropeless fishing with exempted fishing permits (EFP). Under a revised restricted area definition, trap/pot fishermen could fish with trap/pot gear using “ropeless” methods, although an EFP would be required to exempt fishermen from surface marking requirements under other laws. Since 2018, NOAA has invested a substantial amount of funding in the industry's development of ropeless gear, in specific geographic areas and in general. We anticipate that these efforts to facilitate and support the industry's development of ropeless gear would continue, pending appropriations, and would be essential to defray costs for early adopters.

9.7.3 *Summary of the Action*

Table 9.1 lists the details of the Final Rule applied to lobster and Jonah crab fisheries in the Northeast Region. The Final Rule would increase the number of traps per trawl based on area fished and miles fished from shore in the Northeast Region. Trawling up regulations in all coastal regions would be managed based on distance from shore, primarily outside of exempt or state waters. In the Final Rule, existing restricted areas would be modified to be closed to fishing with persistent buoy lines. Massachusetts Restricted Area would be expanded into Massachusetts state waters north to the New Hampshire border from February through April in both state regulations and the Final Rule. Additionally, all state waters within the Massachusetts Restricted Area would be closed by Massachusetts until May 15th unless surveys demonstrate that whales have left the area. Two new seasonal restricted areas would be created that would allow fishing without the use of persistent buoy lines: one in LMA 1 from October through January and one south of Cape Cod from February through April. Fishing without the use of persistent buoy lines would be allowed during these seasons, outside of Cape Cod Bay and the Outer Cape Cod Lobster Management area. Measures also include conversion of a vertical buoy line to weak rope, or insertions in buoy lines of weaker rope or other weak inserts, with a maximum breaking strength of 1,700 lb (771.1 kg). The Final Rule also includes more robust gear marking requirements that differentiate buoy lines by state, includes unique marks for federal waters, and expands into areas previously exempt from gear marking.

9.7.4 *Description and Estimate of the Number of Small Entities to which the Rule Applies*

The RFA requires agencies to assure that decision makers consider disproportionate and/or significant adverse economic impacts of their proposed regulations on small entities. The Regulatory Flexibility Act Analysis determines whether the proposed action would have a

significant economic impact on a substantial number of small entities. This section provides an assessment and discussion of the potential economic impacts of the proposed action, as required of the RFA.

Section 3 of the Small Business Act defines affiliation as: Affiliation may arise among two or more persons with an identity of interest. Individuals or firms that have identical or substantially identical business or economic interests (such as family members, individuals or firms with common investments, or firms that are economically dependent through contractual or other relationships) may be treated as one party with such interests aggregated (13 CFR 121.103(f)). These principles of affiliation allow for consideration of shared interest that does not necessarily require common ownership. However, data are not available to ascertain non-ownership interest so we use an affiliated²⁴ vessel database created by the Social Sciences Branch (SSB) of NEFSC. There are three major components of this dataset: vessel affiliation information, landing values by species, and vessel permits. All federal permitted vessels in the Northeast Region from 2017 to 2019 are included in this dataset. Vessels are affiliated into entities according to common owners. The entity definition used by the SSB uses only unique combinations of owners.

The total number of directly regulated entities is based on permits held. Since this proposed regulation applies only to the pot/trap lobster businesses²⁵ in LMA 1, LMA 2, LMA 3, and OCC, only entities that possess one or more of these permits are evaluated. Then for each affiliation, the revenues from all member vessels of the entity are summed into affiliation revenue in each year. On December 29, 2015, the NMFS issued a final rule establishing a small business size standard of \$11 million in annual gross receipts for all businesses primarily engaged in the commercial fishing industry (NAICS 11411) for RFA compliance purposes only. The \$11 million standard became effective on July 1, 2016. Thus, the RFA defines a small business in the lobster fishery as a firm that is independently owned and operated with receipts of less than \$11 million annually. Based on this size standard, the three-year average (2017-2019) affiliation revenue is greater than \$11 million, the fishing business is considered a large entity, otherwise it is a small entity. Then we determine the number of impacted entities by examining the landing values of lobster. If one or more members of the affiliation landed lobster in 2019, this business will be considered an impacted entity in our analysis.

Regulated entities in this rulemaking include both entities with federal lobster permits and lobster vessels that only fish in state managed waters except for the exempted areas in Maine. Using vessel data from Vertical Line Model developed by the Industrial Economics (see Appendix 5.1 of FEIS for documentation), we identify 1,913 vessels that fished only in state waters outside Maine exempted areas. Due to the lack of owner and landing information of these vessels, we could not provide detailed analysis but have to assume all to be small entities. Using federal permit data, there are 1,547 distinct entities identified as directly regulated entities in this action, those that held lobster permits in LMA 1, 2, 3, or OCC, or some combination. So all together, 3,460 entities are regulated under this action. Table 9.8 displays the details of regulated entities holding federal permits. Of all 1,547 entities, only two of them are large. Within the

²⁴ We use terms affiliation, fishing business and entity interchangeably in this section.

²⁵ During the time period of our analysis (2017-2019), no specific permit needed for Jonah crab fishery. Beginning on December 12, 2019, only vessels that have a federal American lobster trap or non-trap permit may retain Jonah crabs.

1,545 small entities, 262 had no earned revenue from fishing activity even though they had a lobster permit. Because they had no revenue, they would be considered small by default. Among the 1,283 small entities with fishing revenue, 110 entities had no lobster landings. Therefore, 3,086 small entities would be considered as impacted small entities during this rulemaking. The average gross annual revenue for small entities with lobster landings was \$287,000 in 2019, and 91.5 percent of that is from lobsters. For small entities without lobster landings, their annual gross revenue was \$135,000. The average revenue for all small entities was about \$252,000. The revenue of large entities are not reported here for data confidentiality reasons.

Table 9.8: The number of regulated entities with federal permitted vessels and their lobster landing value percentage of annual gross revenue in 2019 (in 2020 U.S. \$)

	Large Entity	Lob% Large	Average Revenue Large	Small Entity	Lob% Small	Average Revenue Small	Total Entities
Fishing with Lobster Landing	2	83.9%	N/A	1,173	91.5%	\$287,000	1,175
Fishing Without Lobster Landing	0	0	N/A	110	0	\$135,000	110
No revenue	0	0	N/A	262	0	0	262
Total Entities	2		N/A	1,545		\$252,000	1,547

Notes: 1. The determination of large or small entity is based on three-year average affiliation revenue from 2017 to 2019. Lobster landing percentage is calculated using only 2019 data.

2. Gross annual average revenue for large entities are not reported here due to confidentiality concern

Source: Social Science Branch vessel affiliation data, 2017-2019

9.7.5 Description and Estimate of Economic Impacts on Small Entities

To calculate the average profitability of small entities and large entities, we need to deduct the operational costs and fixed costs from the annual gross revenue for each vessel (2017-2019), and then sum the profits of all vessels in each entity. A vessel by vessel evaluation is not feasible for this analysis, therefore we adopt the results from a lobster fleet profitability study based on cost survey data collected by SSB for fishing years 2010, 2011, and 2015 (Zou, Thunberg and Ardini, 2021). The profit was calculated by vessel size class, so we assign the profits to the affiliated vessel data by matching vessel length. Vessels less than 35 feet (10.7 meters) normally have a net profit of \$38,446²⁶, vessels between 35 and 45 (10.7 and 13.7 meters) feet have a net profit²⁷ of \$47,404; large vessels between 45 and 55 feet (13.7 and 16.8 meters) have an average profit of 73,063; and vessels above 55 feet (16.8 meters) have a profit of \$34,463. The average profit for small entities is about \$53,000, compared to their mean total revenue of \$287,000, a profitability of 18%. Due the small number of large entities, profit and revenue for these entities cannot be reported for confidentiality concerns. This also means that the economic impacts on large entities would not be reportable and for this reason the analysis herein is focuses only on economic impacts of the Final Rule on small entities

Measures implemented in the Final Rule are intended to reduce the probability of mortality and serious injury of large whales include weak ropes or weak insertions, minimum trawl length

²⁶ All values are in 2020 US dollars.

²⁷ We use net profit here instead of economic profit. Economic profit takes the opportunity cost of labor and capital away from the net profit, and end up with negative values for most vessels.

requirements, and seasonal restricted areas. Changes to gear marking requirements are also proposed to increase the chance of threat identification. These measures generate a series of compliance cost for small entities. Additional impacts on profits are estimated due to reduced revenue caused by catch reduction. In this section, we first identify the gear configuration change compliance costs year by year. Then we list the potential lost revenue from catch reduction and fuel cost changes, and finally we estimate the total profitability change for affected small entities.

Using the economic analysis methods identified above, Table 3 displays the gear configuration change compliance costs for all affected entities from Year 1 to Year 6. Year 0 is the status quo, so the compliance cost is zero, and we do not include it in the table. Weak rope only generates costs in Year 1. Trawling up would have cost savings of \$3.6 million on surface systems, also only in Year 1. It will be shown as a negative number in Table 3. Results indicate that fishermen would have to pay \$3.3 to \$4.8 million in the first year to comply with the gear configuration change in the Final Rule, and \$4.6 to \$6.2 million per year in the subsequent 5 years. In total 6 years, the gear compliance costs could be between \$26.5 and \$35.7 million. Table 4 shows the potential lost revenue from catch reduction and fuel consumption change caused by trawling up and restricted area measures. The total 6-year costs would be from \$23.5 to \$55.4 million. In total, the Final Rule would cost small entities about \$50 to \$91.1 million in 6 years (Table 5). If applied to roughly 3,086 affected small entities, the first year costs would range between \$3,200 and \$6,200 per vessel, but would be lower in Years 2-6. The Year 1 costs would result in an estimated reduction in profit for small entities ranging from 6 percent to 12 percent.

Table 9.9. Yearly compliance costs from gear configuration change (in 2020 U.S. \$, millions)

	Gear Marking Lower	Gear Marking Upper	Weak Rope	Trawling up	Total Lower	Total Upper
Year 1	4.6	6.2	2.2	-3.6	3.3	4.8
Year 2	4.6	6.2	0.0	0.0	4.6	6.2
Year 3	4.6	6.2	0.0	0.0	4.6	6.2
Year 4	4.6	6.2	0.0	0.0	4.6	6.2
Year 5	4.6	6.2	0.0	0.0	4.6	6.2
Year 6	4.6	6.2	0.0	0.0	4.6	6.2
Total	27.8	37.1	2.2	-3.6	26.5	35.7

Note: 1. The lower and upper bound for gear marking costs is due to different assumptions for marking methods in federal waters. The lower bound assumes that fishermen use duct tapes and conduct marking at shore, while the upper bound assumes that fishermen use twines at sea during transiting, which requires higher material costs and more time.

2. Negative number for trawling up means there is a cost saving from this measure.

Table 9.10. Yearly costs from catch reduction and fuel consumption changes (in 2020 U.S. \$, millions)

	Trawling up Lower	Trawling up Upper	Restricted Area Lower	Restricted Area Upper	Total Lower	Total Upper
Year 1	5.2	12.4	1.3	2.0	6.5	14.4
Year 2	4.2	11.2	1.3	2.0	5.5	13.2
Year 3	3.1	8.7	1.3	2.0	4.5	10.7
Year 4	2.1	6.2	1.3	2.0	3.4	8.2

	Trawling up Lower	Trawling up Upper	Restricted Area Lower	Restricted Area Upper	Total Lower	Total Upper
Year 5	1.0	3.7	1.3	2.0	2.4	5.7
Year 6	0.0	1.2	1.3	2.0	1.3	3.2
Total	15.7	43.4	7.8	12.0	23.5	55.4

Note: 1. The lower and upper bound costs for trawling up come from an assumption that vessels adding less than three traps would have a 0 to 5 percent catch reduction, and vessels adding three or more traps would have a 5 to 10 percent catch reduction.

2. The lower and upper bound costs for restricted areas come from an assumption that relocating vessels would have a 5 to 10 percent catch reduction.

Table 9.11: Yearly total cost and profitability change (In 2020 U.S. \$, millions)

	Total Costs Lower	Total Costs Upper	Profitability Change Lower	Profitability Change Upper
Year 1	9.8	19.2	6%	12%
Year 2	10.1	19.3	7%	13%
Year 3	9.1	16.9	6%	11%
Year 4	8.0	14.4	5%	9%
Year 5	7.0	11.9	5%	8%
Year 6	5.9	9.4	4%	6%
Total	50.0	91.1		

9.7.6 *Uncertainties in the economic analysis*

Regulated entities in this rulemaking include both entities with federal lobster permits and lobster vessels that only fish in state managed waters except for the exempted areas in Maine. Using vessel data from Vertical Line Model, we identify an additional 1,913 vessels that fished only in state waters outside Maine exempted areas. Due to the lack of owner and landing information of these vessels, we could not provide detailed analysis but have to assume all to be small entities.

For purpose of analysis the duration of the Final Rule was assumed to be six years based on the average time between ALWTRP rules in the past. With an anticipated implementation starting in 2021 the expected costs to regulated small entities would accrue through 2026. If the Final Rule remains unchanged the annual costs similar to that estimated for year 6 would be expected to continue.

Some caveats in economic analysis include:

1. In the analysis of gear conversion costs, there are a few assumptions: (1) the specific baseline configurations and gear elements used in each fishing area; (2) the cost and useful life of various gear elements; (3) the amount of labor needed to convert short sets to longer trawls; and (4) the implicit value of fishermen's time. There are uncertainties associated with each of these assumptions, but the overall direction of any potential bias in the resulting estimates of gear conversion costs is unclear.

2. For the catch impact of restricted areas, VTR data have been used extensively in the calculation of catch per trap and trip percentage during the restricted period. We are aware that VTR are self-reported data and the catch and location data are limited in accuracy and variation for some vessels. However, the geographic information and gear configuration data could not be found in any other data sources consistently for trap and pot fisheries. In addition, the data quality has been largely improved in recent years due to the use of new technology like electronic reporting. Therefore, we decided to use the recent years' data after carefully reviewing and the removal of outliers.
3. In the analysis of the revenue losses associated with suspending fishing, we assume that fishermen lose all the catch they would ordinarily harvest during the restricted period. The loss in landings may actually be less, depending on lobster movements and behavior. Specifically, some of the lobsters not caught during the closure may simply be harvested once the closed area is reopened (i.e., catch rates may be higher than normal following the restricted area). To the extent that this occurs, the analysis may overstate the economic losses associated with suspending fishing.

9.8 References

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CHAPTER 10 APPLICABLE LAWS

10.1 Magnuson-Stevens Fishery Conservation and Management Act Including Essential Fish Habitat

The Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act require the National Marine Fisheries Service (NMFS) to provide recommendations to federal and state agencies for conserving and enhancing EFH if a determination is made that an action may adversely impact EFH. NMFS policy regarding the preparation of National Environmental Policy Act (NEPA) documents recommends incorporating EFH assessments into environmental impact statements; therefore, this Final Environmental Impact Statement (FEIS) will also serve as an EFH assessment.

Pursuant to these requirements, Chapter 3 of this document provides a description of the alternatives considered for amending the Atlantic Large Whale Take Reduction Plan (ALWTRP or Plan). Chapter 4 provides a description of the affected environment, including the identification of areas designated as EFH (section 4.2.1), Habitat Areas of Particular Concern (section 4.2.2), and an analysis of the impacts of fishing gear on that environment (section 4.2.4). Chapter 5 evaluates the impacts on EFH of the current action and other alternatives. An EFH consultation concluded on May 26, 2021 concluded that adverse impacts to EFH have been minimized to the extent practicable and no further EFH Conservation recommendations pursuant to 50 CFR §600.925(a) were provided.

10.2 National Environmental Policy Act

The analysis in this document was prepared in full compliance with the requirements of the NEPA. All established procedures to ensure that federal agency decision makers take environmental factors into account, including the use of a public process, were followed (Table 10.1 Summary of Scoping Comments). This EIS is being prepared using the 1978 Council on Environmental Quality (CEQ) NEPA Regulations. NEPA reviews initiated prior to the effective date of the 2020 CEQ regulations may be conducted using the 1978 version of the regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020. This review began on August 2, 2019 (Notice of Intent published on this date) and the agency has decided to proceed under the 1978 regulations. This FEIS contains all the components required by NEPA, CEQ Regulations for Implementing NEPA, and National Oceanic and Atmospheric Administration (NOAA) Administrative Order 216-6A, including a brief discussion of the purpose and need for the proposal (Chapter 2), the alternatives considered (Chapter 3), the environmental impacts of the current action and the alternatives (Chapter 5), a list of document preparers and contributors (Chapter 12), and other relevant information.

NEPA provides a mechanism for identifying and evaluating the full spectrum of environmental issues associated with federal actions, and for considering a reasonable range of alternatives to avoid or minimize adverse environmental impacts. The CEQ has issued regulations specifying the requirements for NEPA documents (40 CFR 1500 – 1508) and NOAA's policy and procedures for NEPA are found in NOAA Administrative Order 216-6A. All of those

requirements are addressed in this document, as referenced below. The required elements of an Environmental Impact Statement Assessment (EIS) are specified in 40 CFR 1502.10. They are included in this document as follows:

- A Cover Sheet
- An Executive Summary
- A table of contents
- The purpose and need for this action - Section 2.2
- The alternatives that were considered – Chapter 3
- Affected environment – Chapter 4
- Environmental consequences, including cumulative effects – Chapters 5 through 8
- A list of preparers - Chapter 11
- A Glossary
- Appendices (if any)

10.2.1 *Public Scoping*

We announced our intent to prepare an EIS for this action on August 2, 2019 (84 FR 37822) and held eight public meetings as well as requesting written public comments on management options to reduce the risk of large whale entanglements in trap pot fisheries. During the public scoping process, which ended September 16, 2019, NMFS requested suggestions and information from the public on the range of issues that should be addressed and alternatives that should be considered in this document. Over 89, 200 comments were received. Comments included oral comments received during scoping meetings attended by over 800 people. Posted letters were received from each New England state's fishery management organization, from the Marine Mammal Commission, Atlantic States Marine Fisheries Commission, the Maine Congressional delegation, and a Maine State representative. Four fishing industry representatives sent comments by mail or email, and over 50 unique letters from fishermen providing details about their fishing practices were received by postal mail as well as 125 form letters. By email, we received over 120 unique comments, including 30 emails from fishermen or fishing families. Eleven representatives from environmental organizations sent letters and emails, and over 89,000 emails associated with 12 non-governmental organizations' campaigns were received. A summary of the written and oral comments received during the public scoping process identifying where those comments are addressed in this FEIS can be found in Appendix 1.1 and Volume 3.

10.2.2 *Areas of Controversy*

Litigation related to this action is ongoing, and the action has received close attention from the Maine Congressional Delegation as well as members of the fishing industry and conservation organizations, demonstrating that it is highly controversial. Known and anticipated areas of controversy are discussed in detail in Section 1.5 of this FEIS, but primary issues include the following:

- Ongoing litigation is largely related to non-governmental organizations' and whale conservationists' concerns that rapid changes to current fishing practices are needed to

address impacts to right whales in U.S. fisheries and reverse the decline of the population.

- The alternatives considered in this FEIS are consistent with, but not identical to, the Atlantic Large Whale Take Reduction Team recommendations to NMFS in April 2019 (see Table 3.1). Additionally, as described in Section 3.1.1, while measures proposed by New England states provided the basis for the alternatives analyzed, not all measures proposed by the states are included in the Preferred Alternative. Particularly, a seasonal buoy line closure area 30 miles offshore of Maine was not proposed by Maine or the Take Reduction Team.
- Northeast U.S. trap/pot fishermen are frustrated that after two decades of modifying their fishing practices, the North Atlantic right whale population is declining. Fishermen are concerned that some of the major causes of decline, such as climate change and mortality in Canada, are not being sufficiently addressed and that as a result the burden of reversing the population decline is being disproportionately placed on the Northeast U.S. lobster and crab fisheries.
- The fishing industry and some states have criticized the assessment of the amount of risk reduction (60 to 80 percent) that NMFS indicated needed to be achieved in U.S. trap pot fisheries. As discussed in Chapter 3, it is difficult to identify the initial location of fishing gear that causes serious injury and mortalities to right whales because in most cases no gear is retrieved or if retrieved the gear cannot be identified to a fishery or location. U.S. fishermen disagree with the apportionment of mortality and serious injury assigned to them, and lobster fishermen disagree with the apportionment attributed toward trap/pot or lobster buoy line.
- Stakeholders and commenters criticized the Decision Support Tool (DST) created to help the Team compare risk reduction measures. A recent peer review of the DST recommended a number of improvements but also determined it was a useful tool for assisting the Team in making risk reduction decisions.
- There is continued frustration expressed by fishermen regarding gaps in information about right whale distribution and habitat use, which influences risk reduction targets as well as DST and co-occurrence model evaluation of risk reduction alternatives towards achieving targets. Research needs include amplification of distribution surveys across the range, right whale tagging, and research to support predictions of future shifts in food availability and distribution.
- Similar data concerns were expressed by Team members during meetings regarding gaps in lobster and Jonah crab fishery data. Increased vessel trip reporting and vessel monitoring are needed to inform the DST and co-occurrence models to evaluate the fishery and the risk reduction measures.

Chapter 2 discusses evidence that mortalities and serious injuries of right whales in U.S. fisheries continues to occur at rates above the potential biological removal level established in the Marine Mammal Protection Act (MMPA). Modifications to the Plan are necessary at this time. Chapter 3 describes how, considering the best available information, risk reduction measures in Alternatives 2 and 3 were developed to reduce the risk of mortality and serious injuries in the lobster and crab fisheries toward achieving PBR.

10.2.3 *Document Distribution*

This document is available on the NMFS Greater Atlantic Regional Fisheries Office [ALWTRP web page](#). Announcements of document availability will be made in the *Federal Register* and to the interested parties' mailing list. Copies were distributed to:

U.S. EPA, Region 1
1 Congress St., 11th Floor
Boston, MA 02203-0001

District Commander
First U.S. Coast Guard District
408 Atlantic Avenue Boston, MA 02210-2209

U.S. EPA, Region 2
290 Broadway,
25th Floor
New York, NY 10007

Director, Office of Marine Conservation
Department of State
2201 "C" Street, NW
Washington, DC 20520

U.S. EPA, Region 3
1650 Arch Street
Philadelphia, PA 19106

Executive Director
Marine Mammal Commission
4340 East-West Highway
Bethesda, MD 20814

U.S. EPA, Region 4
61 Forsyth Street
Atlanta, GA 30303

Director, Office of Environmental Policy and Compliance
U.S. Department of Interior
Main Interior Building (MS 2462)
1849 "C" Street, NW
Washington, DC 2052

10.2.4 *Opportunity for Public Comment*

The current Amendment to the Plan was developed between 2019 and 2021. Several opportunities for public input were provided during this time. Public scoping took place in August of 2019. A 60-day public comment period began for the Proposed Rule on December 31, 2020, and ended on March 1, 2021 (85 FR 86878, December 31, 2020). In January 2021, we held four public information sessions and in February 2021, we held four public hearings, all virtual due to the global COVID-19 pandemic. Although the purpose of the January meetings was to provide information and answer questions, we accepted oral comments on the proposed rule and the Draft EIS at all eight meetings. A summary of the written and oral comments received during the public scoping and public comment period can be found in Appendix 1.1 and Volume 3. The public meetings held are as follows:

Public Scoping

1. Thursday, August 8, 2019—Narragansett, RI, 6 p.m. to 9 p.m. URI Graduate School of Oceanography, Corless Auditorium, 215 South Ferry Road, Narragansett, RI 02882
2. Monday, August 12, 2019—Machias, ME, 6 p.m. to 9 p.m. University of Maine at Machias, Performing Arts Center, 116 O'Brien Avenue, Machias, ME 04654
3. Tuesday, August 13, 2019—Ellsworth, ME, 6 p.m. to 9 p.m. Ellsworth High School Performing Arts Center, 24 Lejok Street, Ellsworth, ME 04605
4. Wednesday, August 14, 2019—Waldoboro, ME, 6 p.m. to 9 p.m. Medomak Valley High School, 320 Manktown Road, Waldoboro, Maine 04572
5. Thursday, August 15, 2019—Portland, ME, 6 p.m. to 9 p.m. South Portland High School, 637 Highland Ave., South Portland ME, 04106
6. Monday, August 19, 2019—Portsmouth, NH, 6 p.m. to 9 p.m. Urban Forestry Center, 45 Elwyn Road, Portsmouth, NH 03801
7. Tuesday, August 20, 2019—Gloucester, MA, 6 p.m. to 9 p.m. NMFS Greater Atlantic Region, 55 Great Republic Drive, Gloucester, MA 01930
8. Wednesday, August 21, 2019—Bourne, MA, 6 p.m. to 9 p.m. Upper Cape Cod Regional Technical School, 220 Sandwich Rd., Bourne, MA 02352

DEIS and Proposed Rule Information Sessions

1. Rhode Island, Southern Massachusetts and Lobster Management Area (LMA) 3, Tuesday, January 12, 2021, 6:30-8:30 pm
2. Massachusetts (Outer Cape and LMA 1) and New Hampshire (LMA 1), Wednesday, January 13, 2021, 6:30-8:30 pm
3. Southern Maine, Tuesday, January 19, 2021, 6:30-8:30 pm
4. Northern Maine, Wednesday, January 20, 2021, 6:30-8:30 pm

DEIS and Proposed Rule Public Hearings

1. Rhode Island, Southern Massachusetts and LMA 3, Tuesday, February 16, 2021, 6:30-8:30 pm
2. Massachusetts (Outer Cape and LMA1) and New Hampshire (LMA 1), Wednesday, February 17, 2021, 6:30-8:30 pm
3. Southern Maine, Tuesday, February 23, 2021, 6:30-8:30 pm

4. Northern Maine, Wednesday, February 24, 2021, 6:30-8:30 pm

10.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies conducting, authorizing, or funding activities that may affect threatened or endangered species to ensure that those impacts do not jeopardize the continued existence of listed species or result in the destruction or adverse modification of habitat determined to be critical. Many of the trap/pot regulated under the Plan are also managed under federal fishery management plans (FMPs) that undergo review under the ESA Section 7 requirements. If it is determined through the section 7 process that a fishery (or fisheries) is likely to adversely affect listed species and/or critical habitat, then a formal consultation is initiated to determine whether the current action is likely to jeopardize the continued existence of a listed species and/or destroy or adversely modify critical habitat. Formal consultation concludes with the issuance of a NMFS Biological Opinion (Opinion). The most recent relevant Opinion on fisheries regulated under the ALWTRP include:

- February 6, 2002: ESA Section 7 Consultation on Implementation of the Deep-Sea Red Crab, *Chaceon quinque-dens*, FMP. NMFS most recently considered the effects of activities occurring under the Atlantic Deep-Sea Red Crab FMP on ESA-listed marine mammals and sea turtles during a formal Section 7 consultation completed on February 6, 2002. An Opinion resulting from this consultation concluded that the continued operation of the red crab fishery as authorized under the Red Crab FMP may adversely affect, but would not jeopardize, the continued existence of North Atlantic right whales, fin whales, sei whales, and sperm whales; and loggerhead²⁸ and leatherback sea turtles. That Opinion also concluded that the continued operation of the red crab fishery would not destroy or adversely modify designated critical habitat for North Atlantic right whales. An Incidental Take Statement (ITS) for sea turtles was issued along with the Opinion exempting a level of annual take. Reasonable and Prudent Measures and accompanying Terms and Conditions to minimize the impacts of incidental take were also provided in the ITS. The preferred alternative does impact the red crab fishery, which will be considered in 2021 along with other trap/pot fisheries.
- December 16, 2013: Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the Northeast Multispecies, Monkfish, Spiny Dogfish, Atlantic Bluefish, Northeast Skate Complex, Mackerel/Squid/Butterfish, and Summer Flounder/Scup/Black Sea Bass Fisheries (Batched Opinion). The Opinion concluded that the continued operation of the seven FMPs may adversely affect, but would not jeopardize, the continued existence of North Atlantic right whales, fin and sei whales; loggerhead (Northwest Atlantic Ocean Distinct Population Segment (NWA DPS)), leatherback, Kemp's ridley, and green sea turtles; the five listed DPSs of Atlantic sturgeon; or the Gulf of Maine DPS of Atlantic salmon. The Opinion also concluded that

²⁸ At the time of the 2002 red crab Opinion, loggerhead sea turtles were listed globally, not by distinct population segments (DPSs). On September 22, 2011 (76 FR 58868), nine DPSs were designated, replacing the global listing of loggerhead sea turtles; loggerhead sea turtles in the Greater Atlantic Region are listed as the Northwest Atlantic Ocean DPS. NMFS issued a memo on November 15, 2011, concluding that designation of the Northwest Atlantic Ocean DPS of loggerhead sea turtle did not trigger reinitiation of the 2002 red crab Opinion.

the continued operation of the seven FMPs would not destroy or adversely modify designated critical habitat for right whales or Atlantic salmon. An ITS for listed sea turtles, the five DPSs of Atlantic sturgeon, and the Gulf of Maine DPS of Atlantic salmon was issued along with the Opinion exempting a level of annual take for the seven FMPs. Reasonable and Prudent Measures and accompanying Terms and Conditions to minimize the impacts of incidental take were also provided in the ITS. The preferred alternative does not impact the Batched Opinion fisheries, which will be considered in 2021 along with other trap/pot fisheries.

- July 31, 2014: Endangered Species Act Section 7 Consultation on the Continued Implementation of Management Measures for the American Lobster Fishery (“2014 Biological Opinion”). The 2014 Biological Opinion concluded that the continued operation of the American lobster fishery may adversely affect, but is not likely to jeopardize the continued existence of North Atlantic right whales, fin whales, and sei whales; or loggerhead (NWA DPS) and leatherback sea turtles. The 2014 Biological Opinion also concluded that the continued operation of the American lobster fishery is not likely to destroy or adversely modify designated critical habitat for North Atlantic right whales or the NWA DPS of loggerhead sea turtles. An ITS for the NWA DPS loggerhead and leatherback sea turtles was issued along with the Opinion exempting a level of annual take for the lobster FMP. Reasonable and Prudent Measures and accompanying Terms and Conditions to minimize the impacts of incidental take were also provided in the ITS. On April 9, 2020, the U.S. District Court for the District of Columbia found that the 2014 Biological Opinion was legally deficient. On August 19, 2020, the Court issued a remedy order vacating the 2014 Biological Opinion, but staying that vacatur until May 31, 2021, by which date NMFS anticipates issuing a new final Biological Opinion for the federal American lobster fishery and other federal fisheries.
- On October 17, 2017, an ESA 7(a)(2)/7(d) memo issued by NMFS stated a consultation has been reinitiated on the federal permitted Atlantic deep sea red crab and American lobster fisheries as well as other fisheries that use fixed gillnet and trap/pot gear. In January and February of 2018, four environmental organizations filed two lawsuits in the U.S. District Court for the District of Columbia alleging violations of the ESA and the Marine Mammal Protection Act, and the two lawsuits were consolidated into a single case. On April 9, 2020, the Court ruled against NMFS on the parties' cross motions for summary judgment, finding that the 2014 Biological Opinion on the lobster fishery was legally deficient. On August 19, 2020, the Court issued an order on remedy that vacated the 2014 Biological Opinion, but stayed the vacatur until May 31, 2021, by which date NMFS anticipated issuing a new final Biological Opinion concluding the consultation that was initiated in 2017 for the federal American lobster fishery and other federal fisheries.

Pursuant to section 7 of the Endangered Species Act (ESA), NOAA’s National Marine Fisheries Service (NMFS) issued a Biological Opinion (Opinion) on May 27, 2021, that considered the effects of the NMFS’ authorization of ten fishery management plans (FMP), NMFS’ North Atlantic Right Whale Conservation Framework, and the New

England Fishery Management Council's Omnibus Essential Fish Habitat Amendment 2, on ESA-listed species and designated critical habitat. The ten FMPs considered in the Opinion include the: (1) American lobster; (2) Atlantic bluefish; (3) Atlantic deep-sea red crab; (4) mackerel/squid/butterfish; (5) monkfish; (6) Northeast multispecies; (7) Northeast skate complex; (8) spiny dogfish; (9) summer flounder/scup/black sea bass; and (10) Jonah crab FMPs. The American lobster and Jonah crab FMPs are permitted and operated through implementing regulations compatible with the interstate fishery management plans (ISFMP) issued under the authority of the Atlantic Coastal Fisheries Cooperative Management Act (ACA), the other eight FMPs are issued under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

The 2021 Opinion determined that the actions under those management plans may adversely affect, but are not likely to jeopardize, the continued existence of North Atlantic right, fin, sei, or sperm whales; the Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead, leatherback, Kemp's ridley, or North Atlantic DPS of green sea turtles; any of the five DPSs of Atlantic sturgeon; Gulf of Maine DPS Atlantic salmon; or giant manta rays. The Opinion also concluded that the proposed action is not likely to adversely affect designated critical habitat for North Atlantic right whales, the Northwest Atlantic Ocean DPS of loggerhead sea turtles, U.S. DPS of smalltooth sawfish, Johnson's seagrass, or elkhorn and staghorn corals. An Incidental Take Statement (ITS) was issued in the Opinion. The ITS includes reasonable and prudent measures and their implementing terms and conditions, which NMFS determined are necessary or appropriate to minimize impacts of the incidental take in the fisheries assessed in this Opinion.

- A formal consultation was conducted on the Atlantic Large Whale Take Reduction Plan in 1997. Six subsequent informal consultations were completed in 2004, 2008, 2014, and 2015 associated with modifications to the Plan. Consultation on the Plan was reinitiated on May 3, 2021 including the potential impacts of the alternatives in the DEIS and proposed rule on ESA-listed species. As detailed in Chapter 5, the preferred alternative analysed in the FEIS that would be implemented by the final rule achieves at least as much risk reduction to right whales and other listed species as estimated in the DEIS. Consultation concluded on May 25, 2021, finding that the Plan operates as a mechanism to reduce fisheries related impacts on Atlantic large whales. It does not authorize any fishery. The effects of federal fisheries regulated under the Plan are fully considered under section 7 consultations conducted for the fishery management plans and incidental take attributed to federal fisheries is authorized under those consultations. Based on all of the above information, the gear regulations implemented by the Plan for U.S. fixed gear fisheries will have wholly beneficial effects to ESA-listed species or their critical habitat. As a result, it was determined that the Plan is not likely to adversely affect ESA-listed species or designated critical habitat under NMFS jurisdiction and no further consultation is necessary.

10.4 Marine Mammal Protection Act

Under the Marine Mammal Protection Act (MMPA), federal responsibility for protecting and conserving marine mammals is vested with the Departments of Commerce (NMFS) and Interior (U.S. FWS) and the MMPA is the authority under which much of the current rulemaking is being undertaken. The MMPA prohibits the “take” of marine mammals, with certain exceptions, in waters under U.S. jurisdiction and by U.S. citizens on the high seas. The MMPA requires consultation within NMFS if impacts on marine mammals are unavoidable. The primary management objective of the MMPA is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. The MMPA is intended to work in cooperation with the applicable provisions of the ESA. The ESA-listed species of marine mammal that occur in the Plan management areas are discussed in section 4.1 of the FEIS. The species of marine mammals not listed under the ESA that occur in the Plan management areas are discussed in section 4.1.2 except minke whales and North Atlantic humpback whales, which are discussed in section 4.1.1. NMFS has reviewed the impacts of this action on marine mammals and concluded that the management actions proposed are consistent with the provisions of the MMPA. The potential impact of the alternatives considered on marine mammals is provided in Chapter 5.

10.5 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) is designed to encourage and assist states in developing coastal management programs, to coordinate state activities, and to safeguard regional and national interests in the coastal zone. Section 307 of the CZMA requires that any federal activity affecting the land or water uses or natural resources of a state’s coastal zone be consistent with the state’s approved coastal management program, to the maximum extent practicable. NMFS has determined that the implementation of the Preferred Alternative would be consistent to the maximum extent practicable with the approved coastal management programs of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. In 2020, NMFS provided a copy of the draft environmental assessment and a consistency determination to the state coastal management agency in every state with a federally-approved coastal management program whose coastal uses or resources are affected by these Jonah crab management measures. Each state has 60 days in which to agree or disagree with the determination regarding consistency with that state’s approved coastal management program. If a state fails to respond within 60 days, the state’s agreement will be presumed. NMFS has determined that this action is consistent to the maximum extent practicable with the approved coastal management programs of the U.S. Atlantic coastal states affected by the action. On January 18, 2021, this determination was submitted for review by the responsible state agencies under section 307 of the CZMA. New Hampshire and Rhode Island agreed with NMFS’ determination. Maine and Massachusetts did not respond; therefore, consistency is inferred.

10.6 Administrative Procedure Act

This action was developed in compliance with the requirements of the Administrative Procedures Act (APA), and these requirements will continue to be followed when the final regulation is published. Section 553 of the APA establishes procedural requirements applicable to informal

rulemaking by federal agencies. The purpose of these requirements is to ensure public access to the federal rulemaking process, and to give the public adequate notice and opportunity for comment. NMFS is not requesting any abridgement of the rulemaking process for this action.

10.7 Information Quality Act (Section 515)

The Information Quality Act directed the Office of Management and Budget to issue government wide guidelines that “provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information (including statistical information) disseminated by federal agencies.” Under the NOAA guidelines, the Plan is considered a Natural Resource Plan. It is a composite of several types of information, including scientific, management, and stakeholder input, from a variety of sources. Compliance of this document with NOAA guidelines is evaluated below.

- **Utility:** The information disseminated is intended to describe the current management actions and the impacts of those actions. The information is intended to be useful to: 1) fishermen and other fishing industry participants, conservation groups, and other interested parties so they can provide informed comments on the alternatives considered; and 2) managers and policy makers so they can choose an alternative for implementation.
- **Integrity:** Information and data, including statistics that may be considered as confidential, were used in the analysis of impacts associated with this document. This information was necessary to assess the biological, social, and economic impacts of the alternatives considered as required under NEPA and the Regulatory Flexibility Act (RFA) for the preparation of a final environmental impact statement/regulatory impact review. NMFS complied with all relevant statutory and regulatory requirements as well as NMFS policy regarding confidentiality of data. For example, confidential data were only accessible to authorized federal employees and contractors for the performance of legally required analyses. In addition, confidential data are safeguarded to prevent improper disclosure or unauthorized use. Finally, the information to be made available to the public was done so in aggregate, summary, or other such form that does not disclose the identity or business of any person.
- **Objectivity:** The NOAA Information Quality Guidelines for Natural Resource Plans state that plans must be presented in an accurate, clear, complete, and unbiased manner. Because take reduction plans and their implementing regulations affect such a wide range of interests, NMFS strives to draft and present new management measures in a clear and easily understandable manner with detailed descriptions that explain the decision making process and the implications of management measures on marine resources and the public. Although the alternatives considered in this document rely upon scientific information, analyses, and conclusions, clear distinctions would be drawn between policy choices and the supporting science. In addition, the scientific information relied upon in the development, drafting, and publication of this FEIS was properly cited and a list of references was provided. Finally, this document was reviewed by a variety of biologists, policy analysts, economists, and attorneys from the Greater Atlantic Region and the Northeast Fisheries Science Center as well as the Headquarters office in Silver Spring, MD. In general, this team of reviewers has extensive experience with the policies and programs established for the protection of marine mammals, and specifically with the

development and implementation of the Plan. Therefore, this Natural Resource Plan was reviewed by technically qualified individuals to ensure that the document was complete, unbiased, objective, and relevant. This review was conducted at a level commensurate with the importance of the interpreted product and the constraints imposed by legally-enforceable deadlines.

10.8 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to control and, to the extent possible, minimize the paperwork burden for individuals, small businesses, nonprofit institutions, and other persons resulting from the collection of information by or for the Federal Government. The authority to manage information and recordkeeping requirements is vested with the Director of the Office of Management and Budget. This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications. The gear marking requirements in this action constitute a collection-of-information requirement subject to the Paperwork Reduction Act. Comments on the burden estimates in the proposed rule and modifications to the collection requirements resulted in a modified burden estimate that has been provided to OMB. The general public and other Federal agencies are invited to comment on proposed and continuing information collections to help us assess the impact of our information collection requirements and minimize the public's reporting burden. Written comments and recommendations for this information collection should be submitted at the following website www.reginfo.gov/public/do/PRAMain. Find this particular information collection by using the search function and entering either the title of the collection or the OMB Control Number 0648-0364.

10.9 Executive Order 13132 - Federalism

Executive Order (EO) 13132, otherwise known as the Federalism EO, was signed by President Clinton on August 4, 1999, and published in the *Federal Register* on August 10, 1999 (64 FR 43255). This EO is intended to guide federal agencies in the formulation and implementation of “policies that have federal implications.” Such policies are regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government. EO 13132 requires federal agencies to have a process to ensure meaningful and timely input by state and local officials in the development of regulatory policies that have federalism implications. A federal summary impact statement is also required for rules that have federalism implications.

EO 13132 establishes fundamental federalism principles based on the U.S. Constitution, and specifies both federalism policy-making criteria and special requirements for the preemption of state law. For example, a federal action that limits the policy making discretion of a state is to be taken only where there is constitutional and statutory authority for the action and it is appropriate in light of the presence of a problem of national significance. In addition, where a federal statute does not have expressed provisions for preemption of state law, such a preemption by federal rule-making may be done only when the exercise of state authority directly conflicts with the exercise of federal authority. To preclude conflict between state and federal law on take

reduction plans, the Marine Mammal Protection Act explicitly establishes conditions for federal preemption of state regulations. Furthermore, close state-federal consultation on fishery management measures implemented under the Plan is provided by the take reduction team process. The implementation of any of the alternatives considered could contain policies with federalism implications sufficient to warrant the preparation of a federalism assessment under EO 13132. Therefore, the Assistant Secretary for Legislative and Intergovernmental Affairs will provide notice of the action to the appropriate official(s) of affected state, local and/or tribal governments.

10.10 Executive Order 12866

The requirements for all regulatory actions specified in EO 12866 are summarized in the following statement from the order:

The purpose of Executive Order 12866 is to enhance planning and coordination with respect to new and existing regulations. This E.O. requires the Office of Management and Budget (OMB) to review regulatory programs that are considered to be “significant.” E.O. 12866 requires a review of proposed regulations to determine whether or not the expected effects would be significant, where a significant action is any regulatory action that may:

- Have an annual effect on the economy of \$100 million or more, or adversely affect in a material way the economy, a sector of the economy, productivity, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, priorities of the President, of the principles set forth in the Executive Order.

In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, include the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider.

The analysis meeting the above described requirements of the EO are found in the section entitled Regulatory Impact Review (RIR), which is included within this Draft EIS in Chapter 9. Because this rule has an adverse economic effect on a substantial number of fishermen and may raise novel legal or policy issues arising from the legal mandates of the MMPA, it is considered significant under EO 12866 and has undergone OMB review.

10.11 Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) was enacted in 1980 to place the burden on the federal government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA emphasizes predicting significant adverse impacts on small entities as a group distinct from other entities and

on the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action. When an agency publishes a final rule, unless it can provide a factual basis upon which to certify that no such adverse effects will accrue, it must prepare and make available for public review a Final Regulatory Flexibility Analysis (FRFA) that describes the impact of the rule on small entities. The FRFA for this action is provided in Chapter 9.

10.12 Executive Order 12898 – Environmental Justice

The Environmental Protection Agency (EPA) defines environmental justice as, “the fair treatment for all people of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies.” EO 12898 was implemented in response to the growing need to address the impacts of environmental pollution on particular segments of our society. This order requires each federal agency to achieve environmental justice by addressing “disproportionately high and adverse human health and environmental effects on minority and low-income populations.” In furtherance of this objective, the EPA developed an Environmental Justice Strategy that focuses the agency’s efforts in addressing these concerns. For example, to determine whether environmental justice concerns exist, the demographics of the affected area should be examined to ascertain whether minority populations and low-income populations are present, and, if so, a determination must be made as to whether implementation of the alternatives may cause disproportionately high and adverse human health or environmental effects on these populations. Environmental justice concerns typically embody pollution and other environmental health issues, but the EPA has stated that addressing environmental justice concerns is consistent with NEPA; therefore, all federal agencies are required to identify and address these issues.

Many of the participants in the fisheries regulated under the Plan in the Northeast U.S. may come from lower income and/or ethnic minority populations. These populations may be more vulnerable to the management measures considered in this document. However, demographic data on participants in the lobster and crab fisheries affected by measures analyzed in this FEIS do not allow identification of those who live below the poverty level or are racial or ethnic minorities. Table 10.1 describes poverty and minority rate data at the state and county levels for the primary port communities relevant to this action. In terms of poverty, Washington County is the only county that is more than 1 percent higher than its state average (Maine). Washington and Cumberland Counties are the only counties with a minority rate more than 1 percent higher than their state average (Maine). Fewer minorities live in the one coastal county in New Hampshire relative to the rest of the state. In Massachusetts, only Suffolk County, which includes the city of Boston, has poverty rates more than one percent higher than the poverty rate for the state as a whole. Suffolk and Norfolk Counties in Massachusetts both are also home to minorities at a rate more than one percent higher than the comparable rate for the state as a whole. Washington County in Rhode Island is less diverse and wealthier than the state as a whole. These data do not demonstrate that lower income or minority populations will be disproportionately impacted by the alternatives analyzed within this FEIS.

With respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns of populations who

principally rely on fish and/or wildlife for subsistence. While NMFS tracks these issues, there are no federally recognized tribal agreements for subsistence fishing in New England federal waters.

Table 10.1: Demographic data for Northeast Lobster and Jonah Crab Trap/Pot Fishing Communities (Counties)

State	County	Key Ports	Median Household Income (2014-2018)	Persons below Poverty Level (2014-2018)	Minority Population (did not report as white alone) ²⁹
ME	Washington	Beals Island/Jonesport, Cutler, Eastport, Lubec	41,384	18.30%	8.80%
ME	Hancock	Stonington/Deer Isle, Bucksport	53,068	11.60%	4.10%
ME	Waldo	Belfast, Searsport, Northport	51,564	13.70%	3.50%
ME	Knox	Rockland, Vinalhaven, Port Clyde	55,402	11.00%	3.60%
ME	Lincoln	South Bristol, Boothbay Harbor	55,180	11.10%	3%
ME	Sagadahoc	Georgetown, Phippsburg	62,131	8.70%	4.40%
ME	Cumberland	Portland, Harpswell	69,708	8.20%	8.10%
ME	York	Kennebunkport, Cape Porpoise, York	65,538	9.00%	4.30%
NH	Rockingham	Hampton/Seabrook, Portsmouth, Isle of Shoals	90,429	5.30%	5.20%
MA	Essex	Gloucester, Rockport, Marblehead	75,878	10.70%	19.9
MA	Suffolk	Boston Harbor	64,582	17.50%	44.80%
MA	Norfolk	Cohasset	99,511	6.50%	21.60%
MA	Plymouth	Plymouth, Scituate, Hingham	85,654	6.20%	14.7
MA	Barnstable	Sandwich, Hyannis, Chatham, Provincetown, Woods Hole	70,621	8.00%	8.10%
MA	Bristol	New Bedford, Fairhaven, Westport	66,157	10.80%	15.40%
RI	Newport	Jamestown, Newport, Tiverton, Sakonnet Point	77,237	8.10%	10.40%
RI	Washington	Point Judith/Galilee	81,301	8.00%	7%

²⁹ From United States Census Data, 2018 American Community Survey 5-Year estimates, retrieved May 11, 2020. <https://www.census.gov/programs-surveys/acs/>

10.13 Executive Order 13158 - Marine Protected Areas

EO 13158 requires each federal agency whose actions affect the natural or cultural resources that are protected by a Marine Protected Area (MPA) to identify such actions, and, to the extent permitted by law and to the extent practicable, avoid harm to the natural and cultural resources that are protected by an MPA. EO 13158 promotes the development of MPAs by enhancing or expanding the protection of existing MPAs and establishing or recommending new MPAs. The EO defines an MPA as “any area of the marine environment that has been reserved by federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.”

Pursuant to this order, the Departments of Commerce and the Interior developed a list of MPAs that meet the definition. The Stellwagen Bank National Marine Sanctuary was classified as a MPA. In addition, four Tilefish Gear Restricted Areas in the Mid-Atlantic have been added to the National System of Marine Protected Areas: Lydonia Canyon, Norfolk Canyon, Oceanographer Canyon, and Veatch Canyon. These are the first federal fishery management areas to become part of the national MPA system. Stellwagen Bank National Marine Sanctuary and Oceanographer and Veatch Canyons within the Tilefish Gear Restricted Areas are the MPAs that overlap the footprint of the current action.

This action is not expected to more than minimally affect the biological/habitat resources of MPAs, which was comprehensively analyzed in the Omnibus Habitat Amendment 2 (NEFMC 2016b). Lobster and crab trap/pot fishing gears regulated under this action are unlikely to damage shipwrecks and other cultural artifacts, because fishing vessel operators avoid contact with cultural resources on the seafloor to minimize costly gear losses and interruptions to fishing.

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CHAPTER 13 GLOSSARY, ACRONYMS, AND INDEX

13.1 Glossary

Action agency: The Federal agency charged with permitting, conducting, or funding the proposed activity serving as the basis for a consultation under the Endangered Species Act (ESA).

Algae: Single-celled or simple multi-cellular photosynthetic organisms.

ALWTRP gear: Gear that is currently or potentially subject to the requirements of the Atlantic Large Whale Take Reduction Plan (ALWTRP or Plan).

Anchored gillnet: Any gillnet gear, including a sink gillnet or stab net, that is set anywhere in the water column and which is anchored, secured or weighted to the bottom of the sea. Also called a set gillnet.

Annualize: Convert the summation of multi-year discounted value into equalized yearly value for a certain period of time using determined interest rate.

Anthropogenic: Human made.

Baleen whales: Baleen whales (also known as Mysticeti, or mustached whales) are filter feeders that have baleen, a sieve-like device used for filter feeding krill, copepods, plankton, and small fish. They are the largest whales and have two blowholes. Baleen whales include blue, fin, gray, humpback, minke, bowhead, and right whales.

Benthic: The bottom habitat of any aquatic environment.

Berried: Carrying eggs.

Bioaccumulation: The ability of organisms to retain and concentrate substances from their environment. The gradual build-up of substances in living tissue; usually used in referring to toxic substances; may result from direct absorption from the environment or through the food-chain.

Biological opinion: Under the provisions of the ESA, an opinion prepared by the Action agency as to whether or not a proposed action is likely to jeopardize the continued existence of a listed species, or adversely modify critical habitat.

Biomagnification: Increasing concentration of a substance in successive trophic levels of a food chain.

Biotoxins: Highly toxic compounds produced by harmful algal blooms (HABs).

Breaking strength: The highest tensile force that an object can withstand before breaking.

Buoy line: A line connecting fishing gear in the water to a buoy at the surface of the water.

Bycatch: Fish that are harvested in a fishery but are not sold or kept for personal use, including economic discards and regulatory discards, but not fish released alive under a recreational catch and release fishery management program.

Carapace: The shield-like exoskeleton plate that covers at least part of the anterior dorsal surface of many arthropods.

Cetaceans: Aquatic mammals, including whales.

Climate change: The term “climate change” is sometimes used to refer to all forms of climatic inconsistency, but because the Earth’s climate is never static, the term is more properly used to

imply a significant change from one climatic condition to another. In some cases, “climate change” has been used synonymously with the term, “global warming;” scientists, however, tend to use the term in the wider sense to also include natural changes in climate.

Compliance costs: All costs associated with adapting vessel operations to meet regulatory requirements.

Copepods: Microscopic crustaceans that are important members of the zooplankton.

Critical habitat: The specific areas within the geographical area occupied by a threatened or endangered species, on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection.

Crustacean: Invertebrates characterized by a hard outer shell and jointed appendages and bodies. Higher forms of this class include lobsters, shrimp and crawfish; lower forms include barnacles.

Days at sea (DAS) allocation: The total days, including steaming time that a boat is permitted to spend at sea fishing.

DDT (dichloro-diphenyl-trichloroethane): An organochlorine insecticide no longer registered for use in the United States.

Depleted: Under the provisions of the Marine Mammal Protection Act (MMPA), any species or population stock below its optimum sustainable population as determined by the Secretary of Commerce after consultation with the Marine Mammal Commission (MMC) and the Committee of Scientific Advisors on Marine Mammals.

Discount rate: An interest rate used in calculating the discounted cash flow value.

Driftnet: A gillnet that is unattached to the ocean bottom and not anchored, secured or weighted to the bottom, regardless of whether attached to a vessel.

Endangered: Any species that is in danger of extinction throughout all or a significant portion of its range.

Endocrine system: The endocrine system refers to all of the body's hormone-secreting glands. This system works in conjunction with the nervous system to control the production of hormones and their release into the circulatory system.

Entanglement: An event in the wild in which a living or dead marine mammal has gear, rope, line, net, or other material wrapped around or attached to it and is:

- a. on a beach or shore of the United States; or
- b. in waters under the jurisdiction of the United States (including any navigable waters).

Epifauna: Animals and plants that live on the surface of the seafloor, attached to rocks or moving over the bottom.

Essential Fish Habitat (EFH): Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The EFH designation for most managed species is based on a legal text definition and geographical area that are described in the Habitat Omnibus Amendment (1998).

Eutrophication: A set of physical, chemical, and biological changes brought about when excessive nutrients are released into the water.

Exclusive Economic Zone (EEZ): A zone in which the inner boundary is a line coterminous with the seaward boundary of each of the coastal States and the outer boundary is a line 200 miles away and parallel to the inner boundary

Fathom: A measure of length, containing six feet; the space to which a man can extend his arms; used chiefly in measuring cables, cordage, and the depth of navigable water by soundings.

Fecundity: Fertility or ability to reproduce.

Finfish: Bony fishes such as bass, trout, salmon, goldfish, carp, etc; does not include sharks or rays.

Fishery: The Magnuson-Stevens Fishery Conservation and Management Act (MSA) defines fishery as "one or more stocks of fish which can be treated as a unit for purposes of conservation and management and which are identified on the basis of geographical, scientific, technical, recreational, and economic characteristics; and... any fishing for such stocks."

Fishery Management Plan (FMP): A plan developed by a Regional Fishery Management Council, or the Secretary of Commerce under certain circumstances, to manage a fishery resource in the U.S. EEZ pursuant to the MSA.

Fishing effort: the amount of time and fishing power used to harvest fish. Fishing power is a function of gear size, boat size and horsepower.

Fishing mortality (F): A measurement of the rate of removal of fish from a population caused by fishing. This is usually expressed as an instantaneous rate (F) and is the rate at which fish are harvested at any given point in a year. Instantaneous fishing mortality rates can be either fully recruited or biomass weighted. Fishing mortality can also be expressed as an exploitation rate or, less commonly, as a conditional rate of fishing mortality m , the fraction of fish removed during the year if no other competing sources of mortality occurred. (Lower case m should not be confused with upper case M , the instantaneous rate of natural mortality.)

Float line: The rope at the top of a gillnet from which the mesh portion of the net is hung.

Food web: The complete set of food links between species in an ecosystem.

Fork length: Length of a fish measured from the tip of the snout to the posterior end of the middle caudal rays. This measurement is used instead of standard length for fishes on which it is difficult to ascertain the end of the vertebral column, and instead of total length in fish with a stiff, forked tail, e.g., tuna. Mostly used in fishery biology and not in systematics.

Gear conflict: Interactions between the gear employed by commercial fishing vessels, such as the severing of a buoy line by a dragger.

Gillnet: Fishing gear consisting of a wall of webbing (meshes) or nets, designed or configured so that the webbing (meshes) or nets are placed in the water column, usually approximately vertically. Gillnets are designed to capture fish by entanglement, gilling, or wedging. The term "gillnet" includes gillnets of all types, including but not limited to sink gillnets, other anchored gillnets (e.g., stab and set nets), and drift gillnets. Gillnets may or may not be attached to a vessel. The term is intended to include gillnets with or without tiedowns. Haul/beach seines have bunt/capture bags and wings, and are therefore not considered gillnets for the purposes of the ALWTRP. North Carolina beach-anchored gillnets, which are fished from shore and report their landings as part of the haul/beach seine fishery, are also not considered gillnets for the purposes of the ALWTRP. Nearshore gillnets, which are set from small vessels just off the beach, but are not attached to the beach, are considered gillnets and are regulated under the ALWTRP.

Greenhouse gas: Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrochlorofluorocarbons (HCFCs), ozone (O₃), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆).

Ground line/groundline: With reference to trap/pot gear, a line connecting traps in a trap trawl; with reference to gillnet gear, a line connecting a gillnet or gillnet bridle to an anchor.

Harmful algal blooms (HABs): The proliferation of toxic nuisance algae that cause a negative impact to natural resources or humans. The neurotoxins that are emitted, such as saxitoxins, ciguatoxins, domoic acid, and brevetoxins, can be transferred through trophic levels and have a variety of negative health impacts.

Heavy metal: A generic term for a range of metals with a moderate to high atomic weight (e.g., cadmium, mercury, lead). Although many are essential for life in trace quantities, in elevated concentrations most are toxic and bioaccumulate.

Holding power: The force an anchor can withstand before being dragged along or from the bottom.

Hydrocarbons: Organic compounds containing mainly hydrogen and carbon; the basic constituents of fossil fuels.

Injury: A wound or other physical harm. In whales, signs of injury include, but are not limited to, visible blood flow, loss of or damage to an appendage or jaw, inability to use one or more appendages, asymmetry in the shape of the body or body position, noticeable swelling or hemorrhage, laceration, puncture, or rupture of eyeball, listless appearance or inability to defend itself, inability to swim or dive upon release from fishing gear, or signs of equilibrium imbalance. Any animal that ingests fishing gear, or any animal that is released with fishing gear entangling, trailing, or perforating any part of the body is considered injured regardless of the absence of any wound or other evidence of an injury.

Isobath: Line connecting points of equal water depth on a chart; a seabed contour.

Labor cost: the implicit value of time that fishermen could have earned if invested in other jobs/industries.

Landings: The portion of the catch that is harvested for personal use or sold.

Limited access: Describes a fishery or permit for which a vessel must meet certain criteria by a specified "control date" to participate.

List of fisheries (LOF): A list maintained by NMFS that places each commercial fishery into one of three categories. Fisheries are categorized according to the level of mortality and serious injury of marine mammals that occurs incidental to that fishery.

Marine Mammal Commission (MMC): A scientific advisory board comprised of experts that oversees the administration of the Marine Mammal Protection Act.

Marine Mammal Protection Act (MMPA): An Act passed by the United States Congress in 1972 that prohibits the hunting, killing, harassing, or injuring of marine mammals by any person under U.S. jurisdiction; limited exceptions apply.

Model vessel: Representative of a group of vessels that share similar operating characteristics and would face similar requirements under a given regulatory alternative.

Molting: The regular shedding of an outer body covering such as fur, skin, feathers, or, in the case of crustaceans, a shell.

Monofilament: A twine composed of a single yarn.

Multispecies: The group of species managed under the Northeast Multispecies Fishery Management Plan. This group includes whiting, red hake and ocean pout plus the regulated species (cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, windowpane flounder, white hake and redfish).

Natural mortality: A measurement of the rate of death from all causes other than fishing, such as predation, disease, starvation, and pollution.

Neonate: A newborn baby in the first few months of life.

Net panel: Sheet of netting often comprising two or more sections joined together.

Night: Any time between one-half hour before sunset and one-half hour after sunrise.

No Action Alternative: The status quo, i.e., the baseline set of ALWTRP requirements currently in place.

Nonpoint source: A pollution source that cannot be defined as originating from discrete points such as pipe discharge. Areas of fertilizer and pesticide applications, atmospheric deposition, manure, and natural inputs from plants and trees are types of nonpoint source pollution.

Notice of intent: A statement published by NMFS alerting the public to a forthcoming action.

Observer: any person required or authorized to be carried on a vessel for conservation and management purposes by regulations or permits under the MSA.

Odontocetes: The sub-order of whales that includes toothed-whales.

Open access: Describes a fishery or permit for which there are no qualification criteria to participate.

Optimum sustainable population (OSP): The number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element.

Overfished: A condition defined when stock biomass is below minimum biomass threshold and the probability of successful spawning production is low.

Overfishing: A level or rate of fishing mortality that jeopardizes the long-term capacity of a stock or stock complex to produce MSY on a continuing basis.

Ovigerous: Lobsters that are carrying eggs; egg-bearing lobsters.

Pelagic: A term to describe fish that spend most of their life swimming in the open sea with little contact with or dependency on the ocean bottom.

Phase-in costs: The incremental gear conversion costs that fishermen would incur between promulgation of a final rule and full implementation of the rule's provisions several years later.

Phytoplankton: Microscopic marine plants or algae, which are responsible for most of the photosynthetic activity in the oceans.

Pinnipeds: A suborder of carnivorous marine mammals that includes the seals, walruses, and similar animals using finlike flippers for propulsion.

Planktivorous: Feeding on planktonic organisms.

Poaching: The illegal hunting or taking of wildlife out of its natural habitat.

Point source: A single identifiable source that discharges pollutants into the environment. Examples are smokestack, sewer, ditch, or pipe.

Polychlorinated biphenyls (PCBs): A group of industrial chemicals (of the chlorinated hydrocarbon class) that are commonly used and have become serious and widespread pollutants. They are extremely resistant to breakdown and have contaminated most of the earth's food chains, resulting in biomagnification at higher trophic levels. Known to cause cancer.

Potential biological removal (PBR): Maximum number of animals, not including mortalities that can be removed from a stock while allowing that stock to reach its OSP.

Present value: In economics and finance, present value, also known as present discounted value, is the value of an expected stream determined as of the date of valuation.

Prey availability: The availability or accessibility of prey (food) to a predator. Important for growth and survival.

Profile: The outline of fishing line in the water column, i.e., the amount of line that lies in the water column.

Protected Species: As used in this document, protected species refers to any species protected by either the ESA or the MMPA, and which is under the jurisdiction of NMFS. This includes all threatened, endangered, and candidate species, as well as all cetaceans and pinnipeds excluding walruses.

Quota: A pre-determined total catch of a particular species allowed to be harvested in a season.

Reasonable and prudent alternatives: Alternative actions identified during a formal ESA consultation that (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the Action agency's legal authority and jurisdiction; (3) are economically and technically feasible; and (4) avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

Recovery factor: A factor used in calculating PBR. It accounts for endangered, depleted, or threatened stocks or stocks of unknown status relative to OSP.

Recruitment: The amount of fish added to the fishery each year due to growth and/or migration into the fishing area. For example, the number of fish that grow to become vulnerable to fishing gear in one year would be the recruitment to the fishery. "Recruitment" also refers to new year classes entering the population (prior to recruiting to the fishery).

Ropeless fishing: Ropeless fishing refers to fixed gear fishing without the use of persistent buoy lines to mark and retrieve gear. Often includes the use of timed or remotely controlled technology to retrieve floating devices and buoy lines in fixed gear fisheries.

Scarification analysis: An analysis to determine the cause or potential causes for scars found on a whale's body.

Section 7 consultation: The consultation with the Secretary of Commerce that occurs when a proposed Federal action may affect an ESA-listed marine species.

Serious injury: Any injury that is likely to result in mortality.

Ship strike: A collision between a ship and a whale.

Sink gillnet or stab net: Any gillnet, anchored or otherwise, that is designed to be, or is fished on or near the bottom in the lower third of the water column.

Sinking line: rope that sinks and does not float at any point in the water column. Polypropylene rope is not sinking unless it contains a lead core.

Spawning stock biomass (SSB): The total weight of fish in a stock that are old enough to reproduce.

Species: As defined in the ESA, a species, a subspecies, or, for vertebrates only, a distinct population.

Splice: A joint made by interweaving strands of line together.

Stock: A grouping of fish usually based on genetic relationship, geographic distribution and movement patterns. A region may have more than one stock of a species (for example, Gulf of Maine cod and Georges Bank cod). A species, subspecies, geographical grouping, or other category of fish capable of management as a unit.

Stock assessment: Study to determine the number (abundance/biomass) and status (life-history characteristics, including age distribution, natural mortality rate, age at maturity, fecundity as a function of age) of individuals in a stock.

Stranding: An event in which a marine mammal is dead on a beach, shore, or waters under U.S. jurisdiction; or alive on a beach or shore and unable to return to the water or in need of medical attention, or in waters under U.S. jurisdiction and unable to return to its natural habitat without assistance.

Strategic stock: Under the provisions of the MMPA, a marine mammal stock for which the level of direct human-caused mortality exceeds the PBR. Stock which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA of 1973 in the foreseeable future; or which is listed as a threatened species or endangered species under the ESA of 1973; or is designated as depleted under the MMPA.

Substrate: Ocean floor.

Take: As defined in the MMPA, to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

Threatened: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Toggle: A small buoy used to keep a net or line upright in the water column.

Total length: A fish's greatest length, as measured from the most anterior point of the body to the most posterior point, in a straight line, not over the curve of the body.

Trawl: A series of three or more pots linked together by lines, surface lines, and buoys being placed at intervals, or at the first and last pot.

Trawling up: Increase the minimum number of traps per set of gear (trawl).

Trophic level: The position of a species in a food chain, indicating its level of energy transfer in the ecosystem.

Turbidity: A measurement of the extent to which light passing through water is reduced due to suspended materials; relative water clarity.

Up and down lines: The line that connects the floatline and leadline at the end of each net panel.

Useful life: Under typical circumstances, the length of time a piece of gear can be used before replacement is necessary.

Vessel Monitoring System (VMS): Wireless information system that automatically reports fishing vessel position and activity to NMFS.

Water column: The open ocean environment that lies between the surface and the sea floor.

Weak insert (or weak insertion): A modification or addition to line to allow it to part when subject to a tension load greater than 1700 pounds (e.g. a sleeve or knot).

Weak link: A breakable component of gear that will part when subject to a certain tension load.

Weak line or rope: Rope that will part when subject to a tension load greater than 1700 pounds.

Wet storage: Leaving gear in the water for extended periods of time. ALWTRP regulations prohibit wet storage (i.e., require that lobster traps and anchored gillnet gear must be hauled out of the water at least once every 30 days).

Zero mortality rate goal: The requirement for commercial fisheries to reduce incidental mortality and serious injury of marine mammals to insignificant levels approaching a zero mortality and serious injury rate, as identified in the MMPA. An insignificance threshold has been established as 10 percent of the Potential Biological Removal (PBR) of a stock of marine mammals (See 69 FR 43338 for further details).

Zooplankton: See *Phytoplankton*. Small, often microscopic animals that drift in currents. They feed on detritus, phytoplankton, and other zooplankton. They are preyed upon by fish, shellfish, whales, and other zooplankton.

13.2 Acronyms

ACFCMA Atlantic Coastal Fisheries Cooperative Management Act

ALWTRP Atlantic Large Whale Take Reduction Plan

ALWTRT Atlantic Large Whale Take Reduction Team

ASMFC Atlantic States Marine Fisheries Commission

CEA Cumulative Effects Analysis

CETAP Cetacean and Turtle Assessment Program

CFR Code of Federal Regulations

COLREGS Demarcation Line for the International Regulations for Preventing Collisions at Sea, 1972

DAM Dynamic Area Management

DDT Dichloro Diphenyl Trichloroethane

DEIS Draft Environmental Impact Statement

DMR (Maine) Department of Marine Resources

DPS Distinct Population Segment

EEZ Exclusive Economic Zone

EFH Essential Fish Habitat

EIA Energy Information Administration

EIS Environmental Impact Statement

EO Executive Order

EPA Environmental Protection Agency

ESA Endangered Species Act of 1973

FEIS Final Environmental Impact Statement

FMP Fishery Management Plan

FR Federal Register

FRED Federal Reserve Economic Data

FRFA Final Regulatory Flexibility Analysis

FY Fishing Year
GARFO Greater Atlantic Regional Fisheries Office
GMRI Gulf of Maine Research Institute
GOM Gulf of Maine
HAB Harmful Algal Blooms
HAPC Habitat Areas of Particular Concern
ICES International Council for the Exploration of the Sea
IRFA Initial Regulatory Flexibility Analysis
IUCN International World Conservation Union
IWC International Whaling Commission
LCMA Lobster Conservation Management Area
LCMT Lobster Conservation Management Teams
LMA Lobster Management Area
LOF List of Fisheries
MAFMC Mid-Atlantic Fishery Management Council
MMPA Marine Mammal Protection Act
MSA Magnuson-Stevens Act of 1976
NAO NOAA Administrative Order
NEFMC New England Fishery Management Council
NEFSC Northeast Fisheries Science Center
NEPA National Environmental Policy Act of 1969
NGO Non-Governmental Organization
NMFS National Marine Fisheries Service
NOAA National Oceanic and Atmospheric Administration
NOI Notice of Intent
OCS Outer Continental Shelf
OTP Other Trap/Pot
PBR Potential Biological Removal
PCB Polychlorinated Biphenyl
PPRFFAs Past, Present, and Reasonably Foreseeable Future Actions
RFA Regulatory Flexibility Act
RFAA Regulatory Flexibility Act Analysis
RIR Regulatory Impact Review
SAM Seasonal Area Management
SAR Stock Assessment Report
SARC Stock Assessment Review Committee
SSB Social Science Branch
STSSN Sea Turtle Stranding & Salvage Network
TEWG Turtle Expert Working Group
TRP Take Reduction Plan
USCG United States Coast Guard
VEC Valued Ecosystem Component
VMS Vessel Monitoring System
VTR Vessel Trip Report
WTP willingness to pay

EXHIBIT 8

EXHIBIT A

UNITED STATES DISTRICT COURT DISTRICT OF MAINE

**DISTRICT 4 LODGE OF THE
INTERNATIONAL ASSOCIATION OF
MACHINISTS AND AEROSPACE
WORKERS, LOCAL LODGE 207,
f/k/a, IAMAW MAINE LOBSTERING
UNION – LOCAL 207, et al.,**

Plaintiffs,

v.

GINA M. RAIMONDO, et al.

Defendants.

Docket No. 1:21-CV-275-LEW

DECLARATION OF HON. TROY D. JACKSON

1. I am a Senator of the State of Maine representing Maine Senate District Number 1. Since December of 2018, I have served as the President of the Maine Senate.

2. As the President of the Maine Senate, I am responsible for presiding over the business of Senate, I am first in the line of gubernatorial succession, and I am obligated to serve and protect the interests the people of the State of Maine.

3. Because of the integral role played by the Maine lobstering industry in the economy and culture of the State of Maine, as well as the legacy of Maine's lobstering men and women as stewards of our natural resources, I am keenly aware of and concerned about regulatory actions proposed and promulgated by federal agencies that impact the industry. Consequently, I have actively participated in the dialogue among various individual citizens and interest groups comprising Maine's lobstering community, as well as communications between those individuals and organizations and the federal agencies with regulatory authority over our coastal waters and

fisheries.

4. On March 20, 2019, I participated in an in-person meeting (“the Meeting”) involving David Sullivan, now Chief of Staff for the Eastern Territory of the International Association of Machinists and Aerospace Workers, and representatives of the National Oceanographic and Atmospheric Administration (“NOAA”). The Meeting occurred at the Office of the Maine Senate President at the State House in Augusta. In addition to myself and Mr. Sullivan, also in attendance were B.J. McCollister, Chief of Staff for the Maine Senate President; Maine State Senator David Miramant, Chair of the Senate Marine Resources Committee; Sarah Heil, Assistant Regional Administrator for Sustainable Fisheries, National Marine Fisheries Service, Greater Atlantic Field Office; and Michael J. Asaro, Ph.D., the Acting Assistant Regional Administrator for Protected Resources, Greater Atlantic Region, NOAA Fisheries.

5. The purpose of the Meeting was a discussion concerning regulations under consideration by NOAA for the protection of the north Atlantic right whale and their impact on the health and safety of Maine lobster fishermen and women. At the time of the Meeting, several regulatory options were under consideration that would impact lobster fishing in NOAA’s designated Lobster Management Area I (“LMA 1”). Among the options under consideration were required gear modifications that caused grave concern for the safety, health and well-being of Maine lobstermen.

6. During the Meeting, Mr. Sullivan asked the NOAA representatives whether the agency had “any confirmed sightings or entanglements of right whales in federal waters in the Gulf of Maine,” which includes the 967 square miles located approximately 40 nautical miles off the coast of Maine that now comprise the LMA 1 Restricted Area. The LMA 1 Restricted Area is actively fished by Maine lobstermen, and it provides some of the most important and productive

fishing grounds for Maine lobster between October and January. The LMA 1 Restricted Area had not yet been proposed by NOAA at the time of the Meeting.

7. I clearly recall that the response from Dr. Asaro to Mr. Sullivan's question was that there were "no confirmed sightings." In response to that answer, Mr. Sullivan asked whether the agency performed aircraft surveillance in waters off the coast of Maine, and in response, Dr. Asaro responded "no." Mr. Sullivan then asked the agency representatives, "why not?" Dr. Asaro then replied, "because there is nothing to see there" and "we fly over the Gulf of St. Lawrence and off Massachusetts and Nantucket because we have limited resources and want to use them where the whales are."

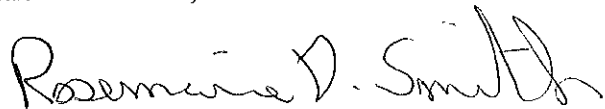
Dated at Augusta, Maine this 1st day of October 2021.



Troy D. Jackson,
President of the Maine Senate

State of Maine
Kennebec, ss.

Personally appeared the above-named Troy D. Jackson before me this 1st day of October 2021 and made oath that the above-stated facts are true upon his own knowledge, information or belief and, so far as they are stated upon information and belief, he swears that he believes them to be true.



Notary Public
Rosemarie D. Smith
Commission Expires
1-6-2023

EXHIBIT 9

EXHIBIT B

Lobsters to Dollars: The Economic Impact of the Lobster Distribution Supply Chain in Maine

**Final Report
June 2018**



Prepared by
Colby College Professor of Economics Michael Donihue
For the Maine State Department of Marine Resources
In Partnership with the
Maine Lobster Dealers' Association

APPX-001285

Acknowledgements

This project was funded by a grant from the Lobster Research, Education and Development (RED) fund administered by the Maine State Department of Marine Resources and Colby College. Research assistance was provided by Colby students Daliah Al-Shakhshir '18 and Matthew DiAngelo '18. Annie Tselikis, Executive Director of the Maine Lobster Dealers' Association provided support for the data collection efforts and access to the dealer network. Digital outreach resources, cartography, and video for this project were provided by Ross Donihue of Maps for Good. Technical assistance for modeling and estimation was provided by the support staff at IMPLAN.

The following lobster dealers participated in the data collection and narrative descriptions of the wholesale lobster distribution supply chain in Maine.

A.C. Inc.	Greenhead Lobster	Ready Seafood
Atwood Lobster	Inland Lobster	Rocky Coast Maine LLC
Bean Maine Lobster	Island Seafood	Sea Salt Lobster
D.B. Rice Fisheries LTD	J.P.'s Shellfish	Seaview Lobster
Eastern Traders	Maine Coast	Stonington Lobster Co-op
Garbo Lobster	Maine Lobster Outlet	Taylor Lobster Company
Gouldsboro Enterprises	Maine Seafood Ventures	Vinalhaven Fishermen's Co-op

Final Report of the Lobsters to Dollars Economic Impact Study

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Summary

Maine's iconic lobster industry is arguably the most visible, and perhaps the most economically important asset for the State. In 2017 more than 110.8 million pounds of Maine lobsters were harvested, with an estimated retail value of over \$451 million – down from a historic peak of 132.5 million pounds valued at \$554.5 million in 2016. Surprisingly, there is little known about the economics of the industry after the product leaves the wharf. Although mandatory reporting provides information on the landed value of lobsters, there has never been an analysis of the value of the lobster industry along its entire supply chain – from the point of first sale to the final consumer. Wholesale distribution supply chains, by their nature, are generally invisible to consumers, policy makers, municipal officials, and regulators. This project makes visible the network of dealers that define the wholesale lobster distribution supply chain in Maine. The Lobsters to Dollars project provides an analysis of the economic output of the wholesale lobster distribution network in Maine in terms of its dollar value and jobs supported by the dealers' operations.

Economic impact studies typically rely on publicly available data on expenditures and employment published by government agencies according to industrial classification. Wholesale distribution operations, whether for furniture, electronics, or lobsters, inherently hard to disentangle from public data sources. The operations of lobster dealers in Maine are variously classified in government data bases as wholesalers, harvesters, retailers, specialty food stores, or restaurants. Further complicating the modeling of economic impacts, most readily available industry multipliers treat all wholesale industries the same. This means that the economic impact of a wholesale distributor of manufactured furniture is assumed to be equivalent to the impact of a lobster dealer shipping a live product to market, according to government estimates. Reliable data for the lobster dealer supply chain in Maine does not exist.

For the Lobsters to Dollars project, thirty-one lobster dealers in coastal Maine communities were interviewed and twenty-one dealers from Kittery to Beals agreed to complete detailed worksheets of their 'upstream' and 'downstream' spending and income relative to their position in the distribution supply chain for live and processed lobsters in 2016. Each participating dealer provided confidential detailed accounts of their spending and revenue for

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2016. This sample of dealers included lobster co-ops (2); wharfs and buying stations (3); large, medium, and small volume wholesale distributors (13); and processors (3). Estimates of the business-to-business indirect effects were computed for each component of spending and induced labor market effects were calculated based on dealer labor payments. Both indirect and induced results were added to dealer direct spending on operational inputs and labor to determine the total regional contribution.

Individual economic impact models were constructed for each of the twenty-one dealers, providing them with an estimate of the dollar value of their contribution to the Maine economy and the number of jobs supported by their operations. The total number of jobs supported, either directly or indirectly by the spending of these dealers included the direct employment of workers doing the grading and packaging of lobsters to induced and indirect employment of local workers whose businesses were impacted by the wages paid to the dealers' employees or business-to-business spending initiated by the dealers.

The twenty-one participating dealers were then matched to a 2017 census of 305 wholesale dealers and divided into subgroups according to similar scales and scope of operation. Retail outlets (including supermarkets), restaurants and individual fishermen holding a dealer's license were excluded from the analysis. Average impacts from the sample were then applied to each subgroup to derive an estimate of the total economic value for the dealer supply chain in Maine.

Scaling the results of this sample of dealers up to an estimate of the impact for the entire network of dealers in Maine proved to be challenging due to the limited participation of the dealers and restrictions on the availability of employer records from the Maine Department of Labor. Of the 305 entities holding dealers' licenses, roughly 150 represent supermarket or grocery stores, restaurants or other retail food outlets. Informal follow-up conversations with a subset of dealers made it possible to divide up the remaining wholesale lobster dealers into size categories according to anecdotal evidence regarding the scale and scope of operations at various points in the distribution supply chain. Wharves and buying stations made up one category, co-ops another, processors were separated into a third group, and the remaining wholesale distributors were categorized according to their approximate scale of operation (small,

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medium, and large). The sample of 21 dealers was then matched to their corresponding functional category and average economic impact values were applied to the other dealers in each group. In this fashion, the wholesale lobster distribution supply chain contributed an estimated \$967.7 million to the Maine economy and supports more than 5,500 jobs in 2016.

Through in-person interviews and survey worksheets, participating dealers were invited to identify the biggest challenges they face as a lobster dealer in Maine. Topping the list of challenges were profit margins and labor shortages. Quality of product and 'shrinkage' was a close second on the list of most of the dealers. Burdensome government regulations and competition from other countries due to recent trade agreements tied for third most mentioned challenges.

The findings of the Lobsters to Dollars project are important for a variety of reasons. The lack of vertical integration and owner-operator fishing rules creates two distinct sectors in this industry: (i) harvesting lobsters; and (ii) the wholesale distribution and processing of the animal. Yet the wholesale distribution of lobsters is neither well understood nor recognized by consumers and policy makers. At the same time, the entire industry faces threats from competing trade agreements, climate change, labor shortages, and insufficient infrastructure investment. Telling the dealers' story, and making visible their economic contributions, provides support for the maintenance and repair of Maine's transportation network infrastructure and policy initiatives designed to improve the efficiency and sustainability of the lobster industry.

What follows is a detailed report of the activities of the Lobsters to Dollars project and accompanying economic impact results. Supporting educational outreach resources can be found at www.colby.edu/lobsters2dollars.

Overview of the Lobsters to Dollars Project

The goals of the Lobsters to Dollars project include: (i) estimating the impact of the operations of wholesale lobster dealers on the Maine economy in terms of dollar value and jobs supported; (ii) providing an educational resource to help dealers, policy makers, and industry analysts better understand the wholesale lobster distribution supply chain; and (iii) make visible the inherently invisible wholesale distribution supply chain of the lobster industry in Maine through the stories told by dealers themselves about what they do.

This project involved in-person interviews with dozens of lobster dealers and harvesters, the collection of a detailed database of spending and revenue sources for lobster dealers, and the construction of dealer-level economic impact models of the wholesale distribution of lobsters on economic activity across the state of Maine.

Wholesale distribution networks, whether for electronics, furniture, or perishable food items like lobsters are an incredibly important component of Maine's economy. Delivering a commodity to its customers is a largely invisible activity that includes transportation, storage, value-added operations, and packaging. Lobsters will often pass from one dealer to another in the process of wholesale distribution and delivery. Economic impact studies of wholesale distribution networks are generally non-existent. Government estimates used for modeling this type of economic activity do not distinguish between different types of wholesale operations – delivering lobsters to market is assumed to be no different than delivering electronics in terms of their wholesale economic impacts – so standard modeling approaches could not be used for the Lobsters to Dollars project.

Further complicating this project were recent limitations imposed by the Federal government and Maine State Department of Labor on the availability of firm-level data on the number of employees and wages paid. As a result, the Lobsters to Dollars project involves several novel approaches in producing the economic impact estimates for the wholesale distribution of lobsters in Maine provided in this report.

Economic Impact Analysis

The economic impact analysis of the Lobsters to Dollars project applies specifically to the wholesale distribution network of lobster dealers in Maine. The economic impacts associated with harvesting lobsters from the Gulf of Maine and retail sales at restaurants, supermarkets, and other food outlets are not part of this project.

Intuitively, economic impact analysis works in the following fashion. Spending by an institution, firm, or individual – like a lobster dealer – directly affects those entities that receive the money. The sum total of this initial spending is referred to as the *direct effects* in economic impact analysis modeling. In general, such spending either goes to individuals in the form of wages, stipends, and salaries (labor services) or to other firms or institutions as fees for provided services (business-to-business transactions).[†]

Employees who receive their wages then spend this money on living expenses and investments in things like education, healthcare, real estate, cars, boats or ATVs. The retail outlets, dealerships, service providers, and entertainment venues in which this spending takes place in turn pay their employees and engage in business-to-business transactions with the money they receive. The sum total of the multiplicative rounds of spending resulting from labor payments by lobster dealers is known as the *induced effects* in an economic impact analysis.

Similarly, business-to-business transactions by a lobster dealer will also have a multiplicative effect on the local, state, and/or regional economy. Transactions for maintenance and repair of vehicles, office equipment, legal and professional services, and even bait, crates, and rubber bands initiate successive rounds of spending by the business that receive these payments and pass a portion along to their employees or supporting operations. The estimated total of this spending represent the *indirect effects* in terms of the economic impact of lobster dealers in Maine.

The total economic impact of a lobster dealer in Maine can then be estimated by summing up the direct, induced, and indirect effects of their business operations.

[†]Note that some spending ‘leaks’ out in each round of the multiplier process in the form of retained earnings of the dealer or supporting businesses, savings by employees, or in taxes paid to the government and municipalities.

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Each of the three components of economic impact analysis have accompanying employment effects. In estimating employment effects, care must be taken to distinguish between newly created jobs (e.g., when a lobster dealer begins operations) and jobs *supported* by the operations of lobster dealers and successive rounds of indirect and induced multiplier effects.

Two approaches for estimating the economic impact of the lobster distribution supply chain were proposed for the Lobsters to Dollars project. The first involved accessing confidential employer-level data from the Maine State Department of Labor (MDOL) for lobster dealers and processors and applying current zip code level multiplier estimates by matching the industry classification in the MDOL database with multipliers used in the IMPLAN software package. These multipliers are derived and regularly updated by the technical staff at IMPLAN using data from the U.S. Bureau of Economic Analysis and a wide array of other government data sets and non-government resources. While this approach would have enabled a geographically detailed level of analysis and involved a great deal of data collection and careful database management, it is not as analytically challenging as other methods of analysis. It would, however, have provided a useful baseline and ‘cross-check’ for more sophisticated estimates of the direct, indirect, and induced effects of the lobster distribution network on the Maine economy. Unfortunately, recent concerns over identity theft and data privacy at the Federal and State levels resulted in a recent policy decision at MDOL to no longer offer academic researchers in Maine non-disclosure access to these confidential employer records so this approach was not possible.

An alternative approach would have been to seek summary data from MDOL for industry-level employment and earnings totals and then apply aggregate multiple estimates to model the direct, induced, and indirect economic impacts of lobster dealers in Maine. As noted above, wholesale distribution operations – whether for furniture, electronics, or lobsters – are by their nature complicated and mostly invisible to the final customer. As a result, the exact nature of wholesale dealer operations are hard to disentangle from public data sources. Specifically, the operations of lobster dealers in Maine are variously classified in MDOL and U.S. Census Bureau databases as wholesalers, retailers, specialty food stores, or restaurants – there is no single

industry for the classification of lobster dealers and no way to assign the aggregate operations of lobster dealers to the various industries in which they operate.

Further complicating the modeling of economic impacts is the fact that most readily available industry multiplier estimates used to construct the models treat all wholesale industries the same. This means that the economic impact of a wholesale distributor of manufactured furniture is assumed to be equivalent to the impact of a lobster dealer shipping a live product to market according to government estimates. In sum, reliable data for the lobster dealer supply chain in Maine does not exist.

To address these complications, the Lobsters to Dollars project models the economic impact of the wholesale distribution supply chain for Maine's lobster industry using a method known as an *analysis by parts*. This approach is more analytically rigorous and better suited for addressing the goals of the Lobster to Dollars project. Analysis by parts is an advanced IMPLAN modeling technique that deconstructs the existing supply chain relationships to isolate the impacts of individual lobster processors and distributors. An analysis by parts approach can produce a much more descriptive and precise impact analysis as regional multipliers are applied to firm-level data. To implement this approach a comprehensive survey of expenditures and revenues for lobster processors and distributors across Maine was created. Using this data, an economic impact analysis at the corresponding county level was constructed for each of the dealers who participated in this project. The total economic impact at the state level was then estimated by aggregating the economic impacts for the sample of dealers.[‡]

Dealer Data

For the Lobsters to Dollars project, thirty-one lobster dealers in coastal Maine communities were interviewed in person and twenty-one agreed to complete confidential detailed worksheets[†] of 'upstream' and 'downstream' spending and income relative to their position in the distribution supply chain for live and processed lobsters in 2016. Dealer

[‡]As a check for robustness of this approach, the spending of all the participating dealers in this study was aggregated by sectoral components and a state-wide 'lobster dealer supply-chain industry' level economic impact analysis was performed. This method is not a perfect comparison to the county level approach described above as the state level approach included interregional trade.

[†]A blank version of the dealer worksheet survey can be found in the appendix to this report.

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participation was a real challenge and often involved multiple site visits to wharves, processing facilities, tank room operations, and warehouses in coastal communities across the state. Every member of the Maine Lobster Dealers' Association received multiple invitations to participate in this project. Invitations and encouragement was also provided by Maine DMR officials. Informational brochures, a short video, and sample surveys were mailed and hand delivered to dealers. There was suspicion and reluctance on the part of many dealers to provide detailed information on their spending and income and scale of operations by essentially providing open access to the profit and loss statements for their businesses. In the end, it was the tenacity of Annie Tselikis, in her role as the Director of the Maine Lobster Dealers' Association, the promise of confidentiality, the development of an introductory 'sizzle reel' video of the goals of the project, and the support of a few key dealer advocates that brought together the subgroup of businesses and individuals represented in the Lobsters to Dollars Project. Economic impact analyses were performed for each of the participating dealers totaling their direct spending with the indirect and induced multiplier effects.

Summary statistics for self-reported spending from the dealer survey worksheets used in modeling their economic impacts are reported in Table 1. The spending categories presented in Table 1 provide a glimpse into the wide variation in the type of operations that exist among lobster dealers and processors in Maine. Wharves, co-ops and pounds do little in the way of 'downstream' value-added in the distribution supply chain but typically provide the 'upstream' harvesters with bait and rubber bands. Distributors and wholesalers generally buy their lobsters directly from wharves, harvesters, and co-ops and then grade, pack and ship the lobsters along the supply-chain to other dealers, retailers or for export directly to food distribution networks and other customers both domestically and abroad. This stage of the supply chain also includes some warehousing – keeping the lobsters alive and healthy in a variety of tanks and shower units. Processors buy lobsters from whomever they can and transform the animal into a commodity that then gets sold to retailers or food distribution networks. All told, the sample of 21 participating dealers reported buying more than 120.2 million pounds of lobster in 2016 valued at over \$62 million.

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Table 1. Self-Reported Lobster Dealer Spending by Category

Category	Average	Median	Maximum	Minimum
Background checks	\$39,626	\$9,000	\$230,000	\$300
Bait	\$655,071	\$290,179	\$4,000,000	\$260
Bank services	\$14,675	\$12,356	\$40,793	\$2,250
Building maintenance	\$17,514	\$13,537	\$63,229	\$750
Business entertainment	\$16,665	\$7,500	\$125,000	\$300
Business insurance	\$32,028	\$10,220	\$289,630	\$300
Cell phone	\$505,622	\$184,000	\$3,500,000	\$2,243
Computer repairs & maintenance	\$49,205	\$49,205	\$95,281	\$3,129
Electricity	\$74,199	\$50,000	\$250,000	\$3,000
Equipment rental	\$184,225	\$134,091	\$587,000	\$18,260
Equipment repairs & maintenance	\$3,365	\$940	\$16,373	\$100
Motor fuel	\$34,384	\$152,308	\$1,300,000	\$1,500
Legal and professional services	\$29,714	\$15,486	\$124,000	\$342
Marketing & advertising	\$356,517	\$14,982	\$120,000	\$1,500
Office supplies	\$42,457	\$17,337	\$140,000	\$5,000
Packaging expenses	\$328,582	\$15,000	\$2,863,669	\$500
Payroll services	\$138,223	\$100,000	\$450,000	\$8,560
Plowing/landscaping	\$441,411	\$441,411	\$880,000	\$2,823
Postage	\$836	\$617	\$1,805	\$306
Product shipping fees	\$220,542	\$80,000	\$1,485,884	\$1,530
Rent	\$49,807	\$15,000	\$209,064	\$375
Rubber bands	\$194,585	\$76,000	\$1,000,000	\$2,040
Sewer & Water	\$8,748	\$1,530	\$37,000	\$765
Telephone and business internet	\$35,551	\$15,000	\$170,000	\$500
Vehicle leasing	\$107,918	\$67,284	\$350,000	\$9,000
Vehicle maintenance & repairs	\$42,700	\$29,865	\$175,000	\$2,000
Waste removal	\$35,300	\$22,000	\$75,000	\$8,899

Results

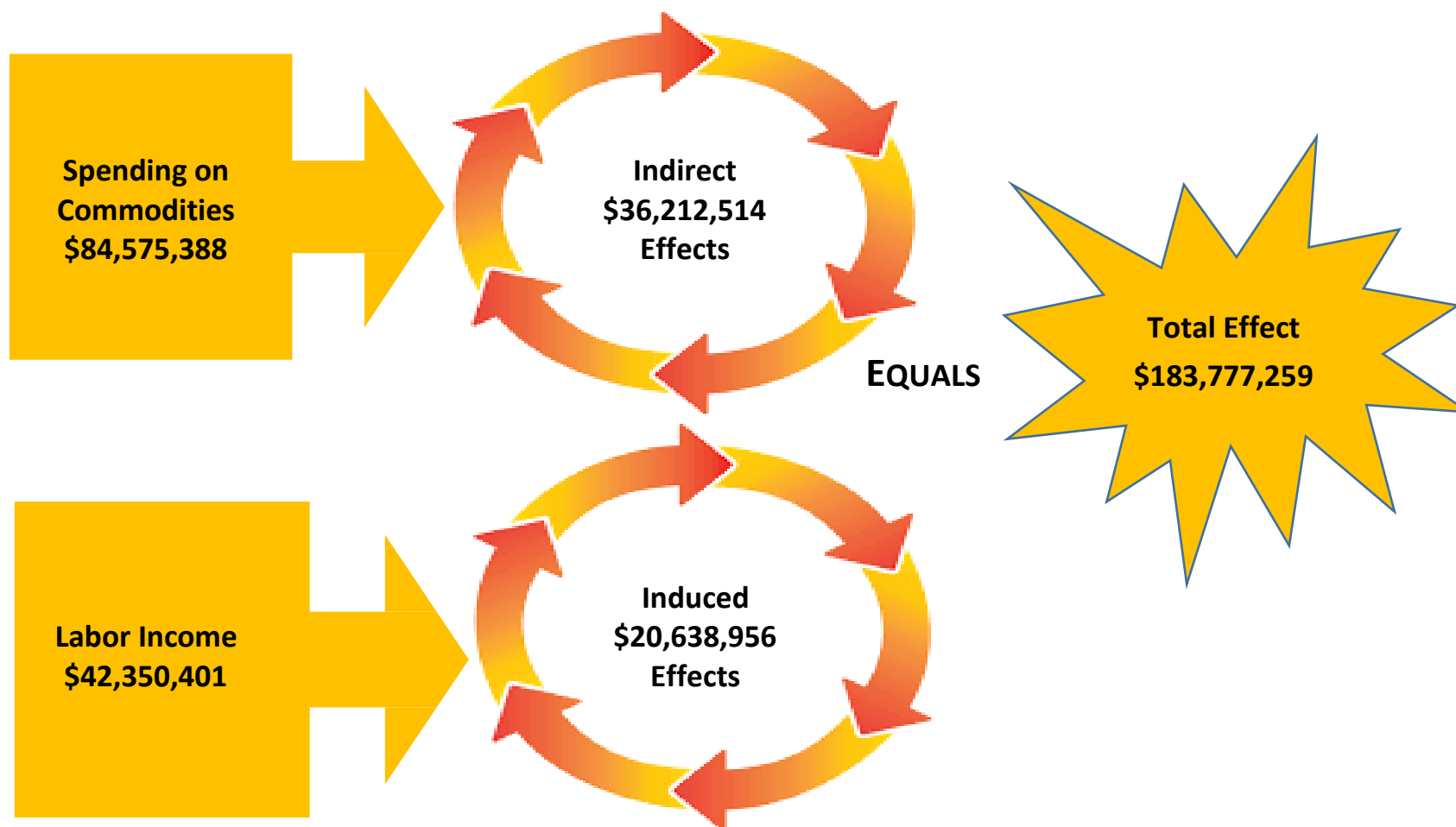
The spending categories in Table 1 were assigned to IMPLAN's activity sectors using NAICs codes and definitional categories specific to the modeling application and a dealer's scope of operations. Each dealer model included two activities: one for employment, income and *direct value added* – non-commodity payments and income associated with a dealer's operations including payroll expenses, business taxes, and other income (profits, rents, etc.); and a second for the individual categories of spending on commodities. The model was then solved in IMPLAN, applying 2016 county-level multiplier estimates. Figure 1 on the following page presents the results.

Dealers who participated in the Lobsters to Dollars project reported total spending on goods and services in the amount of \$84,575,388 in 2016 which in turn generated an estimated additional \$36,212,514 in indirect (business-to-business) economic activity. This group also reported payroll spending and other income totaling \$42,350,401 in 2016 which is estimated to have generated \$20,638,956 in induced economic activity. The total economic output from the operational activities of this group of wholesale distributors and processors is estimated to have been \$183,777,259 in 2016. Accompanying this level of economic activity is an estimated 1,206 jobs that were supported as a result of these dealers' operations in 2016.

The twenty-one participating dealers were then matched to a 2017 census of wholesale dealers and classified by similar scale and scope of operation. Using these economic impact results from the sample of dealers the entire list of firms and individuals holding lobster dealer licenses was then arranged by function (e.g., processor, wharf, co-op, wholesaler, and distributor) and scale of operations. As noted above, retail outlets (including restaurants and supermarkets) and individual fishermen holding dealer's licenses were excluded from the analysis. Average economic impacts calculated from the sample of participating dealers were then applied to the remaining dealers for each operational subgroup. The subgroup results were then aggregated and an estimate of the total economic output and number of supported jobs attributable to the wholesale distribution of lobsters in Maine was derived as detailed below.

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Figure 1. Economic Impacts for the Sample of Participating Dealers



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Aggregate Economic Impact for the Maine Economy

As noted above, aggregating and extrapolating the \$183,777,259 in economic output attributable to the 21 dealers who participated in the Lobsters to Dollars data collection exercise required a subjective analysis of the full census of 305 Maine businesses, harvesters, and co-ops holding dealers' licenses in 2017. With the help of DMR professionals, the director of the Maine Lobster Dealers' Association (Annie Tselekis) and conversations with some of the participating dealers, the census of dealer license holders was classified into subgroups according to the nature of their business and their scale of operations. After excluding restaurants, supermarkets, grocery stores, other retail outlets and fishermen holding one or more dealer's licenses, 167 wholesale dealers and processors remained. Each of these representative subgroups had one or more dealer who participated in the Lobsters to Dollars project. Average economic impact values and estimated impacts were then applied to each group and totaled to get an estimate for the total economic impact of the wholesale lobster dealer distribution supply chain in Maine as described below in Table 2. These 167 wholesale distributors, processors, wharfs, pounds, and co-ops licensed lobster dealer contributed an estimated \$967,675,313 – nearly \$1 billion – to the Maine economy and supported more than 5,500 jobs in 2016.

Table 2. Aggregation of Economic Impacts

Category of Operations	Total Dealer License Holders	Lobster to Dollars Participants	Impacts	
			Economic Output (2016 \$s)	Jobs Supported
Distributor	7	1	\$19,980,073	1,163
Processor	11	3	\$274,489,504	873
Wharf	84	3	\$206,551,022	1,259
Large & medium volume wholesaler	15	8	\$162,304,010	1,008
Other wholesaler	36	4	\$141,684,999	652
Pound/Co-op	14	2	\$162,665,705	631
TOTALS	167	21	\$967,675,313	5,586

Challenges Facing Lobster Dealers in Maine

In addition to gathering data, dealers were surveyed as to the most pressing challenges they face in their day-to-day operations. Their responses are reported in the table at right. Chief among the concerns, with nine dealer responses each, was a shortage of labor and shrinking profit margins.

Next on the minds of dealers is the challenge of “shrink”, or the quality of product in terms of lobsters that arrive weak, unhealthy or die before reaching the end of the wholesale distribution supply chain.

The supply of herring as a source of bait for lobster traps was of significant concern among dealers at the time of this survey in 2017.

Migrant labor plays an important role in the wholesale lobster distribution supply chain, primarily in the sorting, grading, and packing of lobsters. Dealers from Kittery to Beals all had stories to share about how difficult it was to find workers. In the end, it’s clear that the wholesale distribution of lobsters is an important ‘second-chance’ industry for workers willing to show up and work hard. Dealers are willing to pay a premium for workers regardless of their background or skill level.

Rank	Challenge
1	Labor shortage
	Profit margins
3	Shrink
4	Competition
	Regulation
6	Bait supply
7	Future supply
	Aging dealers
	Disconnect between mkt place and the share harvesters think the dealers are selling at
	False price reports
	Financing
	Getting paid for lobsters
	Keeping employees happy
	Lack of respect
	Market dynamics
	Paper work
	Price volatility
	Seasonally constrained cash flow
	Space
	Taxes
	Year-round Maine supply

Outreach Resources and Recommendations

A variety of outreach resources accompany the Lobsters to Dollars project. Specifically, an interactive web site (www.colby.edu/lobsters2dollars) and an eight minute video (https://youtu.be/LSBK72HiW_U) provide opportunities for telling the dealers' story, informing policy makers and the general public about the work of lobster dealers in delivering this crustacean to market, and generally make visible the wholesale lobster dealer supply chain in Maine.

The findings of the Lobsters to Dollars project are important for a variety of reasons. The lack of vertical integration and owner-operator fishing rules creates two distinct sectors in this industry: harvesting lobsters; and the wholesale distribution and processing of the animal. Yet the wholesale distribution of lobsters is neither well understood nor recognized by consumers and policy makers. At the same time, the entire industry faces threats from competing trade agreements, climate change, labor shortages, and insufficient infrastructure investment. Telling the dealers' story, and making visible their economic contributions, provides support for the maintenance and repair of Maine's transportation infrastructure network and policy initiatives designed to improve the efficiency and sustainability of the lobster industry.

Looking forward, there is a need for better data and additional research regarding the economic impact the lobster industry has in Maine. Increased participation of the dealers would improve the estimates offered in this report. Similar economic impact analyses for the harvesting and retail sale sectors of the lobster industry would provide valuable information as well. There is no doubt that the lobster industry in Maine is among the most – if not *the* most – important in the state in terms of economic impact and cultural identity. There is a general consensus that the lobster industry today faces serious threats from climate change, environmental degradation, uncertain biological behavior of the species, and cultural and economic barriers to trade coming from abroad. The ability of policy makers, government regulators, and members of this industry – from harvesters to dealers to trade representatives and retailers – to sustain this important sector of the Maine economy depends critically on the availability of accurate and timely information.

EXHIBIT 10



JANET T. MILLS
GOVERNOR

STATE OF MAINE
DEPARTMENT OF MARINE RESOURCES
21 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0021

EXHIBIT C

PATRICK C. KELIHER
COMMISSIONER

December 27, 2019

Michael Pentony
Regional Administrator
National Marine Fisheries Service
55 Great Republic Drive
Gloucester, Massachusetts 01930

Dear Mr. Pentony

The Maine Department of Marine Resources (ME DMR) submits to NOAA Fisheries its proposal for regulatory changes to the Atlantic Large Whale Take Reduction Plan (ALWTRP). This proposal is in response to the finding that the removal of North Atlantic right whales is above the Potential Biological Removal established in the Marine Mammal Protection Act (MMPA). The document includes proposed regulatory modifications to the Maine lobster fishery.

The attached proposal was developed by ME DMR staff, with input from industry. It focuses regulatory change on areas where right whales are most likely to be present in Maine's coastal waters, with the goal of achieving protective measures where they are needed most and would be the most effective. It also balances this conservation with the safety concerns highlighted by industry and the economic viability of the lobster fishery. As stated at NOAA Fisheries' scoping meetings, the lobster fishery is the economic and social cornerstone of Maine's coastal and island communities. It includes not only license holders but crew, lobster dealers, processors, distributors, and a multitude of associated restaurant and tourism industries. This fishery has been a model of conservation, not only in the management of the lobster resource, but also in its two-decade participation in regulations aimed at protecting large whales. In fact, a right whale entanglement has not been directly linked to the Maine lobster fishery in well over a decade.

ME DMR's proposal is comprised of several components. They include reductions in the number of vertical lines, weakening of remaining vertical lines, increased gear marking, and increased harvester reporting. There is also a discussion regarding the enforcement benefits and potential impacts of tracking on federally permitted vessels. In combination, these measures not only minimize the risk of serious injury and mortality which may result from an entanglement but also reduce the potential of an entanglement occurring. Further, these measures improve the effort and location data collected by the Maine lobster fishery. Our hope is that, if future conversations are needed, an improved data set will enable measures to be targeted to fisheries and regions with high right whale densities and known entanglements. The

proposal also includes a provision for conservation equivalency so that regional differences in fishing practices and oceanographic conditions can be considered. This level of flexibility is critical so that safety issues not addressed in the state-wide approach can be ameliorated prior to implementation.

In addition, this proposal outlines several concerns that ME DMR has had with the ALWTRT process, the development of supporting analyses, and the timing of pending management versus needed scientific data. These concerns have prompted the Department to develop its own supporting analyses given a completed model was not available at the time of proposal submission. Given management measures related to the protection of right whales are generally reviewed on a five-year schedule, my hope in raising these issues is to ensure the process can be improved for the future.

I am confident the measures outlined in this proposal provide significantly greater protection to right whales transiting through the Gulf of Maine. As such, we request NOAA Fisheries include these measures as preferred alternatives in the upcoming proposed rule.

ME DMR remains committed to working with NOAA during the upcoming regulatory process. If you have any questions, please do not hesitate to reach out.

Sincerely,

A handwritten signature in blue ink, appearing to read 'P. Keliher', with a long horizontal flourish extending to the right.

Pat Keliher, Commissioner

Maine Department of Marine Resources' Proposal to Amend the Atlantic Large Whale Take Reduction Plan

The following proposal includes a series of measures intended to prevent right whale serious injury and mortality, and to reduce the presumed risk of entanglement posed by the Maine lobster fishery. The proposal was developed after thorough analyses regarding the location of right whales in the Gulf of Maine, the location of Maine lobster gear, the relative threat of different gear configurations, and the risk reduction associated with various management tools. Development of the proposal also considered several important criteria including safety of fishermen, feasibility, enforceability, and economic impacts to the fishery.

ME DMR has been an active participant on the Atlantic Large Whale Take Reduction Team (ALWTRT) and has routinely worked with state and federal partners to better the science and data needed to support this group's discussions. We are committed to solving issues regarding the endangered status of right whales and recognize that the ALWTRT process allows for input from multiple caucuses, including fishermen, Non-Governmental Organizations, and state agencies. While at the April 2019 meeting ME DMR supported the preliminary recommendations put forth by the ALWTRT, the Department also reserved its right to disagree with this recommendation in the future, pending analysis to determine what a 50% vertical line reduction meant in practice and to consider new, changing, or emerging data. After conducting this analysis, it became clear a 50% vertical line reduction placed the largest portion of the burden on the fishery within Maine's exemption line – an area NOAA found, based on scientific data, that endangered large whales rarely venture.¹ This large burden in exempted waters resulted because roughly 70% of vertical lines associated with the lobster fishery in Maine state waters are located within Maine's exemption line. Consequently, an overall 50% vertical line reduction forced drastic measures primarily in areas where whales do not frequent. This would have resulted in large economic hardship for inshore fishermen, a reduction in the diversity of the Maine lobster fleet, and minimal benefits to right whales.

Given this information, ME DMR completed its own analysis, using many of the same data inputs as NOAA Fisheries, to understand Maine's 'risk' resulting from the overlap between the Maine lobster fishery and the transiting of right whales through the Gulf of Maine. The results showed the risk in Maine waters increases with distance from shore, with the majority of Maine's risk occurring outside the 12-mile line. Thus, this proposal focuses measures in federal waters.

This proposal includes management measures and data collection tools. Many of the measures are differentiated by distance from shore given Maine's expansive coast and vast regional differences. Detailed explanations of these measures are provided in the sections that follow. A cornerstone of ME DMR's proposal is the request for conservation equivalency and an individual safety program. This flexibility is needed to address significant regional differences such as traditional fishing practices, tides, and vessel traffic.

¹ 72 Fed. Reg. 57104, 57162 (Response to comment 337)

Without this management flexibility, future rules will fail to take into account the diversity of Maine's lobster fleet and differing oceanographic conditions within the Gulf of Maine.

This proposal does not include any trap reductions or area closures. As outlined in ME DMR's September 2019 scoping comments (Appendix IV), both trap reductions and area closures present several concerns in Maine. Because there are often multiple traps fished on a single endline or trawl, a practice known as trawling up, trap reductions do not decrease vertical lines on a one-to-one basis. This means substantial trap reductions are needed to see a modest reduction in the number of vertical lines, prompting serious economic consequences. For area closures, their efficacy is based on the assumption that gear is brought to shore. However, the year-round nature of the offshore lobster fishery makes it unlikely this assumption would be met. Instead, it is more likely gear would be moved to adjacent fishing grounds yielding denser aggregations of gear around areas intended to protect whales. Or, risk associated with the gear could simply be shifted to another location.

ME DMR identified several challenges with the decision support tool presented to the ALWTRT. These challenges included incomplete analysis, particularly in regard to the gear threat score, and frequently changing risk reduction percentages as methodologies and data inputs changed. As a result, the Department developed its own tool (Appendix I) to calculate the risk reduction gained using certain management measures. Section B in this document describes the challenges that prompted ME DMR to develop its own tool, as well as concerns with the overall process, in greater detail.

A. Background on the Maine Lobster Fishery and Regulations To-Date

American lobster is the most valuable single species landed in the U.S. The Maine lobster fishery is a critical component of the State's economy and culture. Since the early 2000's, landings in the lobster fishery have exponentially increased from roughly 57.2 million pounds in 2000 to a high of 132.6 million pounds in 2016.² In 2018, 121.3 million pounds of lobster were landed in Maine, representing an ex-vessel value of \$491 million dollars.³ These 2018 landings represented 82% of the total lobster landings in the U.S.⁴

The fishery encompasses roughly 4,800 lobster license holders and 1,100 student license holders. Underscoring the importance of commercial fishing to Maine is the most recent data from the Atlantic Coastal Cooperative Statistics Program which reveals that Maine commercial harvesters took more than twice the number of commercial fishing trips than any other state on the east coast. In 2017, Maine harvesters reported 447,523 trips while harvesters from Virginia, the next highest state, reported just 217,940.⁵ Importantly, participation in the lobster fishery is much greater, as is its value to Maine's coastal economy. Many individuals who do not have a lobster license are an integral part of the fishery's operations, including dealers, processors, sternmen, bait dealers, trap builders, and boat mechanics. Many more participate in the logistics and tourism businesses associated

² ME DMR landings data: <https://www.maine.gov/dmr/commercial-fishing/landings/documents/lobster.table.pdf>

³ ACCSP Data Warehouse. Data pull on 12/23/19.

⁴ ACCSP Data Warehouse. Data pull on 12/23/19.

⁵ ACCSP Data Warehouse. Data pull on 12/11/19.

with the lobster industry. In fact, a recent economic study concluded the Maine lobster supply chain has an economic impact to the state of \$1 billion annually.⁶ Maine's coastal communities are particularly dependent on lobster fishing and related business due to low alternate wages and limited career options in those communities.⁷

ME DMR has actively contributed to the development and implementation of protective measures for right whales and has a history of expanding federal measures beyond the minimum federal requirements. Since the establishment of the ALWTRP, ME DMR has implemented 600 lbs weak links on buoy lines to ensure low breaking strengths, gear markings to identify trap/pot gear, sinking groundline to reduce entanglements, and trawling-up requirements to reduce the number of vertical lines in the fishery. ME DMR has also expanded many of these requirements to areas exempted from the federal ALWTRP. For example, ME DMR prohibits float rope on the surface for all lobster pot gear, including gear fished inside the exemption line. ME DMR has also been at the forefront of efforts to improve the spatial resolution of gear marking; the State has already adopted rules to implement new gear marking requirements which prescribe a Maine-specific purple gear mark, increase the frequency of markings on a rope, and expand gear marking requirements into exempted waters. These new regulations will be implemented in 2020, ahead of the federal regulatory process. Finally, Maine Marine Patrol and the Bureau of Marine Science collaborate with NOAA Fisheries, serving as primary regional responders to address whale entanglements on the Maine Coast. There are approximately 46 uniformed field personnel trained to a minimum of Level I that are capable of responding to entanglements for initial assessment and stand-by purposes. Nine officers and one Bureau of Marine Science staff have undergone apprentice training and hold their Level III authorizations under the Marine Mammal Health and Stranding Response Program's permit. This authorization designates the holder as a primary responder for disentanglement activities. As a part of the Atlantic Large Whale Disentanglement Network, ME DMR's primary responders work with NOAA Fisheries and other network members to engage in assessment, reporting, and response when reports of entanglements are received.

Many of the above regulations and activities have been adopted with minimal data linking the Maine lobster fishery to cases of right whale entanglement, particularly in the last decade. Since 2017, there have been thirty documented cases of right whale serious injury and mortality. None of these cases have been attributed to the Maine lobster fishery. In fact, entanglement records indicate the most recent known right whale entanglement in Maine lobster gear occurred fifteen years ago in 2004. Thus, the data from known entanglements suggest the Maine lobster fishery is not the primary source of right whale serious injury and mortality. The data also suggest previous regulations, particularly the implementation of sinking groundline which occurred in 2009, have been effective. In fact, since the sinking groundline rule went into place, there have been no right whale entanglements linked to groundlines from the US lobster fishery.

⁶ Lobsters to Dollars: The Economic Impact of the Lobster Distribution Supply Chain in Maine by Michael Donihue, Colby College. June 2018.

⁷ Gulf of Maine Research Institute. Understanding Opportunities and Barrier to Profitability in the New England Lobster Industry 13 (2014), https://www.gmri.org/sites/default/files/resource/gmri_2014_lobster_survey.pdf.

In contrast, there is a mounting level of evidence which indicates that other fisheries, particularly the Canadian snow crab fishery, and vessel strikes are contributing to an increasing portion of right whale serious injuries and mortalities. Of the thirty documented cases of right whale serious injury and mortality since 2017, twenty-one have occurred in Canada.⁸ This includes nine cases of serious injury and mortality which occurred in 2019. Further, an additional two mortalities, which were first sighted in US waters, have been attributed to Canadian snow crab gear entanglements. Looking further back to 2012- 2016, the years used by NOAA to calculate a recommended risk reduction, one of the cases of serious injury and mortality attributed to a US fishery was the result of an entanglement with netting. Additionally, evidence suggests that vessel strikes are a significant contributor to right whale serious injury and mortality. Out of the thirty cases of serious injury and mortality since 2017, eight have been attributed to vessel strikes, including a case in US waters.

Information collected from right whale entanglements also indicates the vast majority of rope taken off of right whales is not indicative of the Maine lobster fishery. Based on a 2018 industry survey, ME DMR found the most prominent rope diameters used in the Maine lobster fishery are 3/8" rope followed by 7/16" rope (Appendix V). Results of the survey also showed that over 79% of rope used in the Maine lobster fishery is less than 1/2" in diameter. In contrast, entanglement records indicate that, between 2010 and 2018, 81% of all recovered rope taken off right whales was greater than 1/2" diameter.⁹ This data further suggests that the Maine lobster fishery is not a primary contributor to right whale entanglements.

Right whale habitat use and residency times in historically known feeding habitats are also changing. Since 2010, right whale occurrence in the Gulf of Maine has declined.¹⁰ A similar decrease of habitat use has also been documented across the same time frame in what had been critical late summer feeding habitat in the Bay of Fundy.¹¹ Hypotheses explaining this shift include large-scale changes in food supply, namely the copepod *Calanus finmarchicus*. A recent study supports this hypothesis by documenting an increase in the bottom temperature experienced in the basins within the eastern Gulf of Maine.¹² This ecosystem change is acting to drive down the availability of the calanus copepod in the Bay of Fundy and can potentially predict whether right whales will be seen there year to year. Other

⁸ NOAA Fisheries. 2017-2019 North Atlantic Right Whale Unusual Mortality Event.

<https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2019-north-atlantic-right-whale-unusual-mortality-event>

⁹ ALWTRT October 2018 Meeting. Presentation by GARFO Staff re: Line Diameter.

https://archive.fisheries.noaa.gov/garfo/protected/whaletrp/trt/meetings/October%202018/eg_line_diameter.pdf

¹⁰ Davis, G. E., Baumgartner, M. F., Bonnell, J. M., Bell, J., Berchok, C., Thorton, J. B., Brault, S., Buchanan, G., Charif, R. A., Cholewiak, D., Clark, C. W., Cockeron, P., Delarue, J., Dudzinski, K., Hatch, L., Hildebrand, J., Hodge, L., Klinck, H., Kraus, S., Martin, B., Mellinger, D. K., Moors-Murphy, H., Nieukirk, S., Nowacek, D. P., Parks, S., Read, A. J., Rice, A. N., Risch, D., Sirovic, A., Soldevilla, M., Stafford, K., Stanistreet, J. E., Summers, E., Todd, S., Warde, A., and S. M. Van Parijs. 2017. Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (*Eubalaena glacialis*) from 2004 to 2014. *Scientific Reports*. 7:13460 (1-12).

¹¹ Davies K.T.A., Brown M.W., Hamilton P.K., Knowlton A.R., Taggart C.T., and A.S.M. Vanderlaan. 2019. Variation in North Atlantic right whale *Eubalaena glacialis* occurrence in the Bay of Fundy, Canada, over three decades. *Endangered Species Research*. 39:159-171.

¹² Record, N., Runge, J. A., Pendleton, D. E., Balch, W. M., Davies, K. T. A., Pershing, A. J., Johnson, C. L., Stamieszkin, K., Ji, R., Feng, Z., Kraus, S. D., Kenney, R. D., Hudak, C. A., Mayo, C. A., Chen, C., Salisbury, J. E., and C. R. S. Thompson. 2019. Rapid Climate-Driven Circulation Changes Threaten Conservation of Endangered North Atlantic Right Whales. *Oceanography*, 32, 2: 162-169.

feeding habitats, outside of the Gulf of Maine, have seen increases in use by right whales over the last decade. Cape Cod Bay and the surrounding waters in Massachusetts have seen an increase in individuals sighted or detected in this important early season feeding habitat.¹³

As the use of the Gulf of Maine as a summer feeding ground has decreased, sighting and acoustic surveys have documented a shift towards summertime use of the Gulf of St. Lawrence by right whales.¹⁴ The shifts in habitat use documented above show a decreasing reliance on the Gulf of Maine as a feeding habitat for right whales. This is likely particularly true for waters very near to shore where most of the lobster fishery is executed. ME DMR again notes that the majority of Maine state waters, where most lobster permits are held, are exempted from the ALWTRP and outside designated right whale critical habitat. This spatial designation (e.g. the exemption line and critical habitat boundary) was based on the low number of right whale sightings as well as studies which show low concentrations of calanus which do not support the aggregation of right whales.¹⁵

B. Review of September 2018 – Present; Challenges and Concerns

ME DMR has been an engaged partner in the ALWTRT process since the group's inception. However, over the last few years, ME DMR has expressed concerns about the thoroughness of analyses being conducted, the availability of preparatory work prior to meetings, and the existence of new, changing, or emerging data. This has impacted ME DMR's ability to fully engage in the process and make informed decisions when developing this plan.

In September 2018, the Northeast Fisheries Science Center (NEFSC) released a technical memo entitled "*North Atlantic Right Whales – Evaluating Their Recovery Challenges in 2018*". While the title of the memo suggested the document would be a comprehensive review of many challenges facing right whales, the memo focused on a single fishery in a single region: the American lobster fishery in the Gulf of Maine. Throughout the memo, hypotheses were stated as fact, with inappropriate or no data to support the assumptions and conclusions. For example, the memo incorrectly suggested the 2015 vertical line regulations increased the strength of rope used, and therefore the severity of entanglements; however, the data provided to support this assumption included a paper which looked at data from 1994-2010, well before the regulatory change. Many of the datasets cited in the memo were inappropriate for the context, including the citation of an industry newsletter which approximated the number of traps fished. This figure was then used to inform an absolute

¹³ Mayo C., Ganley L., Hudak C.A., Brault S., Marx M.K., Burke E., and M.W. Brown. 2018. Distribution, demography and behavior of North Atlantic right whales (*Eubalaena glacialis*) in Cape Cod Bay, Massachusetts 1998-2013. *Marine Mammal Science*. 34(4): 979-996; Charif R.A., Shiu Y., Muirhead C.A., Clark C.W., Parks S.E., and A.N. Rice. 2019. Phenological changes in North Atlantic right whale habitat use in Massachusetts Bay. *Global Change Biology*, 00:1-12.

¹⁴ Simard Y., Roy N., Giard S., Aulancier F. 2019. North Atlantic right whale shift to the Gulf of St. Lawrence in 2015, revealed by long-term passive acoustics. *Endangered Species Research*. 40: 271-284; DFO. 2019. Review of North Atlantic right whale occurrence and risk of entanglements in fishing gear and vessel strikes in Canadian waters. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2019/028.

¹⁵ Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations, 72 Fed. Reg. 57103 (October 5, 2007); Endangered and Threatened Species; Critical Habitat for Endangered North Atlantic Right Whale, 81 Fed. Reg. 4837 (January 27, 2016).

number of traps in the memo. Many more statements were not cited. ME DMR communicated its serious concerns about the merit of this technical memo and its basis for the upcoming ALWTRT meeting in an October 2018 letter to the Director of the NEFSC (Appendix II). Unfortunately, despite ME DMR's concerns regarding the inaccuracies in the document, the Technical Memo remains published without substantial edits by the NEFSC and continues to be cited on NOAA's own website¹⁶. In fact, the only change made to the memo was the addition of the word "may" to a statement to indicate it is a hypothesis.

On April 5, 2019, less than three weeks before the ALWTRT meeting, NOAA released a statement indicating the agency would be seeking a risk reduction target of 60-80%. This announcement included minimal data to support its conclusions and, because it was distributed via email, did not provide an opportunity for questions and discussion. In response to numerous questions from the Maine Lobstermen's Association, a follow-up email from NOAA Fisheries staff was sent on April 18, 2019 which indicated other approaches were considered to calculate the risk reduction target; however, yet again, minimal rationale was provided for the method ultimately chosen. Of greatest concern to ME DMR was the assumption that 50% of unattributed cases of serious injury and mortality (SI&M) were the result of U.S. entanglements and 50% were the result of Canadian entanglements. This assumption did not match recent trends which show Canadian fisheries are responsible for an increasing portion of SI&M. Unfortunately, no time was set aside ahead of the April 2019 ALWTRT meeting to discuss these assumptions or the risk reduction target. At the April 2019 ALWTRT meeting, members were discouraged from discussing the risk reduction target given time constraints.

At the same time, NOAA announced weeks before the April 2019 ALWTRT meeting that it was developing a model, called the "decision support tool", to calculate risk reduction percentages achieved through various management tools. While ME DMR had no objection to this goal and fully supported additional modeling efforts to help inform the recommendations of the ALWTRT, ME DMR was concerned about the short timeframe for a model to be thoughtfully developed, tested, and reviewed. These concerns were realized on an April 16th webinar in which NEFSC staff walked through preliminary results of the model. First, ME DMR expressed concern about the components of the model. The severity score was based off a poll given to the ALWTRT members which was neither developed nor reviewed by a social scientist or someone with direct expertise in survey methodology. In addition, there was a clear incentive for ALWTRT members to inflate or deflate gear severity scores given the data would directly impact management recommendations. Unsurprisingly, ALWTRT members voted along caucus lines resulting in a wide range of scores for most gear configurations. Sensitivity analyses run by ALWTRT members during the April 2019 meeting confirmed the results from the tool were highly dependent on the gear severity scores derived from the poll. Additionally, the whale habitat component of the model raised concerns as it lacked key data components including the most recent standardized whale surveys, and available information from alternative sighting sources and acoustic deployments. It also had low effort in inshore Gulf of Maine where the bulk of the lobster fishery is promulgated. As a result, recent changes in right whale distribution were

¹⁶ <https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/right-whales-and-entanglements-more-how-noaa>

not reflected in the data outputs, whale distribution data were ‘stretched’ within the exemption line, and there was a high level of uncertainty where the majority of vertical lines are deployed.

The compilation of these concerns resulted in puzzling risk reduction model results. While areas south of Nantucket, where right whales are known to visit but fishing effort is low, were given low risk scores, areas of inshore Gulf of Maine, where fishing effort is high but right whales are extremely infrequent, were given high risk scores. This result did not match NOAA’s stated intention of identifying overlapping areas of high gear density and frequent whale presence. In the end, the risk reduction model used at the ALWTRT meeting was not a finished product; data inputs were not finalized, the code was not perfected, and the model was not peer-reviewed. In fact, the model crashed during a Maine break-out session at the meeting when the Maine delegation tried to look at measures differentiated by distance from shore. The suite of ME DMR’s concerns regarding the risk reduction target and the decision support tool were outlined in a letter to the Regional Administrator dated April 19, 2019 (Appendix III).

Since the April 2019 ALWTRT meeting, ME DMR has struggled to develop a proposal due to instability in the risk reduction percentages achieved by various management measures. In April 2019, calculations from the decision support tool showed vertical line reductions received, by far, the highest percent risk reduction of the measures considered. This output was used to derive Maine’s preliminary plan. However, since the April 2019 ALWTRT meeting, changes have been made, and continue to be made, to the model in response to the concern expressed by many ALWTRT members, and to changing and emerging data. While ME DMR is appreciative that NEFSC staff continue to develop and improve the decision support tool, the modifications have resulted in frequent changes to the risk reduction percentages associated with various management options. These percentages continue to change as of the writing of this proposal. Most notably, the risk reduction percentage associated with the implementation of rope which breaks at 1,700 lbs has significantly increased relative to percentages given at the ALWTRT meeting. These changes in the risk reduction percentages have not been communicated to the broader ALWTRT.

Further, the November 2019 Peer Review of the decision support tool highlighted that many of the concerns raised in ME DMR’s April 2019 letter to NOAA have not been addressed. ME DMR staff attended the Peer Review in hopes of learning more about the model since no documentation has been shared with the ALWTRT. Unfortunately, it became clear from the meeting that several components of the model were not finalized. Specifically, the updated whale habitat data, which is critical to understanding the new migration patterns of right whales, is delayed and was not available for the peer review. Further, a substitute for the gear severity poll had not yet been developed or tested. In fact, a potential new gear severity score presented on the last day of the Peer Review showed confounding results in which the highest gear severity in Maine was calculated to be in a lobster zone with the fewest participants and the lowest trap allocation. As a result, it was clear that significant work was still needed on the decision support tool. Further, ME DMR was concerned to hear that, for some portions of the offshore lobster fishery, catch was being used as a proxy to estimate the number of vertical lines. While ME DMR recognizes data on effort in the offshore lobster fishery is limited, we have repeatedly commented that it is inaccurate to assume an increase in landings is correlated to an equal increase in fishing

effort (this proposal provides data regarding landings and effort on pages 14-16). This is particularly true given the exponential increase in the abundance of lobster within the Gulf of Maine/Georges Bank stock. As a result, the model is likely overestimating the number of vertical lines in the offshore lobster fishery given the increase in abundance, catch per trap, and landings.

As the decision support tool continues to be developed, it is unclear how the model results will be used in the upcoming proposed rule. While advancements are still needed on the decision support tool, the management process required to implement new ALWTRP regulations continues to move forward. As a result, there is a clear disconnect between the timeline for the science intended to support management and the implementation of new regulations. NOAA has previously acknowledged this discrepancy. During a meeting with NOAA on July 11, 2019, NOAA staff indicated the co-occurrence model, not the risk reduction model, would be used in the proposed rule. This was a significant departure from what ME DMR anticipated, particularly given the co-occurrence model was not discussed at the April 2019 ALWTRT meeting. Further, without a gear threat score, it is unclear how differences between gear configurations will be considered or how rope which breaks at 1700 lbs, a key component of the discussions at the April 2019 ALWTRT, will be evaluated. Most importantly, this change has not been communicated to the full ALWTRT.

Given uncertainty about ongoing and future changes to the decision support tool, the constantly changing percentages produced by a model which is being updated, the lack of clarity of how the decision support tool will be used in the proposed rule, and uncertainty about how the co-occurrence model will evaluate rope which breaks at 1700 lbs, ME DMR endeavored to produce its own analysis to determine the risk reduction associated with this proposal. This in-state analysis was conducted because a clear and stable alternative from NOAA was not available before this proposal was due. If ME DMR had not conducted its own analysis, it is unclear how the state would have calculated a risk reduction for various management options and engaged the industry when weighing the options. A description of ME DMR's analysis is included in Appendix I.

C. Elements of Maine's Proposal

I. Vertical Line Reductions

ME DMR proposes a vertical line reduction in the Maine lobster fishery, to be achieved through changes to the trawling up requirements. As noted in ME DMR's scoping comments to NOAA fisheries on September 16, 2019 (Appendix IV), the Department has pursued measures associated with trawling up because it appears to provide some of the strongest conservation benefits; it reduces the risk of SI&M under the MMPA and the risk of entanglement under the Endangered Species Act (ESA). The proposed trawling up requirements are separated by distance from shore in recognition of differing fishing practices between inshore and offshore fishermen, as well as the likelihood of right whale occurrence along Maine's coast the farther one gets from shore.

a. Shoreline to Exempted Waters Line (<1% of Maine's whale-days, see Appendix I)

Proposal: Status quo; maintain exempt status for all such waters.

Rationale: The addition of trawling-up regulations within Maine's exempted waters would result in significant safety concerns, reduce diversity in the fleet, and have negative economic impacts for the lobster fishery, while providing minimal, if any, protections for right whales. Established in 2007, the Maine exemption line designates inshore waters, including bays and rivers, where right whale sightings are extremely rare. It was created in recognition that additional regulations in these areas would not have a significant benefit to large whales.¹⁷ As a result, past modifications to the ALWTRP have not included regulations in exempted waters. The exemption line was subsequently used when denoting critical habitat as it concluded "late stage copepods in quantities sufficient to trigger right whale foraging are not present inshore of the Maine exemption line".¹⁸ Sightings data corroborate the finding that right whales are extremely rare shoreward of the exemption line. Recent data on changing and decreasing copepod abundance in the eastern Gulf of Maine further corroborates these findings.¹⁹

Establishing trawl minimums in exempted waters would also unnecessarily result in large economic impacts by increasing operating costs and lowering the efficiency of inshore fishermen. The majority of the Maine lobster fishery's catch and effort occurs in state waters (shoreline to 3-mile limit). In 2016, 68% of landings and 81% of trips occurred inside state waters.²⁰ With over 70% of state waters existing within the exemption line, a significant portion of the fishery is executed close to shore. Much of the fishery in this area uses small boats and skiffs which have limited capacity to haul and store multiple traps. Thus, consideration of trawl limits in exempted waters precipitates large safety concerns as it could force fishermen to operate beyond their boat's means, resulting in fishermen being caught in additional rope on deck, fishermen going overboard or losing limbs, and vessels sinking. Further, trawling up requirements would have significant economic consequences on the fleet. Longer trawls would almost certainly increase gear loss as trawls are set over one another, increasing marine debris. It is also likely small boat captains would have to hire an additional crew member or purchase a larger boat to safely fish under the new requirements. Finally, longer trawls would result in lower trap efficiency due to a decreased ability to maneuver traps on to specific ledges and cracks where lobsters are frequently found.

¹⁷ Taking of Marine Mammals Incidental to Commercial Fishing Operations; Atlantic Large Whale Take Reduction Plan Regulations, 72 Fed. Reg. 57103 (October 5, 2007).

¹⁸ Endangered and Threatened Species; Critical Habitat for Endangered North Atlantic Right Whale, 81 Fed. Reg. 4837 (January 27, 2016).

¹⁹ Record et al., 2019.

²⁰ Based on harvester reporting collected in the Maine lobster fishery.

- b. Exempted Waters Line to Three Miles from Shore (0.8% of Maine's whale-days and 4% Maine's of overall risk, see Appendix I)

Proposal: Require a minimum trawl length of three traps per single endline.

Rationale: A three-trap trawl considers safety concerns of small boat, state-waters fishermen with the goal of reducing the number of endlines and the associated risk to right whales. Unique safety concerns for small boat fishermen include lack of deck space and frequently operating a vessel without a crew. Particularly in mid-coast Maine, moving to a three-trap trawl minimum will be a substantial change from current fishing practices where, due to bottom type, many people presently fish doubles.

- c. Three Miles to Six Miles from Shore (Three to twelve miles from shore represents 11% of Maine's whale-days and 30% of Maine's overall risk, see Appendix I)

Proposal: Require a minimum trawl length of eight traps per two endlines, or four traps per single endline.

Rationale: An eight (four) trap trawl minimum recognizes the historical sighting of right whales in the Gulf of Maine is higher in federal waters than state waters and that higher trawl length minimums are needed to reduce the risk of entanglement. Various fishing practices along the coast make the unilateral transition to an eight-trap trawl with two endlines difficult; this region includes small boat fishermen who fish just over the three-mile line, as well as larger vessels which traditionally fish offshore. The ability to fish a four-trap trawl with a single endline provides needed flexibility to the fleet and achieves the same conservation value.

- d. Six Miles to Twelve Miles from Shore (Three to twelve miles from shore represents 11% of Maine's whale-days and 30% of Maine's overall risk, see Appendix I)

Proposal: Require a minimum trawl length of fifteen traps per two endlines, or eight traps per single endline.

Rationale: A fifteen-trap trawl configuration is expected to result in substantial endline reductions in this area. The flexibility to use either a fifteen-trap trawl with two endlines or an eight-trap trawl with a single endline, near equivalent configurations from a conservation standpoint, allows for greater compliance with the regulations and recognizes that fishing practices differ along the coast. This flexibility in trawl configuration also considers fishermen safety and boat capacity, as some fishing operations in the region may not be able to safely haul and stow fifteen traps on a boat. Load cell data collected by ME DMR also informed the proposal for a fifteen-trap trawl length (see Section C-II). In particular, some of the load cell data collected to evaluate the placement of weak points measured loads on the vertical line of fifteen-trap trawls. This provided a level of data to inform both the trawling-up and weak point components of ME DMR's proposal.

- e. Twelve Miles from Shore to the Lobster Management Area 1/3 Boundary (88% of Maine's whale-days and 66% of Maine's overall risk, see Appendix I)

Proposal: Require a minimum trawl length of twenty-five traps per two endlines.

Rationale: This trawl length provides the lowest ratio of vertical lines to traps in Maine's proposal. It also pushes the bounds of fishermen's safety. At ME DMR's June 2019 industry meetings, fishermen from many parts of the coast expressed significant concern that few vessels are equipped to handle thirty- or forty-trap trawls in addition to the mile of rope needed to fish at these trawl lengths. Requiring fishermen to operate beyond their boat's capacity would result in dangerous fishing practices and the potential loss of human life. A twenty-five-trap trawl length recognizes that vertical lines in the offshore areas of the Gulf of Maine pose a greater risk to right whales given whales are more frequently sighted in this area; however, it also acknowledges the limits on the capacity of fishing vessels in the area. Finally, this trawl length is enforceable, but longer trawls likely would not be. With current vessel platforms, it would be nearly impossible for Maine's Marine Patrol to safely haul long trawls (i.e. greater than 30 traps per trawl) to check compliance with ALWTRP measures.

Modifications to Maine's Approach on Vertical Line Reductions

At the April 2019 ALWTRT, there was a consensus statement that each state and/or Lobster Management Area (LMA) would meet a 60% risk reduction in their respective region. At the time, one way for Maine to achieve this target was to take a 50% vertical line reduction (equivalent to a 50% risk reduction) and implement 1700 lbs breaking strength rope in the top 75% of all vertical lines in federal waters (equivalent to a 10% risk reduction).

Since that time, outputs of the decision support tool have substantially changed based on modifications to the model as well as emerging and changing data. As a result, the information available to ME DMR is different than what was available at the time of the ALWTRT meeting. Specifically, the risk reduction attributed to weak rope has steadily increased. This is corroborated by peer reviewed literature which suggests a full weak rope would significantly reduce the risk of serious injury and mortality for multiple large whale species by 72%.²¹ It also matches results of the analysis conducted by ME DMR (Appendix I). Given these changes, ME DMR has relied more heavily on weak points in the line (see Section C-II) as a method to achieve risk reduction.

Furthermore, analysis by ME DMR following the ALWTRT April 2019 meeting showed that, to achieve a 50% vertical line reduction, a substantial portion of this reduction would have to be taken within exempted waters. This is because roughly 70% of state waters, where the majority of the Maine lobster fishery is licensed, are within the exempt area.²²

²¹ Knowlton, A. R., Robbins, J., Landry, S., McKenna, H. A., Kraus, S. D., and T. B. Werner. 2015. Effects of fishing rope strength on the severity of large whale entanglements. *Conservation Biology*, 30, 2:318-328.

²² Currently, reporting requirements do not allow for effort to be discerned between exempt and non-exempt waters. It is therefore assumed that 70% of vertical lines in the Maine state waters lobster fishery are shoreward of the exemption line because this is the percentage of area that is included shoreward of that line. This is also the assumption made in the

Implementing strict vertical line reduction measures in this area does not align with right whale sightings data and the associated risk of entanglement. Right whales are rarely sighted in Maine's exempted waters and copepod abundance does not support right whale feeding aggregations²³, hence why they were designated as areas where additional regulations would not provide meaningful conservation benefits to right whales. As a result, a 50% vertical line reduction would have forced the greatest regulatory change on areas where whales do not frequent, having minimal effectiveness. In contrast, the vertical line reductions put forward in this proposal focus on areas outside of exempted waters and provide more meaningful protections to right whales. We believe this is a stronger and more defensible plan which balances right whale conservation with maintaining a viable lobster fishery.

Trends Regarding Latent Effort in the Maine Lobster Fishery

A potential concern with vertical line reductions via trawling up is that latent licenses will become active and negate the intended conservation benefits. ME DMR reviewed trends in latent lobster licenses in Maine and found them to be extremely stable (Figure 1). In particular, over the last ten years, there has been little perturbation in the number of latent licenses in the Maine lobster fishery. This corresponds to a time of record high landings when we may have expected latent fishermen to re-engage in the fishery. Furthermore, this stability persisted through previous changes to the ALWTRP, including the 2014 vertical line rule which established the previous trawling-up minimums. Given these trends, ME DMR is confident the activation of latent licenses will not negate the conservation benefit gained by the proposed trawling-up scenarios and will result in meaningful reductions in vertical lines.

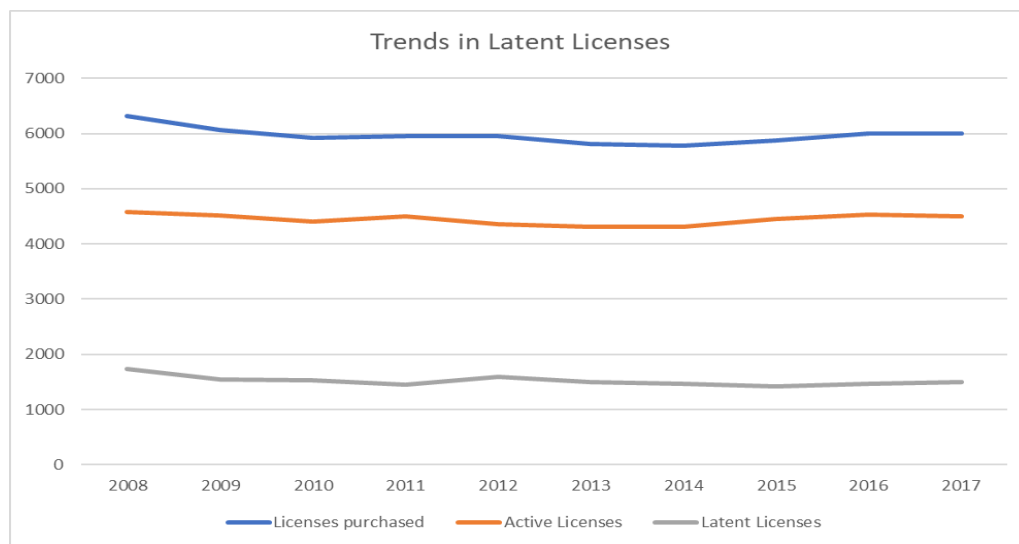


Figure 1: Trends in Maine lobster licenses, including number purchased, active licenses, and latent licenses. Data come from Maine DMR's license and 100% dealer reporting databases. Dealers are required to report purchases from all harvesters. Any harvesters without any reported purchased landings are considered latent.

Industrial Economics model of the fishery, which is used in the Decision Support Tool and accepted by both NOAA Fisheries and the ALWTRT as best available information.

²³ Endangered and Threatened Species; Critical Habitat for Endangered North Atlantic Right Whale, 81 Fed. Reg. 4837 (January 27, 2016).

Misconceptions about Changes in the Maine Offshore Lobster Fishery

It has been repeatedly alleged that effort in the offshore lobster fishery is expanding and thereby increasing the risk of entanglement posed by the fishery. In fact, this allegation is a basis for the conclusions made in the NEFSC's September 2018 technical memo. ME DMR sought to investigate this claim by looking at landings, number of trips, and catch per unit effort by distance from shore. Outside of 3 miles from shore, pounds landed (Figure 2) in the Maine lobster fishery has increased over time. However, a similar trend is not reflected in the number of trips; the number of trips in the federal Maine lobster fishery has been relatively stable (Figure 3). This suggests that there has been an increase in the landings per trip, rather than an increase in effort, which has contributed to the increased harvest offshore. This conclusion is supported in Figure 4; regardless of distance from shore, all areas have seen an increase in average catch per trap in the Maine lobster fishery. The slope of this increase is greater in federal waters than state waters. Thus, while it is accurate to say landings have increased in the federal Maine lobster fishery, there has also been a significant increase in average catch per trip.

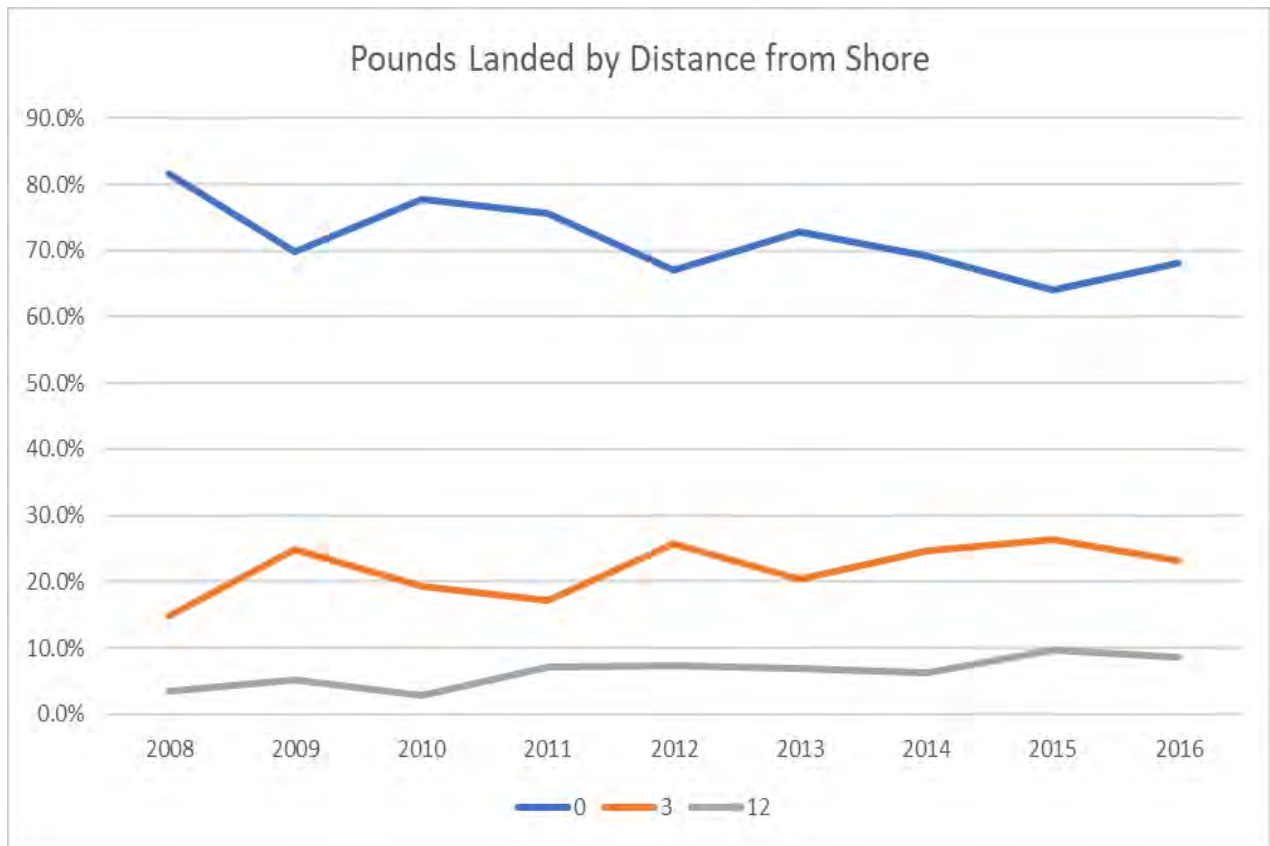


Figure 2: Proportion of pounds of American lobster landed by distance from shore in Maine. The blue line represents 0-3 miles from shore. The orange line represents 3-12 miles from shore. The grey line represents 12 miles to the LMA 1/3 boundary. Data come from Maine DMR's harvester reporting database.

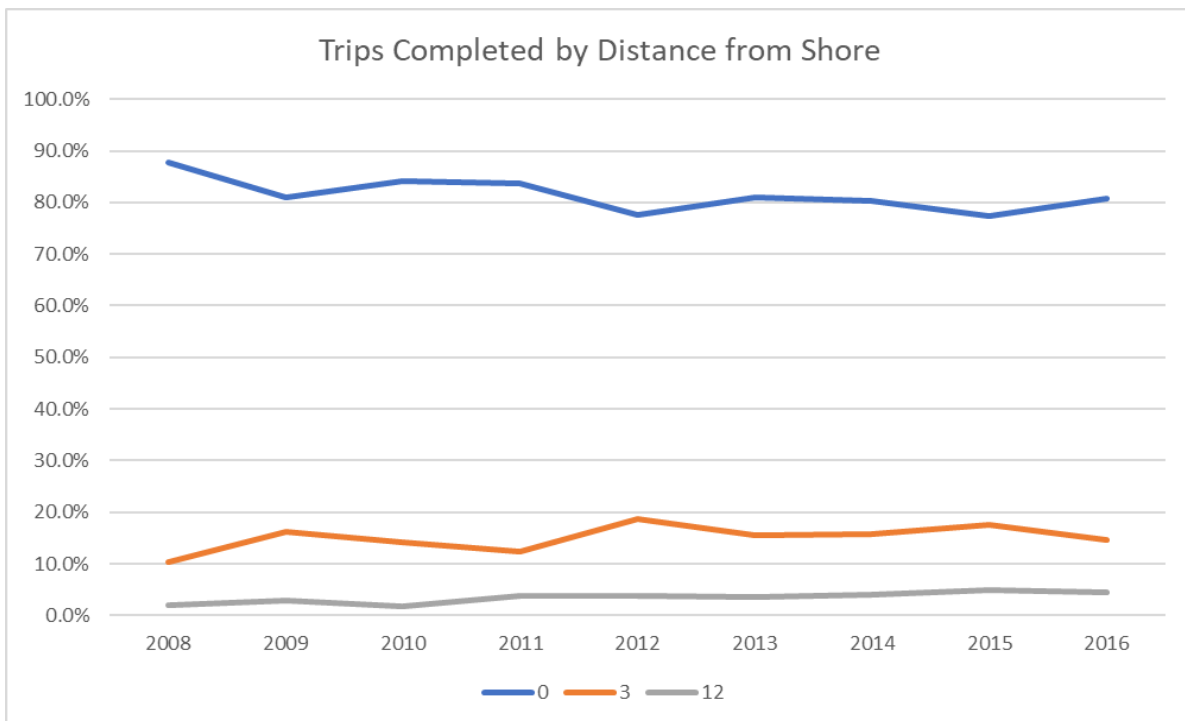


Figure 3: Proportion of directed American lobster trips in Maine since 2008. The blue line represents 0-3 miles from shore. The orange line represents 3-12 miles from shore. The grey line represents 12 miles to the LMA 1/3 boundary. Data come from Maine DMR's harvester reporting database.

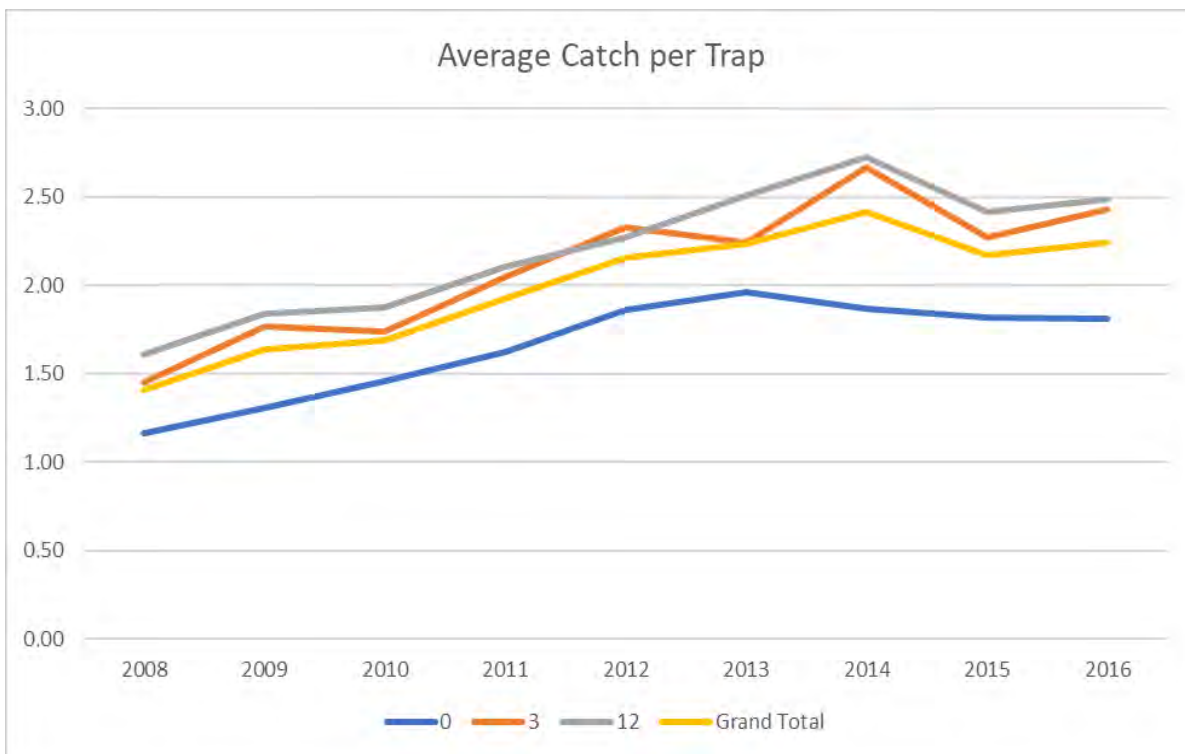


Figure 4: Average catch per trap (in pounds) in the Maine lobster fishery. The blue line represents 0-3 miles from shore. The orange line represents 3-12 miles from shore. The grey line represents 12 miles to the LMA 1/3 boundary. Data come from Maine DMR's harvester reporting database.

II. 1700-Pound Weak Points

This proposal includes the addition of weak points to remaining vertical lines in the Maine lobster fishery. This measure will result in rope breaking at 1700 lbs, a value determined in the literature to be weak enough to allow a right whale to break free.²⁴ Moreover, Knowlton *et al.*, concluded from their research that a 1700 lbs breaking strength will significantly reduce the rate of serious injury and mortality to right whales as a result of entanglements. Thus, it offers a level of protection for all lines left in the water.

Appendix V describes results of ME DMR's research initiative to determine the breaking strength of vertical lines already being used by the fishery, as well as various rope and weak point configurations. This analysis is provided to NOAA Fisheries to begin the development of a list of 1700 lbs weak points options approved for use in the fishery. ME DMR has specifically focused on weak points which result from alterations to existing rope. This aligns with ME DMR's goal of reducing economic impacts on the fishery. As such, ME DMR plans to continue this work with the industry and requests the ability to continue to refine and add to the list of options approved for use as 1700 lbs weak points.

ME DMR highlights that weak points, in combination with the minimum trawling-up levels proposed, must be in conjunction with conservation equivalency. Due to the varying fishing conditions along the coast, a 'one size fits all' approach does not work in Maine. As a result, a method for flexibility must be included in the proposed rule so that, in consideration of local practices and challenges, fishermen can suggest modifications to the regulations to achieve the same level of protection for right whales. Conservation equivalency is particularly important for safety; without a method to modify the state-wide proposal to fit regional oceanographic conditions, fishermen will be required to partake in unsafe fishing practices. ME DMR is committed to ensuring the safety of fishermen throughout this regulatory process and feels conservation equivalency is a key to this endeavor. Sections VI and VII provide greater detail on this management flexibility.

a. State Waters (shoreward of the 3-mile line)

Proposal: Through state regulations enacted by ME DMR, a single 1700 lbs weak point will be required half way down vertical lines in the Maine lobster fishery.

Rationale: The inclusion of weak points in all vertical lines means rope will part at the 1700 lbs breaking strength recommended in literature and by the ALWTRT. In particular, including a weak point in exempted waters provides protection such that, in the rare event a right whale enters exempted waters and gets entangled, the encounter will not result in a SI&M. It is important to note that the risk reduction associated with the weak point in exempted waters is not included in ME DMR's analysis as shown in Appendix I. As a result, the risk reduction achieved from the implementation of a weak point in exempted waters is in addition to the risk reduction percentage calculated in Appendix I.

²⁴ Knowlton *et al.*, 2015.

ME DMR intends for this measure to be implemented in state regulations and not in the federal ALWTRP. It is recommended NOAA Fisheries cite the state regulation when federal regulations are published. If necessary, ME DMR would support a clause that, if Maine removes this state regulatory requirement, NOAA Fisheries would take emergency action to implement the same regulatory measure in the ALWTRP.

b. Federal Waters (3-mile line out to 12 miles)

Proposal: Two 1700 lbs weak points will be required in the top half of all vertical lines in the Maine lobster fishery from the 3 -mile line out to 12 miles. One weak point should be roughly 25% down the vertical line and the other roughly 50% down the vertical line.

Rationale: The inclusion of weak points in all vertical lines means rope will part at the 1700 lbs breaking strength recommended in literature and by the ALWTRT. As a result, this substantially reduces the risk of serious injury and mortality in Maine's waters.

Based on industry comments, ME DMR is concerned that, in some areas, a weak point 50% down the vertical line may compromise fishermen safety when hauling, particularly as the minimum trap-per-trawl requirement increases. Maine's Commercial Fishing Safety Council, a body established in state statute charged with providing information and advice concerning fishing safety issues, also expressed concerns particularly when fishing in large tides. Given it is likely that a weak point 50% down the vertical line may work for some fishermen and not for others, ME DMR highlights the importance of having a method for conservation equivalency and individual safety exemptions in the federal proposed rule (see Sections VI and VII). This flexibility would allow some lobster management zones and/or individuals in Maine to achieve the same level of conservation by adopting a different measure (e.g. greater level of trawling-up, trap reduction) in order to move the weak points further up the vertical line.

c. Federal Waters (outside 12 miles)

Proposal: One 1700 lbs weak point one-third of the way down the vertical line in the Maine lobster fishery outside 12 miles from shore.

Rationale: The inclusion of weak points in all vertical lines means rope will part at the 1700 lbs breaking strength recommended in literature and by the ALWTRT. As a result, this substantially reduces the risk of serious injury and mortality in Maine's waters. Proposing one weak point further up the vertical line outside 12 miles is in response to safety concerns heard from the fishing industry and Maine's Commercial Fishing Safety Council. Trawl minimums of 25-trap trawls fished in deeper waters at this distance from shore put higher hauling loads on the vertical lines and could result in safety issues. Putting a weak point one-third of the way down the vertical line, as per the recommendation of the Maine Commercial Fishing Safety Council, puts a protection measure in place for right whales encountering the top of the vertical line, while ensuring the safety of fishermen utilizing these waters. A greater description of these safety concerns and associated data are included on pages 22-25.

Maine's proposal for weak points was developed by focusing on three factors: feasibility, enforceability, and protections to right whales. ME DMR originally began to consider the inclusion of weak points in vertical lines because a 1700 lbs manufactured rope is currently not available at marine supply stores. Further, ME DMR's testing of various functional breaking strengths (Appendix V) indicated a 5/16th diameter rope would be needed to meet the threshold of breaking at 1700 lbs. At industry meetings, fishermen consistently commented that 5/16th diameter rope would be too small for their haulers. Given these constraints, ME DMR began to consider weak points as a way to reduce the breaking strength of vertical lines.

Enforceability of Proposed Weak Point Measures

In its development of a weak point proposal, ME DMR had several conversations with law enforcement personnel to determine what types of weak point measures can be enforced on the water. Maine Marine Patrol agreed that implementing regulations requiring a specific number of weak points in broad fishing areas is enforceable; but requiring weak points based on a prescribed depth interval is not. More specifically, if a regulation were to require weak points at a specified depth spacing, each fisherman would have a different weak point requirement for each of his or her lines depending on the depth at which his or her traps were submerged. As a result, enforcement personnel would have to know the depth of water when the traps were set and then count the associated number of weak points to determine compliance. Not only is this time consuming but it is impractical given depths change throughout the day due to tides. Further, traps can be moved in large storms, meaning a trap legally set at one depth may be moved to a different depth and be in violation of the ALWTRP.

Trying to create uniformity in weak point regulations by lobster zone also poses enforcement challenges. Depths vary between and within Maine lobster zones. For example, offshore regions of Zone G (adjacent to the New Hampshire border) have much shallower sections than its neighboring Zone F. As a result, regulations based on depth would result in different weak point requirements for the two zones. This disparity between zones creates complications given fishermen can, and often do, move between adjacent areas. Under Maine's regulations, fishermen can fish up to 49% of their traps in an adjacent zone. This means, for example, a Zone G fisherman can fish 49% of his or her traps in Zone F. If fishermen setting traps side by side are subject to different regulations, enforcement of these regulations becomes extremely difficult.

Operational Feasibility for Industry

Another key consideration for ME DMR when discussing weak points was their feasibility for industry. Staff at the NEFSC compiled information showing the number of points which would result if weak points were required every 40 ft in the top half of a vertical line (Figure 5). While this analysis was intended for discussion, it highlighted the impracticality of weak points at this spacing. Specifically, fishermen in three to six miles would be required to have roughly 3 to 8 weak points in the top half of their line as water depths increased; fishermen in six to twelve miles would be required to have roughly 5 to 13 weak points in the top half of their line; and fishermen outside of twelve miles would be required

to have anywhere from 5 to 20 weak points in the top half of their line. These numbers of weak points would likely incentivize the use of more rope, increasing the risk of whales getting entangled in the water column and fishermen getting entangled in additional rope on deck. At ME DMR's industry meetings, fishermen commented that, in response to an initial proposal that 75% of their vertical line break at 1700 lbs, they would likely lengthen their vertical line to ensure a safe rope strength when hauling traps. ME DMR believes a similar response would occur if numerous weak points are required; fishermen will likely lengthen line, even at the cost of adding more weak points, to ensure 'strong' rope when hauling. This outcome is counter to the efforts of the ALWTRT as it would result in the presence of additional slack rope in the water, thereby increasing the risk of entanglement.

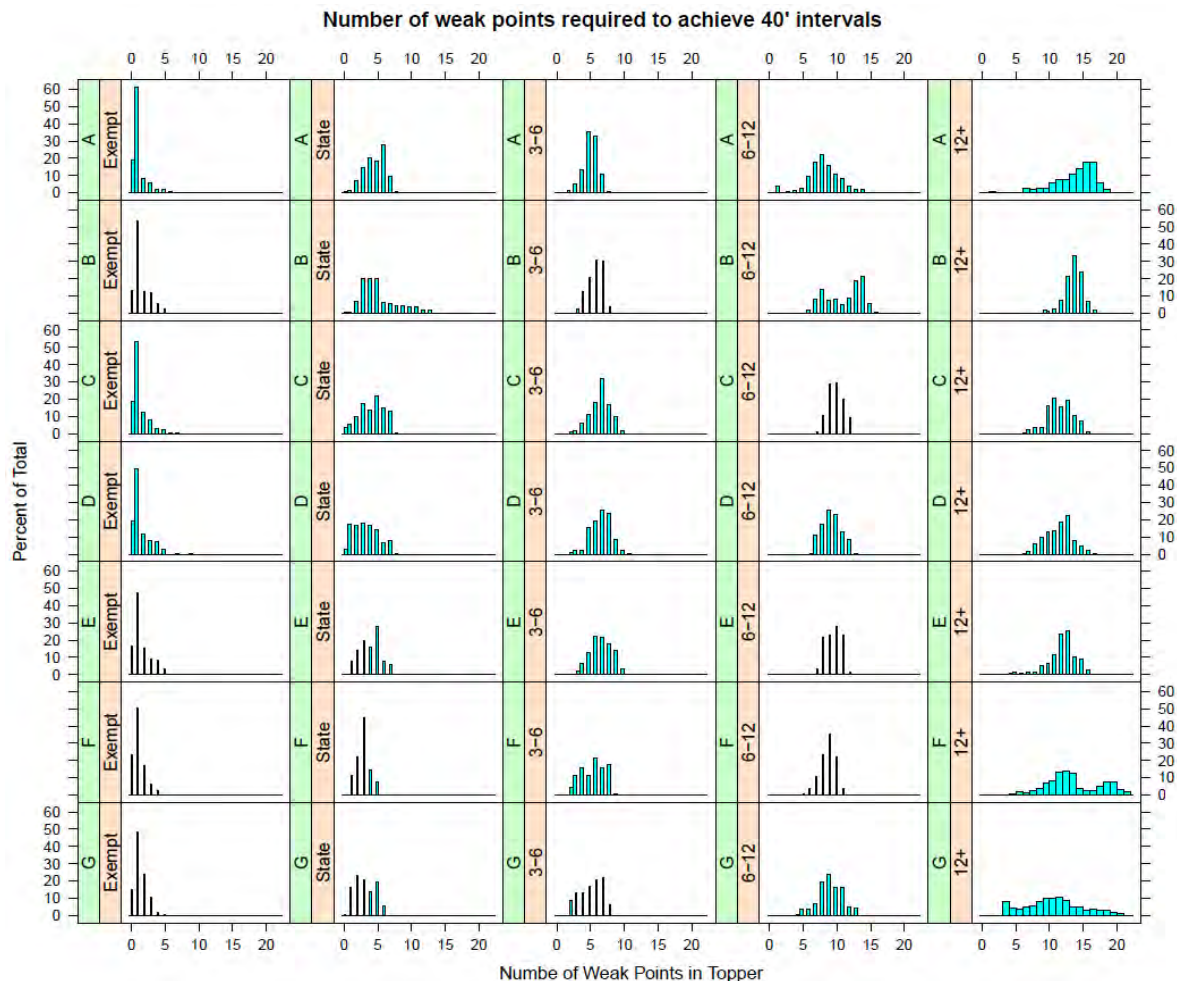


Figure 5: Number of weak points in the top half of a vertical line if required every 40 ft, by Maine lobster zone and distance from shore. Data and figure provided by the NEFSC.

ME DMR is confident that its proposal for 1700 lbs weak points is enforceable, feasible, effective and, most importantly, will not create perverse incentives which jeopardize right whale conservation. A specific number of weak points is enforceable because it is simple and uniform based on distance from shore. This proposal is also feasible for fishermen, helping to ensure compliance with the regulations. ME DMR does not anticipate it will drastically alter current vertical line lengths given rope strength is preserved in the bottom half of the vertical line where load cell data shows the strain is highest.

Development of Weak Point Measures: Data and Previous Discussion

In ME DMR's analysis for this proposal, we found a lack of data or peer-reviewed literature regarding the ideal distance between weak points. Further, the definition of weak rope, how weak points may be integrated into vertical lines, or how much risk reduction should result from these measures were not agreed upon at the April 2019 ALWTRT meeting. Review of the meeting summary for the April 2019 ALWTRT meeting showed neither a discussion regarding the appropriate spacing of weak points nor a definition of what might constitute weak rope was ever made or included in the vote.

In the history of the ALWTRT, there have been discussions and proposals which have included measures which occur every 40 ft; however, it has never been formally agreed that this is the correct spacing for any measure. ME DMR reviewed the origin of the 40 ft spacing and found it was initially a recommendation developed for potential gear marking requirements. The first mention of using 40 ft spacing for gear marking occurred in a 2009 report on experimental wire tags from the International Fund for Animal Welfare. This report was included as a part of the November 2010 ALWTRT meeting. The report suggests that because 90% of the gear recovered from whales is at least 40 ft in length, marking gear every 40 ft would result in 90% of recovered gear having a mark which can be used to discern fishery and/or set location. The data referred to in the report are from a study conducted by John Kenney, a former NMFS gear specialist. Kenney looked at gear taken off of whales from 1997-2003 which ranged in length from 5-1200 ft. He found in the 61 samples analyzed, the average length of line was 181 ft, the median length was 102 ft, and the lower and upper quartiles were 60 and 222 ft, respectively. From this analysis it was concluded that 12 ft spacing would result in 95% recovery of a mark, 40 ft would result in 90% recovery, 60 ft would result in 75% recovery, and 102 ft would result in 50% recovery.

The first place that the 40 ft spacing was used in conjunction with a weak point was in the April 2017 ALWTRP exemption request from the Massachusetts South Shore Lobstermen's Association. In this proposal, the fishermen proposed to implement a weak sleeve (breaks at 1700 lbs) every 40 ft in their vertical lines as a way to be able to fish inside the Massachusetts Restricted Area closure. The 40 ft spacing was used, not because it was determined to be the ideal spacing for weak points, but because they were proposing the sleeves double as their gear marking requirement as well. This proposal was not ultimately accepted by the ALWTRT.

There have also been comments that the 40 ft spacing is consistent with the girth or length of a right whale. ME DMR maintains this has not been discussed by the ALWTRT nor has it been published in peer-reviewed literature. Therefore, 40 ft spacing has no basis as the standard by which the addition of weak points for the conservation benefit of right whales should be held.

Modifications to Maine's Weak Rope Measures

At the April 2019 ALWTRT meeting, the implementation of 1700 lbs breaking strength rope in the top 75% of vertical lines was discussed for the federal Maine lobster fishery. This idea was presented to fishermen at ME DMR's industry meetings in June 2019 and concerns were expressed regarding the ability to safely haul gear. Specifically, fishermen

were concerned that weakening the top 75% of the vertical line in combination with the proposed increases in trawl lengths would reduce safety at sea. Many fishermen commented that, to accommodate the proposed weakening of the majority of their endline, they intended to increase the length of their vertical line to lengthen the bottom 25% of their endline and ensure enough rope strength when hauling traps. Increasing overall amounts of rope in the water is counter to the efforts of the ALWTRT, particularly when such additional line will likely be slack. Industry members that fish in federal waters inshore of the 12 mile line did express that, with existing vertical line lengths, modifications to the top 50% of the rope would be more feasible and preferable, in that it would not likely lead to fishermen's use of increased rope amounts. As a result, ME DMR moved towards examining changes to the top 50% of the rope to ensure industry feasibility and safety in addition to the protection of right whales.

ME DMR has heard from fishermen fishing outside of 12 miles that a weak point 50% of the way down the vertical line would present safety concerns given the 25-trap minimum being proposed in this area. These concerns are supported by the load cell data gathered by ME DMR and presented in Figure 8 (discussed in depth below). Loads recorded on vertical lines for gear being fished in more than 100 fathoms of water and more than 20-traps on a trawl exceeded 2,000 lbs of load. Hauling loads at a weak point 50% of the way down the line would likely result in loads routinely over 1,000 lbs of force. To accommodate weather conditions, hang downs, and set over events, ME DMR worked with industry to propose a weak point one-third of the way down the vertical line.

Using Load Cell Data to Inform Protections for Whales and Safety for Fishermen

The strategy to achieve a conservation benefit for right whales in the top portion of the line, while maintaining safe hauling practices for fishermen, is supported by data collected through ME DMR's vertical line research initiative. Beginning in 2018 and extending through 2019, ME DMR worked with fishermen throughout the Gulf of Maine region to deploy load cells on lobster vessels and document the hauling loads experienced by vertical lines during common fishing conditions. Of the 14 fishermen who fished with load cells on their boats, six of those were from Maine, documenting over 140 hauls in five of the seven Maine Lobster Management Zones (Figure 6). The Maine portion of the dataset occurs in federal waters and includes trawl lengths ranging from 15 to 20 trap trawls in depths of 55-125 fathoms.

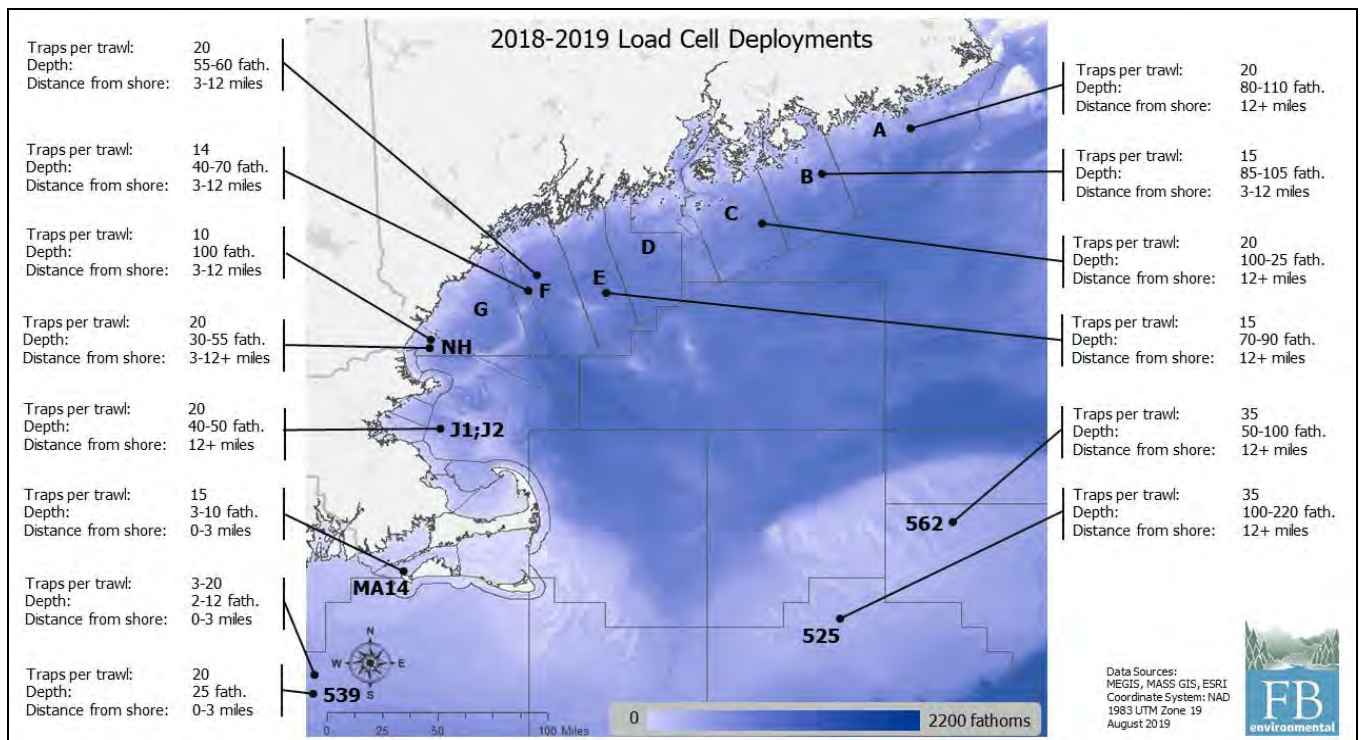


Figure 6. Summary of load cell deployments throughout the Gulf of Maine and New England with associated information on the trawl lengths, depth, and distance from shore.

Results of the load cell deployments show peaks in the load asserted on the line as the trawl is being hauled (Figure 7). Often, the highest peaks in the loads are in the first section of the haul, including the vertical line, because this corresponds to when the maximum number of traps are suspended in the water column. Most of the hauls recorded were in calmer weather and, while some gear set overs (where a trawl is laid over another) were recorded, these results shouldn't be expected to show the highest possible loads that would be experienced by fishermen in more extreme hauling events.

Length (min): 32.9 Traps/Trawl: 20 K-Factor: 0.709219858156028
 Span: 0.05 Peak Distance: 10 Peak Height: 200

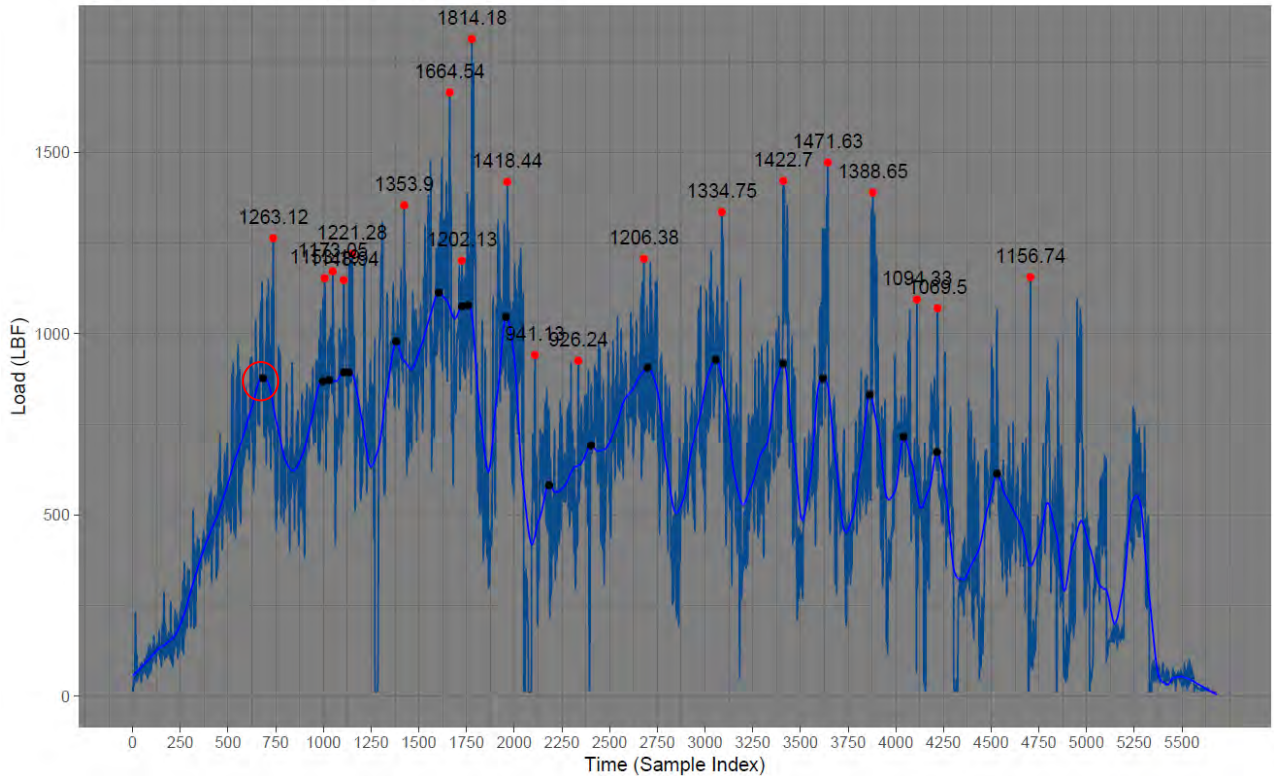


Figure 7. An example of a load cell output from a 20-trap trawl. The portion of the haul that is the load on the vertical line occurs between 0-750 on the time axis and increases steadily as traps are picked up off of the bottom. The first trap coming onboard the vessel is denoted by the red circle and was validated by observers on the vessel. The peak load on the vertical line occurred at the first trap with a load of 1,263 lbs. Loads after this point were hauled on the groundline.

The results from the load cell deployments in Maine federal waters support the concerns expressed by fishermen, namely that the combination of increased trawl lengths and weak points half way down the line could compromise safety. Figure 8 shows the average and range of hauling loads on the vertical lines for a variety of trawl lengths and how those loads are affected by the depth of the trawl. Trawl lengths of 20 traps in more than 100 fathom depths have average vertical line loads greater than 1700 lbs and range over 2000 lbs. As a result, it is essential that this portion of the fishery be allowed a sufficient length of vertical line at the bottom to be able to haul these common working loads safely.

The average hauling loads documented for trawls between 5-20 traps in 50-100 fathoms are below the 1700 lbs threshold for loads. However, this does not allow a safety buffer for more extreme hauling events that include weather, gear set-overs, and getting hung-down (or caught) on rocky bottom. There were 60 hauls of 15-trap trawls in this depth range with the load cells. The maximum load recorded on a vertical line was 2,152 lbs, which is over the weak point 1700 lbs threshold. The average vertical line hauling load of these trawls was 1365 lbs, just 335 lbs below the 1700 lbs target. 25% of these hauls recorded vertical line loads over 1500 lbs and 97% of hauls were over 1000 lbs. Additionally, 100% of hauling loads for the 5-trap trawls in this depth bin were also over 1000 lbs of load.

ME DMR supports the industry's request for safe buffers in working line loads to allow for variables that impact both the load put on lines during hauling and the likelihood that a line may break. These variables include the natural degradation of line strength over time, extreme hauling events, weather, and tides.

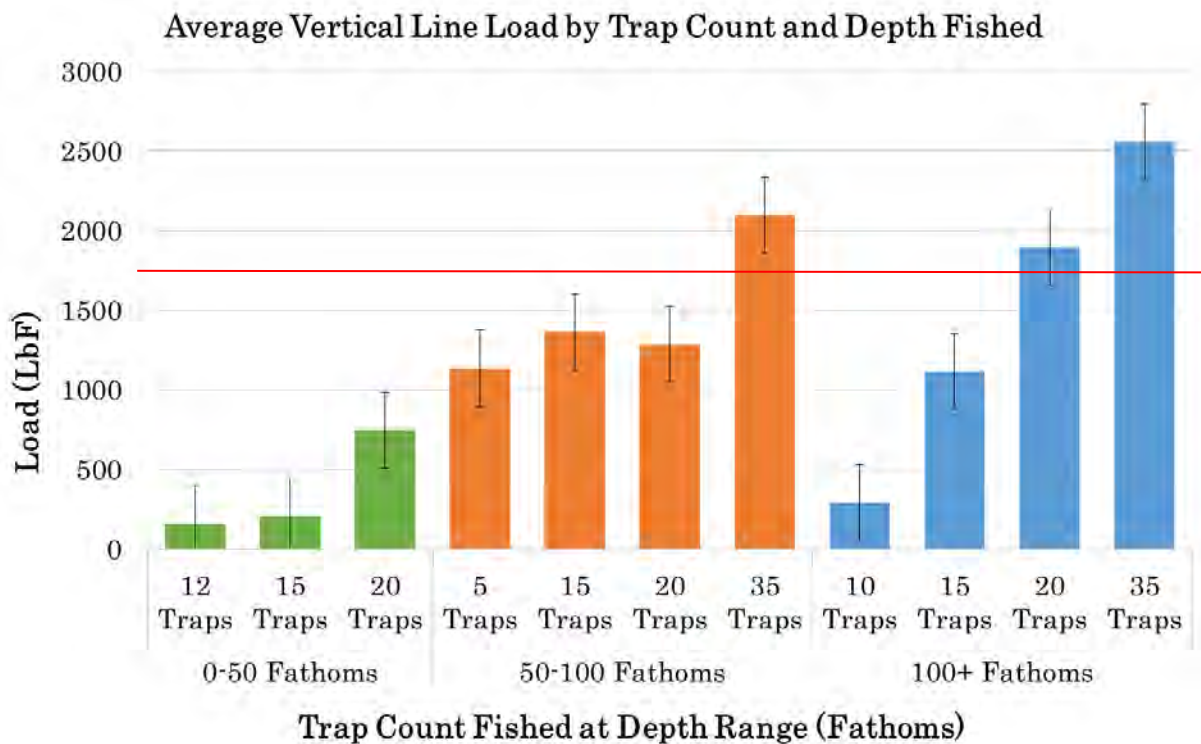


Figure 8. All recorded vertical line loads binned by trawl length and depth fished. Average vertical line loads for more than 20-trap trawls in 100 fathoms of water are above the 1,700 lbs weak point threshold. Trawl lengths from 5-20 in the 50-100 fathom depth bin average below the 1700 lbs threshold, but almost reach over 1000 lbs almost 100% of the time.

Implications for Drag Should Entanglement Occur

In this proposal, varying lengths of vertical line have the potential to be left on a right whale in the event it becomes entangled and the rope breaks at a weak point. The length of the trailing line depends on the initial length of the vertical line and the number of weak points required in the area. Figures 9-11 were developed by the NEFSC for discussion around this topic and show the spectrum of line lengths which could be left on right whales under this weak point proposal. Figure 9 should be used for the state waters (all exempt and non-exempt state waters) proposal of one weak point half way down the vertical line. In general, less than 100 ft of line would be remaining after a break inside the exemption area. Only slightly more, up to 150 ft, could be left on a right whale in Maine's non-exempt state waters.

Figure 10 shows the lengths of line that could result from three to twelve miles in federal waters where two weak points in the upper 50% of the vertical line are required. The results

vary by distance from shore, which is mainly attributable to the differences in depth and therefore the scope of the vertical line in each area. From 3-6 miles from shore the length of line left on a whale could range from about 50-125 ft. The more offshore section from 6-12 miles increases to a range of 100-200 ft.

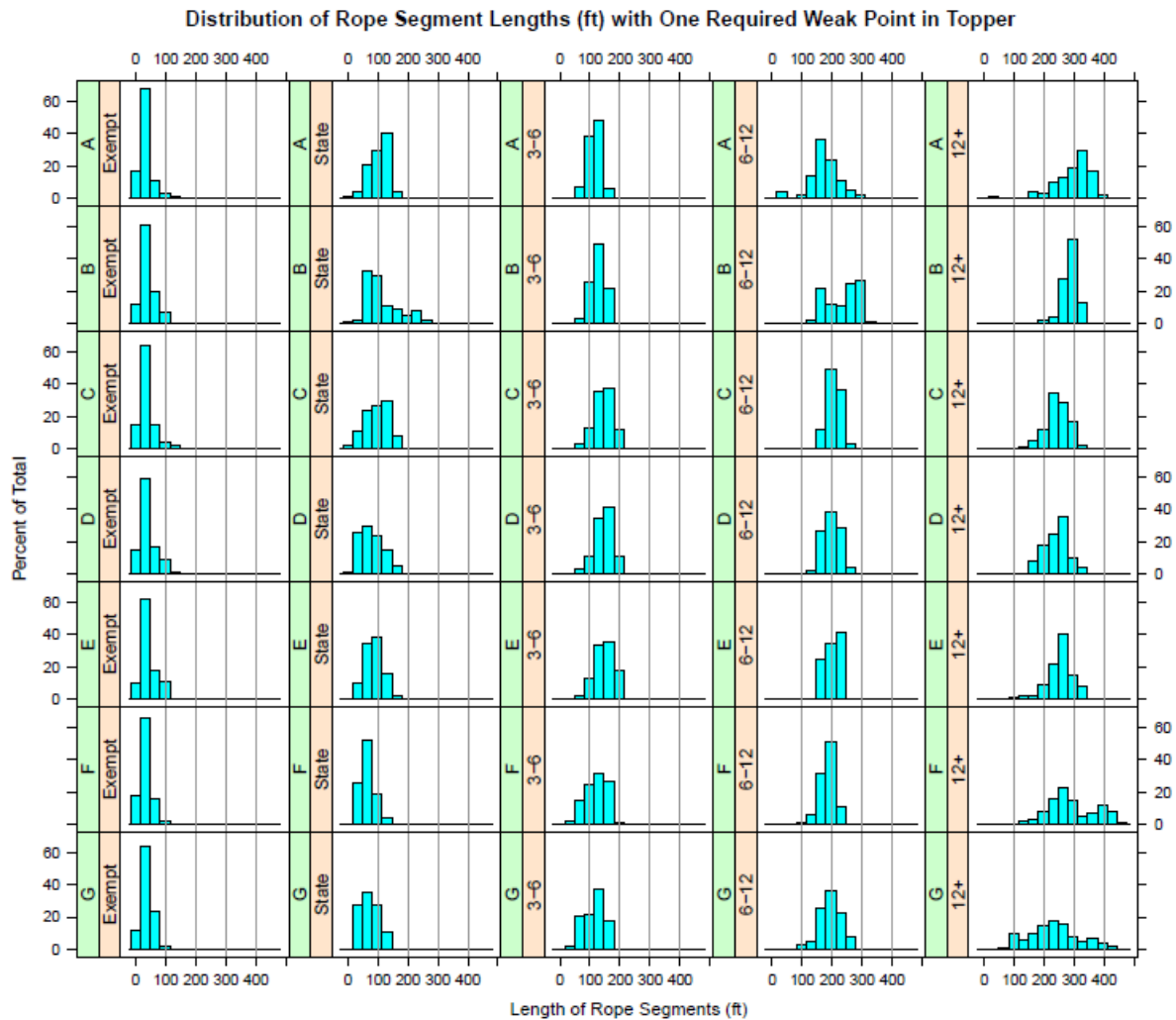


Figure 9. This figure was prepared by the NEFSC for discussion purposes. The first two columns, “exempt” and “state”, show the range in lengths of lines that could be left on a right whale after a weak point breaks. This is assuming one weak point 50% down the vertical line in state waters and is categorized by the amount of gear in a given depth. Most gear inside the exemption line would result in less than 100 ft of line remaining on a right whale after a break. Gear in non-exempt or “state” waters would result in slightly longer lengths of line, generally ranging from 100-150 ft.

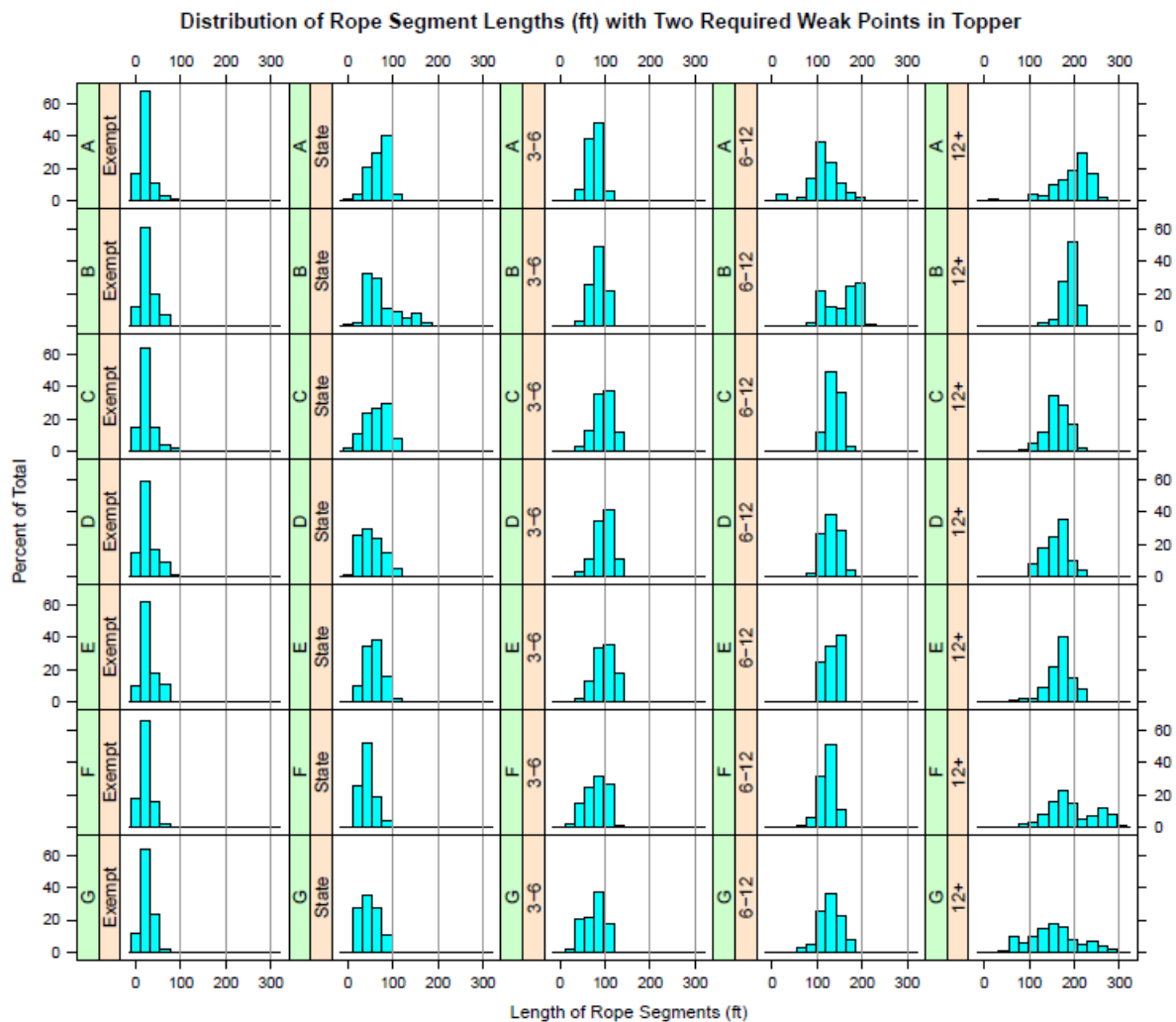


Figure 10. This figure was prepared by the NEFSC for discussion purposes. The columns labeled “3-6” and “6-12” show the range in lengths of lines that could be left on a right whale after a weak point breaks from three to twelve miles in federal waters by distance from shore. This is assuming two weak points in the top 50% of the vertical line in this area and is categorized by the amount of gear in a given depth. Most gear in the 3-6 mile band would range in remaining line length from 50-125 ft. A break in the distance range 6-12+ could result in lines left from 100-200 ft.

Under this proposal the area outside of 12 miles from shore will have one weak point 1/3 of the way down the vertical line from the buoy to accommodate the safety needs of the fleet operating in deeper depths with longer trawls. Figure 11 shows the distribution of vertical lines occurring at different water depths by distance from shore in Maine waters. The fishing area outside of 12 miles can generally range from 50-125 fathoms depth, but most of the vertical lines occupy the depths around 100 fathom. Assuming a 1.5 scope of vertical line length to depth, a common practice in the fishery, the vertical line lengths would range to 188 fathom. A weak point breaking 1/3 of the way down this vertical line could result in a line 62 fathom in length on a right whale.

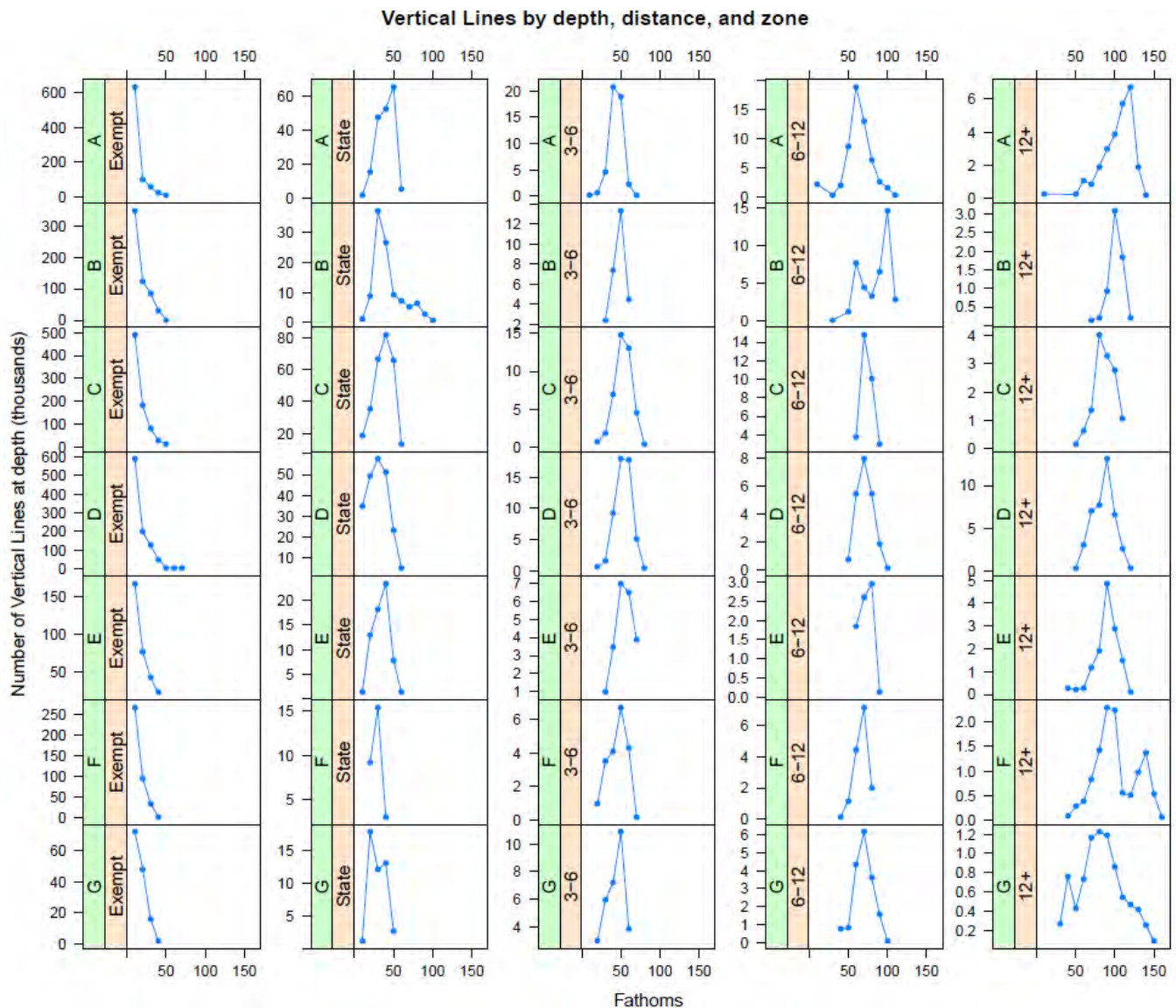


Figure 11. This figure was prepared by the NEFSC for discussion purposes. The last column label “12+” by Maine Lobster Management Zones A-G, shows the number of vertical lines distributed in that area by depth in fathoms. Most of the gear set in the 12+ distance from shore is set in a range around the 100fa depth strata.

Van der Hoop *et al.* (2015)²⁵ shows some results of the drag resulting from different lengths of 5/16” line and concludes shorter lengths of line are better for whales due to less drag forces being applied to the swimming whale. ME DMR attempted to duplicate these results using two different diameters of rope most common in the fishery: 3/8” and 7/16” sink rope. Van der Hoop used a range of line lengths including 82-480 ft. DMR used a set of three lengths which included 60, 120, and 240 ft. In the ME DMR study (Figure 12), the different diameters and lengths of line were tested using a load cell to measure the pounds of drag force exerted on the lines at varying vessel speeds. The slow speed, around 2.5

²⁵ Van der Hoop, J. M., Corkeron, P., Kenney, J., Landry, S., Morin, D., Smith, J., and M. J. Moore. 2015. Drag from fishing gear entangling North Atlantic right whales. *Marine Mammal Science*, 32, 2:619-642.

knots, simulates the swimming right whale. The higher speeds may be confounded by the wake created by the vessel exerting more drag force on the lines.

The results show that, at the 2.5 knot speed, drag forces are at or below 10 lbs of force for any of the line lengths in both studies. DMR's results show that at the line lengths of 60 and 120 ft, line drag is less than 5 lbs of force. Lengthening the line out to 240 ft only increased the drag a couple of pounds, up to 7 lbs of drag force. DMR believes that increasing the number of weak points and, therefore, shortening the distance between them will have minimal effect on the potential drag for right whales, but would come at a much greater cost to the fishing industry.

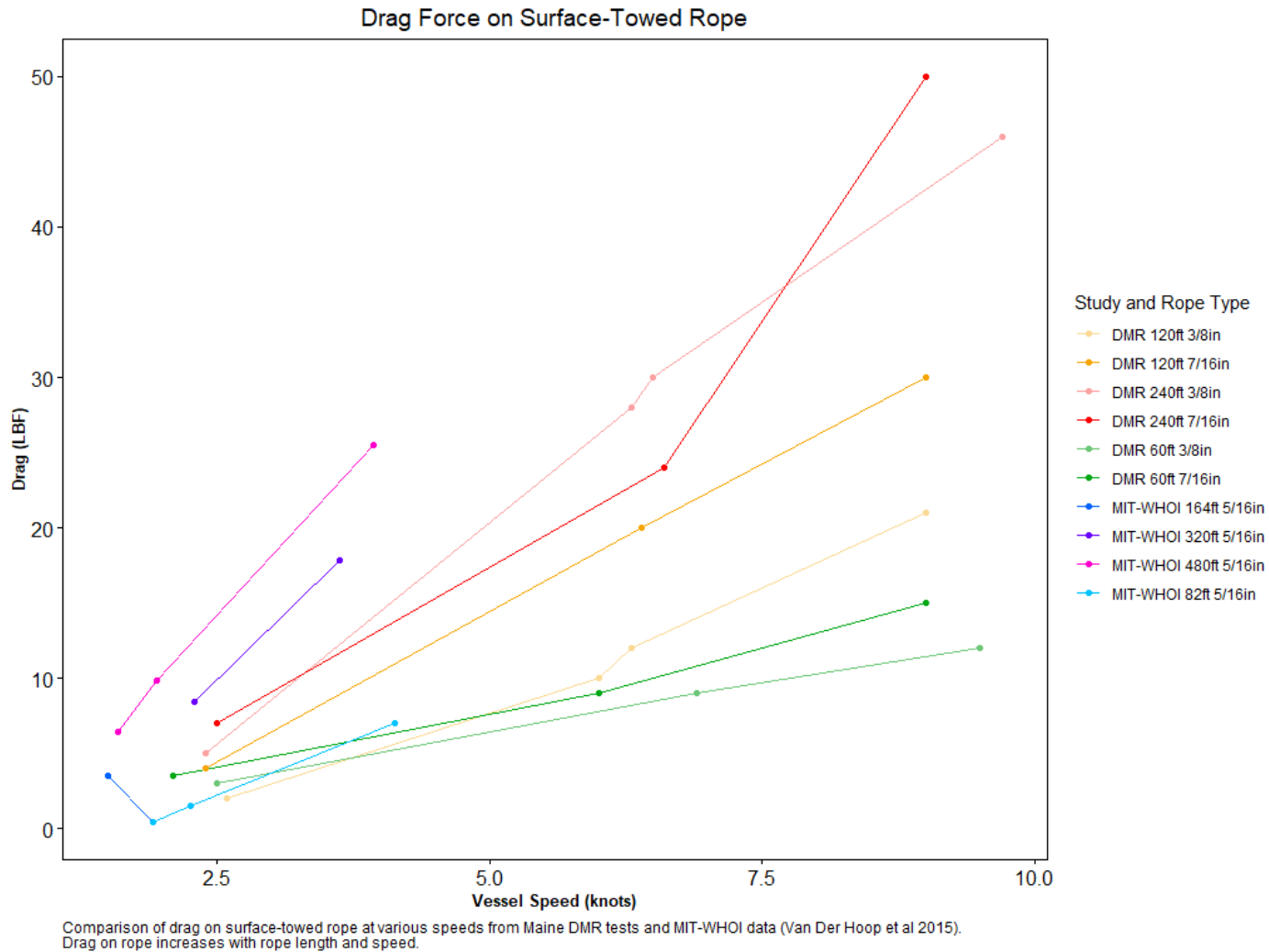


Figure 12. Data from ME DMR field trials assessing the drag force exerted by different diameters and lengths of line are plotting here next to the results from Van Der Hoop *et al.* 2015. At the speed of 2.5 knots, all lengths of line exert less than 10 lbs of drag force, with the 60 and 120 ft lengths exerting less than 5 lbs.

III. Gear Marking

a. Exempt Waters (shoreward of the exemption line)

Proposal: A purple Maine-only gear mark is required at the top, middle, and bottom of the vertical line. The top mark is 36” in length and must be in the top two fathoms of the line. The middle and bottom marks are 12” in length. Gear mark requirements within exempt waters have been finalized by the adoption of state regulations.

Note: ME DMR finalized gear marking requirements for exempt waters at its October 2019 DMR Advisory Council meeting. The regulations set an implementation date of September 2020, ahead of the federal regulatory process, and will allow for individuals to switch to purple gear-marking ahead of the implementation deadline. A copy of the regulations can be found here:

https://www.maine.gov/dmr/laws-regulations/regulations/documents/dmrchapter75_11132019.pdf

It is recommended NOAA Fisheries cite ME DMR’s regulation when the federal rule is published and include a clause that, if the State removes this requirement, NOAA Fisheries would take emergency action to implement the same regulatory requirement in the ALWTRP.

Rationale: (see rationale included for non-exempted waters below)

b. Non-Exempt Waters

Proposal: A purple Maine-only gear mark replaces the existing 12-inch red marks at the top, middle, and bottom of the vertical line. In addition, a 6” green mark and a 36” purple mark, in the top two fathoms of the line will be required.

Note: ME DMR finalized gear marking requirements for non-exempt waters at its October 2019 DMR Advisory Council meeting. The regulations set an implementation date of September 2020, ahead of the federal regulatory process, and will allow for individuals to switch to purple gear-marking ahead of the implementation deadline. A copy of the regulations can be found here:

https://www.maine.gov/dmr/laws-regulations/regulations/documents/dmrchapter75_11132019.pdf

Rationale: It has been clear throughout the ALWTRT discussions that a primary impediment to the development of regulations is the lack of conclusive data on what gear is involved in entanglements. This includes cases in which no gear is present and cases in which gear is retrieved but does not have markings which can be traced to a specific fishery. Maine’s gear markings address both of these challenges by increasing the amount of gear that is marked and increasing the frequency of markings on those lines. Maine has adopted these additional gear markings ahead of the federal regulatory process given the importance of spatially-specific data.

The core of Maine's gear marking proposal is the implementation of a state-specific purple mark for Maine's lobster fishery. At present, all Northeast trap/pot gear is identified by a red mark. This lack of spatial specificity means that, if red-marked gear is retrieved during an entanglement, the gear cannot be attributed to a specific state. As a result, it is nearly impossible to develop protections for right whales which are specific to fisheries or regions with confirmed entanglements, and broad-brush management measures must be used as a default. Maine's adoption of a state-specific mark will help provide the basis for spatially specific data and support better management advice in the future. Furthermore, a lack of purple marks in future entanglement records will help Maine justify the success of its right whale protection measures in place at that time.

Another major component of Maine's gear marking plan is the requirement that all commercial lobster gear within Maine's exempted waters be marked. Currently, gear fished shoreward of the exemption line is not subject to the gear marking requirements in the ALWTRP. While scientific evidence does not show that right whales frequent exempted waters or that gear within the exemption area has contributed to a right whale entanglement, the State does recognize that this lack of marking creates holes in the data. Requiring this gear to be marked will address these data gaps and greatly increase the number of marked vertical lines. Further, it will reduce uncertainty surrounding the retrieval of gear that is unmarked since all Maine commercial lobster gear will be subject to marking requirements and, therefore, identifiable.

Gear in both the exempt and non-exempt waters will be required to have a 36" purple mark in the top two fathoms of the line. This requirement stemmed from a Coast Guard and New England Fishery Management Council recommendation intended to increase the visibility and frequency of markings. Specifically, the Coast Guard suggested a 36" mark at the top of the line could enable the identification of fishery-specific gear from various platforms such as boats and planes. This would mean data in the entanglement record could be significantly improved without gear being retrieved. Further, the additional mark increases the number of marks per line by 25%, making it more likely that a piece of retrieved gear from an entangled whale will have a mark.

Finally, Maine is proposing a green mark, in combination with the Maine-only purple mark, be required on vertical lines outside of exempted waters. A cornerstone of Maine's right whale regulations is the exemption line, which identifies inshore waters and bays where right whales are rarely, if ever, present. This exemption line creates a balance between establishing protections for right whales and ensuring a viable lobster fishery in Maine. As all Maine lobster gear becomes marked, it is critical to differentiate between gear in exempted versus unexempted waters given the two regions are subject to different regulations. Requiring an additional green mark, in combination with the purple mark, allows Maine to achieve this objective.

IV. Harvester Reporting

a. All Maine Commercial Lobster License Holders

Proposal: Move the Maine lobster fishery to 100% harvester reporting.

Rationale: Currently 10% of Maine lobster license holders are randomly selected each year to complete harvester reporting. While analysis by the ASMFC's Lobster Technical Committee²⁶ suggests this level of reporting is enough to get precise estimates of catch, it does not provide the level of information on fishing effort or location needed for current right whale discussions. Increased harvester reporting will close this data gap and provide a complete picture of activity in the Maine lobster fishery. Addendum 26 to Amendment 3 to the Atlantic States Marine Fisheries Commission American Lobster Fishery Management Plan, which was approved in February 2018, requires all states to implement 100% active commercial harvester trip-level reporting by January 1, 2024. Given, the importance of improved fishery effort data to ongoing discussions, ME DMR is considering adopting 100% reporting ahead of the ASMFC requirement.

Moving to 100% harvester reporting in the Maine lobster fishery is a large financial endeavor. The Maine lobster fishery comprises roughly 40% of all commercial fishing trips taken each year by all fisheries along the Atlantic coast. As a result, the anticipated volume of reports requires additional ME DMR staff for QA/QC, technical support, and licensing. Further, options for electronic reporting will need to be developed and offered to defray costs associated with paper reporting. Currently, DMR is under contract with a third-party firm to develop a harvester reporting application (expected to go live in Fall 2020) for iOS and Android devices that will make harvester reporting more efficient and user-friendly. ME DMR has also submitted a proposal for funding to the Atlantic Coast Cooperative Statistics Program (ACCSP). While the exact amount of funding is yet to be determined, it is likely there will be a substantial difference between the level of funding needed and the level of funding received. This deficit means other levels of funding will need to be identified and secured. ME DMR highlights the feasibility of 100% reporting, and the date associated with its implementation, are highly dependent on the level of funding received.

V. Electronic Tracking on Federal Vessels

At the April 2019 meeting, ALWTRT members had a cursory discussion regarding electronic tracking on federally permitted vessels. Given this discussion, ME DMR had conversations with law enforcement and industry to gather feedback.

From an enforcement perspective, vessel tracking in federal waters would be a critical tool to ensure new and existing regulations are properly enforced. Offshore fishing areas pose unique challenges to enforcing regulations because the areas are vast. As a result, many hours can be spent searching for gear. Further, Maine Marine Patrol currently has eight patrol vessels with the capability to haul lobster gear in state waters. Of those eight, only

²⁶ Addendum 26 to Amendment 3 to the American Lobster Fishery Management Plan.
http://www.asmfc.org/uploads/file/5a9438ccAmLobsterAddXXVI_JonahCrabAddIII_Feb2018.pdf

four boats have the capability to effectively and safely inspect lobster gear in areas where larger trawls are fished outside of Maine state waters. As a result, Marine Patrol's capability to enforce lobster regulations drops as one moves further offshore.

Industry has expressed many reservations about adopting tracking on federally permitted vessels. These concerns include the cost of the unit, ongoing expenses associated with data plans, whether technical failures of a tracking device would cause boats to be tied to the dock, and whether vessels which already have VMS onboard will be required to have two different tracking units. Given a webinar on vessel tracking, as discussed at the April 2019 ALWTRT meeting, was never held, many questions remain regarding the parameters and potential impacts of this program.

Given industry's concerns and the lack of clarity around a federal tracking program, ME DMR recommends NOAA work with industry to understand the various tracking technologies which are available and to determine the associated costs. As a starting point, ME DMR notes that during the development of Addendum 26 to Amendment 3 to the American Lobster Fishery Management Plan, the ASMFC's Law Enforcement Committee (LEC) spent significant time discussing vessel tracking in the federal lobster fishery. This group produced several recommendations, including the need for a fast ping rate to discern between steaming and hauling. The LEC concluded the ability to distinguish these actions through a tracking device is important because it can indicate where traps are set and for how long. The LEC also noted that real-time data is not necessary in the lobster fishery given traps are set for multiple days; knowing the location of the traps is more important than getting hourly, real-time data. Given these criteria, it may be that a cellular-based tracking device is a better fit for the federal lobster fishery, and it is available at a substantially lower cost. At present, ASMFC is conducting a pilot program with cellular-based tracking devices in the lobster fishery to better understand their performance. This information may be crucial as NOAA begins to engage with the industry on this issue.

VI. Request for Conservation Equivalency

A unique feature of the Maine lobster fishery is that it is based on a system of co-management. The coast of Maine is divided into seven lobster zones in recognition that areas along the coast differ in habitat and traditional fishing practices. Each zone is represented through a Zone Council, which is comprised of fishermen in the region. These Zone Councils are an integral part of the lobster management process within the State. Under ME DMR's regulations, Zone Councils have the authority to set some measures within their Zone, including exit ratios (number of licenses issued vs. the number of licenses that are not renewed), number of traps fished (as long as this is more conservative than the statewide limit), number of traps on a trawl (as long as it is more conservative than state regulations), and time of day when fishing may occur. Several Zones have used this authority to fit regulations to their region. For example, fishermen in Zone E have adopted a 600-trap limit based on local fishing practices. All fishermen who fish in Zone E, regardless of whether it is their primary zone, are held to the 600-trap limit.

At present, ME DMR's proposal is for all state-licensed fishermen and is not differentiated by Maine's lobster management zones. However, this statewide approach does not

acknowledge the acute regional differences in the Maine lobster fishery. Further, it does not consider that Zone Councils may prefer a different combination of measures to achieve the same level of risk reduction. Allowing for future flexibility in the regulations to meet the same level of risk reduction will be crucial to the success of this rule. As a result, ME DMR recommends NOAA Fisheries include an alternative for conservation equivalency within the proposed rule. This will prevent the need for lengthy rule-making process if regional measures need to be adjusted to achieve the same level of risk reduction. Conservation equivalency is a management tool frequently used by the Atlantic States Marine Fisheries Commission and specific guidance has been developed on its implementation and use.²⁷

VII. Individual Safety Program

For a small number of fishermen, the measures included in this proposal exceed the physical limitations of their boat and would require the purchase of a new boat to come into compliance. While ME DMR believes these individual cases are few and far between, we do believe they exist. Given the purchase of a new vessel can be cost prohibitive, ME DMR is asking for the flexibility to address these safety concerns on an individual basis. To be clear, ME DMR is not asking that these individuals be exempt from the risk reduction included in this proposal. Instead, ME DMR is asking for the flexibility to address these individual cases in which a fisherman physically cannot comply with the requirements.

For example, it may be that a fisherman does not have the boat capacity to comply with the new trawling-up requirements. ME DMR is requesting the flexibility to develop an individual plan to achieve the same risk reduction at a lower trawling-up scenario. This could include an individual trap reduction and/or the use of full weak rope to compensate for the lower trawl limit.

Maine Marine Patrol would be notified of these individual cases to ensure enforcement and all analysis showing the individual conservation equivalency would be sent to GARFO staff for review.

²⁷ Atlantic States Marine Fisheries Commission. Conservation Equivalency: Policy and Technical Guidance Document. Approved May 2004; Edited October 2016. http://www.asmfc.org/files/pub/ConservationEquivalencyGuidance_2016.pdf

EXHIBIT 11

**UNITED STATES DISTRICT COURT
DISTRICT OF MAINE**

**DISTRICT 4 LODGE OF THE
INTERNATIONAL ASSOCIATION OF
MACHINISTS AND AEROSPACE
WORKERS, LOCAL LODGE 207,
f/k/a, IAMAW MAINE LOBSTERING
UNION – LOCAL 207, et al.,**

Plaintiffs,

V.

GINA M. RAIMONDO, et al.

Defendants.

Docket No. 1:21-CV-275-LEW

DECLARATION OF VIRGINIA OLSEN

I, **Virginia Olsen**, hereby declare and state as follows:

1. I am a Member of the Maine Lobstering Union (“MLU”) and serve as its Executive Liaison & Political Director.

2. The MLU is a division of the International Association of Machinists and Aerospace Workers (“IAMAW”) and an authorized Maine fishing cooperative owned by its Members. All Members of the MLU must be licensed Maine lobster fishermen and women.

3. I am a licensed Maine lobster fisherman and, together with my husband, have owned and operated a lobster fishing boat in Stonington, Maine for 27 years. By virtue of my membership in the MLU, my 11 years of as a lobster fisherman, and my own household's reliance on lobster fishing as a means of support, I follow closely and am familiar with regulations governing our fishery and issued by the State of Maine and federal regulators, including those implemented for the protection of other species such as the North Atlantic right whale.

4. I have read the Final Rule published by the National Marine Fisheries Service on August 30, 2021 and am profoundly concerned about its order to prohibit the use of Vertical Buoy Ropes (“VBRs”) in 967 square miles of federal waters located approximately 30 miles off the coast of Maine within Lobster Management Area 1 (the “LMA 1 Restricted Area”) between October and January of each year.

5. At the present time, VBRs are the one and only viable means of harvesting lobster and, therefore, the prohibition will effectively eliminate all lobster fishing in the LMA 1 Restricted Area. Indeed, the Final Environmental Impact Statement (“FEIS”) accompanying the Final Rule anticipates that at least through 2025, “ropeless fishing in these restricted areas is likely to be done primarily by collaborators borrowing gear from the NMFS gear cache, with up to an additional 10 percent of effort by other researchers and fishermen coast-wide. The NEFSC gear team projects that by 2025, they expect to have about 300 ropeless units and enough deck controllers for about 30 vessels, as well as technology to support adjacent mobile fishing vessels. That is at the most, coast-wide, there would be up to 33 vessels fishing ten ropeless trawls.” *FEIS* at 199.

6. The LMA 1 Restricted Area is not merely an innocuous body of water. Based on my own knowledge and experience, I believe that it is the most important and productive expanse of lobster fishing grounds available to Maine lobster fishing fleets, which utilizes the area to supply Maine and the world with lobster during the critically important winter months, when Maine lobsters are in their most healthy state and most amenable to live retention and transportation in commerce. Moreover, because of the natural migration pattern of Maine lobster, the LMA 1 Restricted Area is only fished during the winter months, when lobster is prevalent and plentiful there.

7. While closed to the harvesting of lobsters by VBRs, the LMA 1 Restricted Area

would remain open to ground fishing, including for the taking of lobster. Much of the ground fishing that occurs and will increasingly occur within the LMA 1 Restricted Area is undertaken by fishing interests from outside the State of Maine. I have received reports from MLU Members of ongoing surveillance of the LMA 1 Restricted Area by ground fishermen from other states, predominately Massachusetts, in anticipation of the closure. I and other Maine lobster fishermen are greatly concerned about the irreparable harm to the sustainability of our lobster fishery that is certain to result if lobstering is effectively barred in the Restricted Area, only to be replaced by ground fishing.

8. Unlike Maine lobstermen and women, who are closely regulated and monitored by the State of Maine, regardless of whether occurring in Maine or federal waters, it is virtually impossible to ensure compliance with ground fishing boats which are allowed to drag for and retain 100 lobsters per day and 500 lobsters per fishing trip. Because lobster is merely an incidental catch to these fishermen, it is common for them to collect lobsters, keep the largest and most healthy, and then discard the smaller and less healthy lobsters, before landing them. Invariably, the largest and healthiest of the female lobsters retained will be those with a greater egg-bearing capacity, with the smaller and less productive females being tossed overboard. For this very reason, in keeping with their long history of conserving our most important and iconic fishery, Maine lobstermen and women have steadfastly opposed, and the Maine legislature has time and again rejected, attempts to legalize the landing in Maine of lobster obtained by ground fishing. For Maine lobstermen and women, who have nurtured the ecology of their fishery in order to sustain it for generations, to be extricated from the all-important LMA 1 Restricted Area, only to be replaced by the irreparably harmful effects of ground fishing, is abhorrent. The depletion of our fishery as consequence of ground fishing, a method that has been historically limited due to

the presence of lobster fishing by means of VBRs, will result in long term and irreparable injury to the sustainability of the fishery.

9. The enforcement of the LMA 1 Restricted Area restricted area will be economically devastating for the Members of the MLU and for Lobster 207, the first union-owned fishing cooperative in Maine. Lobster 207 purchases a large portion of its product from ports in Stonington, Vinalhaven, and Mount Desert Island, localities that will be most directly and immediately impacted by the closure. During the four months of the closure, our cooperative relies heavily on our offshore boats to keep our products available for our established markets. These markets order lobster from us week after week because they appreciate the particularly high quality of the lobsters that we can provide during the winter months.

10. If the MLU loses access to the ready supply of lobster from the LMA 1 Restricted Area due to a winter closure specified by the Final Rule, it is certain to suffer serious financial injuries that will leave it unable to retain employees that transport and pack our product for shipment. Based on vendor sales data that I have reviewed; it is estimated that Lobster 207 will lose 4 million pounds should the closure become effective. The annual loss of this all-important source of supply and the income it generates is simply not sustainable and threatens to undue all that the MLU has accomplished since it established the cooperative for the benefit of its Members and employees.

11. The economic harm that would befall the families of hundreds of Maine lobstermen and women, and the scores of industry-related small businesses that either service the fleet or rely on its catch for re-sale, would be enormous. Many MLU members have reached out to me sick with worry about how they are going to survive the winter without access to their winter fishing grounds. I received an account from one MLU Member who fishes predominantly in the LMA 1

Restricted Area during the winter season and anticipates losing \$400,000 in revenue due to the closure. Other Members who fish in both the Restricted Area and in other zones report anticipated annual income losses of \$275,000 and \$323,000, respectively.

12. Without the all-important winter income, the equipment and infrastructure necessary to sustain the lobster industry will be jeopardized and investments already made over the past year for gear, boat modifications and up-keep will have been for naught. I know that lobster boat purchases are typically in the range of \$350,000 to \$500,000 and often are leveraged with financing requiring annual balloon payments which, by design, fall due annually and in December or January when both the catch and prices are at their highest. In the event of closure, lobstermen and woman and their families will be confronted with the choice of defaulting on boat loans versus defaulting on a home mortgage or meeting ordinary household expenses.

13. The Final Rule issued by NMFS also imposes on lobster fishermen new gear modifications that will take effect in May of 2022. These new gear modifications follow from years of costly government-imposed modifications designed to reduce entanglement risks to right whales. Although Maine's lobstermen and women have steadfastly complied with these mandates, NMFS has admitted that it has not evaluated their effectiveness in protecting the whales before mandating new ones. Ironically, due the closure of the LMA 1 Restricted Area, lobster fishermen will confront new gear marking requirements in May without the income needed to pay for them.

14. The lobstering communities most immediately and dramatically impacted by the closure of the LMA 1 Restricted Area to VBRs are located in coastal Down East Maine. These include, in particular, the lobstering hubs of Stonington and Vinalhaven, Maine's two largest. According to a 2017 comprehensive plan for my hometown of Stonington, and related public statements made by Kathleen Billings, its Town Manager, 76% of the community's economy is

related to the lobster industry. Stonington's fleet of lobster boats lands an estimated \$60 million of lobster annually. The town estimates that its lobster fishermen will lose 50% or more of their income as a result of the closure of the LMA 1 Restricted Area.

15. Based on my conversations with fishermen impacted by the LMA 1 Restricted Area, an estimated 200 lobster boats will be expelled from that area effective October 18, 2021, including 45 members of the Maine Lobstering Union. Contrary to federal regulators, as an experienced lobster fisherman, I know that it is not possible to simply pack up and move 200 such boats to adjacent open fishing areas in order to offset any significant portion of the lost catch and income. For one thing, lobster fishermen follow the seasonal migration of the lobster. The fleet fishes the grounds comprising the new LMA 1 Restricted Area during winter months because that is where the lobsters are located. Moreover, were it even hypothetically productive to do so, the relocation of 200 of our larger boats to adjacent grounds would result in chaos and conflict. First, the boats designed for deeper winter fishing, many over 45 feet long, are incompatible with fishing in close quarters in and about islands and other small fishermen. Because of design features for deep water safety, the larger boats are equipped with spurs that will cut fishing buoys and ropes, resulting in lost gear and replacement costs. Second, the impact on the remaining small boats, who will be competing for ocean bottom with the larger boats, will simply transfer a portion of the lost income from the LMA 1 Restricted Area from one fisherman to another. Finally, were fishermen to move to other fishing grounds, at issue will be areas already fished and protected by other lobstermen, sometimes by their families for generations. The risk of conflict, particularly with economic survival at stake, are obvious and real. The suggestion that the loss of Maine's most productive lobster fishing grounds can simply be offset with minimal economic and social impacts is wrong and demonstrates a complete misunderstanding of lobster fishing.

16. Because of their size and the number of traps carried, boats used for winter lobster fishing and most impacted by the LMA 1 Restricted Area typically employ between 2 and 4 stern men. Without productive winter fishing grounds to work, many of these individuals will lose their employment. Unfortunately, the areas most impacted by this sudden unemployment are already within one the more economically depressed regions of our state. Good paying jobs in the region are hard to come by and many of those left unemployed by the closure and their families will be uprooted and forced to relocate, leaving the fleet with a deficit in its skilled workforce during the remaining lobstering season, resulting in further irreparable harm.

17. Within the directly and immediately impacted areas of Down East Maine, few small businesses will be spared from irreparable economic harms should the LMA 1 Restricted Area take effect. By way of example, two of Lobster 207's lobster vendors will be profoundly impacted. The Fox Island Lobster Company of Vinalhaven, owned by MLU Member Frank Thompson and his wife, Jean Thompson, estimates that it stands to lose \$5 million in revenue due to the mandated closure of the LMA 1 Restricted Area. The Damon Family Lobster Company of Stonington, owned by Bill Damon, estimates that it will lose between 1 million and 1.3 million pounds, or more than a quarter of the company's annual sales volume, from the closure of the LMA 1 Restricted Area during its most productive four months. Losses of these magnitudes, occurring in small towns and within already economically deprived regions, will inevitably result in lost jobs, lost homes and societal disruptions.

18. I have been lobster fishing since 2010. I have never encountered a North Atlantic right whale or known of another Maine lobster fisherman or woman who has encountered a North Atlantic right whale.

I hereby declare and state under penalty of perjury that the above-stated facts are true upon

my own knowledge, information or belief and, so far as they are stated upon information and belief,
I swear that I believe them to be true.

Dated at Stonington, Maine this 14th day of October 2021.

/s/ Virginia Olsen
Virginia Olsen

EXHIBIT 12



NOAA Technical Memorandum NMFS-NE-247

North Atlantic Right Whales- Evaluating Their Recovery Challenges in 2018

**US DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts
September 2018**



NOAA Technical Memorandum NMFS-NE-247

This series represents a secondary level of scientific publishing. All issues employ thorough internal scientific review; some issues employ external scientific review. Reviews are transparent collegial reviews, not anonymous peer reviews. All issues may be cited in formal scientific communications.

North Atlantic Right Whales - Evaluating Their Recovery Challenges in 2018

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**US DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center
Woods Hole, Massachusetts
September 2018**

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ABSTRACT

The North Atlantic right whale (*Eubalaena glacialis*) population has been in decline for 8 years due to increased mortality and sublethal effects from multiple factors. Together these have contributed to a decrease in calving. Shifting ecosystem conditions have also changed North Atlantic right whale behavior and fishing patterns. For example:

- North Atlantic right whales have expanded their distribution farther into northern waters, and are visiting different foraging areas.
- Calanoid copepod distributions appear to be in a similar state of change and this may be affecting available forage for North Atlantic right whales
- The whales' range expansion has exposed them to vessel traffic and fisheries in Canadian waters, which did not have protections for right whales in place until late last summer (2017).
- American lobster (*Homarus americanus*) populations are also changing distribution, moving north and into deeper, cooler waters of the Gulf of Maine. The US fisheries are moving farther offshore to capitalize on this, increasing the overlap between their fishing activity and North Atlantic right whale foraging areas and migration corridors.

The net result of these events is that severe entanglements have increased among North Atlantic right whales. Animals are in poor body condition likely from a combination of repeated entanglement stress, potentially limited forage and increased migratory costs- all contributing to a decrease in female calving rate. Ship strikes are still a real threat to the population. At the current rate of decline, all recovery achieved in the population over the past three decades will be lost by 2029.

INTRODUCTION

Signs of Trouble

After several decades of recovery and years of collaboration among stakeholders, the North Atlantic right whale (*Eubalaena glacialis*), hereafter referred to as the right whale, began to decline (Pace et al. 2017). This trend was subtle at first, initially signaled by fewer sightings in traditional survey areas, but other warning signs began to emerge (Kraus et al. 2016). The number of documented mortalities increased markedly in 2016 and 2017 (Hayes et al. 2018; Hayes et al. 2017) and an improved way of modeling the population's numbers (Pace et al. 2017) revealed a clearer picture of the population size and decline in numbers. Concern further escalated throughout 2017 and 2018 when only 5 calves were born and there were 19 confirmed mortalities through August.

Taken together these signs meant that risks posed to right whales and associated management measures needed to be revisited for multiple US fisheries on the Atlantic coast. This occurs through the biological opinion process under the federal Endangered Species Act, which was reinitiated in October 2017, and through the take reduction team process under the federal Marine Mammal Protection Act.

Demographic Effects

Increased mortality rates and decreased calving have moved the population into a decline that has continued for at least the last 8 years. At present, right whale deaths attributable to human activity are mostly caused by ship strikes and entanglement in pot/trap and anchored gillnet fishing gear. An encounter with fishing gear is the most frequent cause of documented right whale serious injuries and deaths in recent years. The odds of an entanglement event are now increasing by 6.3% per year, while ship strikes events remain flat (Fig. 1). At the current rate of decline, the population will have returned to its 1990 numbers, likely with comparatively reduced genetic diversity, and could decline past a point of no return in just a few decades.

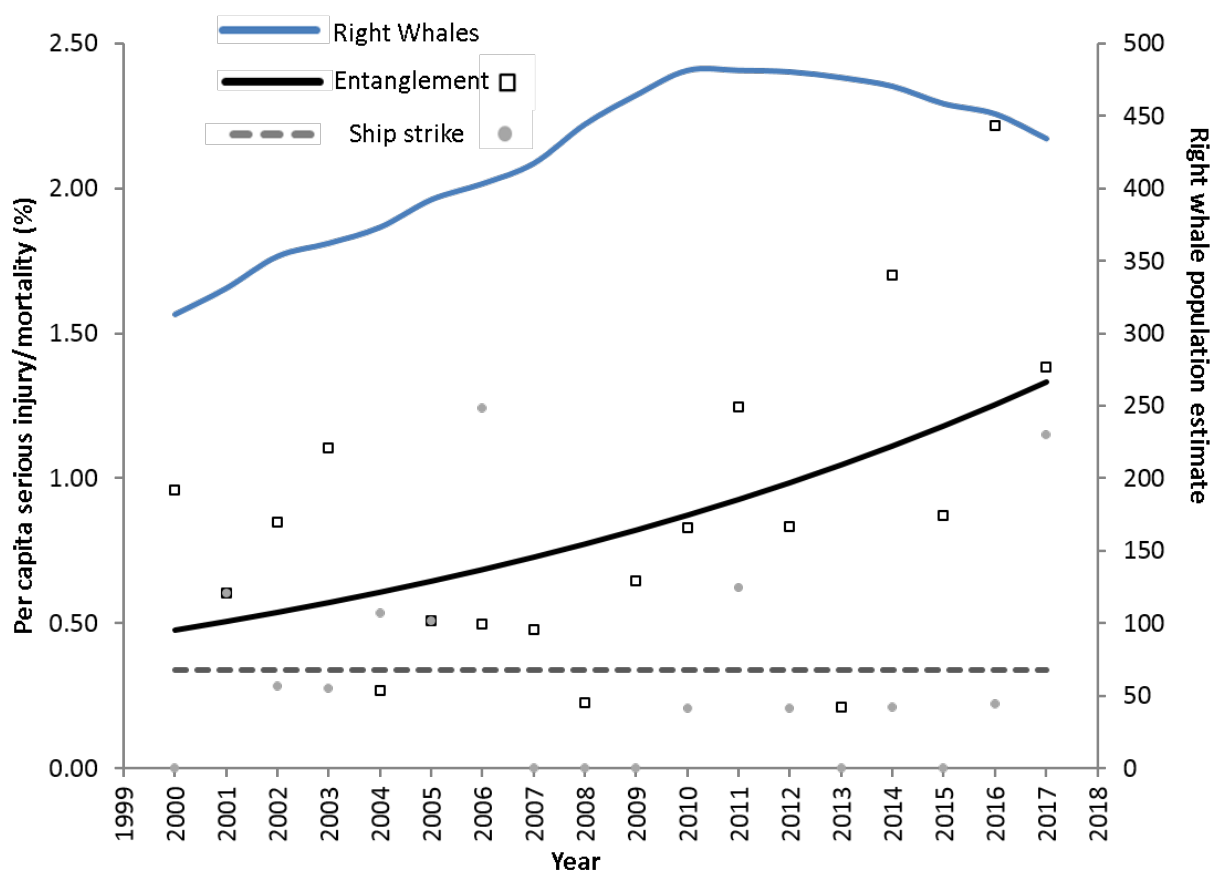


Fig. 1 North Atlantic right whale serious injury/mortality rates from known sources 2000-2017 (Henry et al 2017; 2016 & 2017 values preliminary). Models are simple logistic regressions fit using maximum likelihood-based estimation procedures available in R. The right whale population trend is overlaid and referenced to right y-axis (Hayes et al, 2018).

Distribution Change

Historically, right whales have returned to habitats in specific geographic locations annually, ensuring that a large portion of the population could be seen in each year. Therefore annual population estimates were conducted by simply sighting and counting as many animals as possible each year. Resulting estimates also assumed that an animal had died if it were not seen for 6 consecutive years.

Changes in this distribution pattern began around 2010 when the population peaked at 481 individuals. The whales were no longer using some of their established habitat areas in as great a number, and not staying within them for as long. This meant a new method was needed to account for animals, even those not sighted in a year. Once developed, this more advanced assessment tool, based upon mark recapture methods, enabled rapid assessment of the population with increased precision within one calendar year, much faster than the five or so years required to get good confidence on an annual estimate using the previous method. It also provided precise population estimates with greater resolution on the number of whales that likely died in any given year. Estimates made using the new method confirmed that in recent years, many deaths (around 10 to 20/yr) were going undetected annually and that by the end of 2016, the right whale population had declined to 451 individuals. A revised population estimate accounting for the many deaths and few births of 2017 is being developed and will be available later this year.

Increased Mortality

The large number of observed right whale mortalities in 2017 triggered an unusual mortality event (UME) to investigate the causes. The National Marine Fisheries Service (NMFS) is authorized to declare UMEs under the federal Marine Mammal Protection Act when an unanticipated significant die-off occurs in a marine mammal population, requiring an immediate response. Two other UMEs were declared that year due to 80 humpback whale and 40 minke whale deaths. Ongoing investigations for these two species have preliminarily identified causes of death that include entanglements, ship strikes, and disease.

In contrast to other large whale species, the problems of right whales are often more apparent because they are monitored more intensely and their coastal distribution means more opportunity for overlap with human activities, leading to it being nicknamed ‘the Urban Whale’ (Kraus et al. 2007).

While perhaps more attention is paid to the right whale given their more dire population status, it can be an indicator of more chronic problems that need addressing, not just for the sake of right whales but also for other populations of large whales. By example, although Gulf of Maine humpback whale status has improved, entanglement mortalities still remain high for this stock (Hayes et al. 2018).

There is considerable urgency to address the issues of mortalities that stem from human activities. Large whales, including right whales, are long-lived and can breed multiple times during their lives. This means these species can be resilient and able to recover after periods of

poor reproduction. However, recovery for any species cannot take place if the number of deaths is more than the number of births in the population.

POTENTIAL CAUSES OF THE DECLINE

Ecosystem Dynamics

One of the constant challenges of resource management is that things change. While it is much easier to make management decisions if conditions are static, ecosystems are inherently dynamic and will change over time in response to a variety of influences. This is the case for the emerging story for right whales.

Sometime around 2010, ecosystem shifts occurred within their habitat that changed right whale movements and fishing practices in a way that has increased interaction between whales and fishing gear, and that potentially presents other environmental challenges.

Currently the Gulf of Maine is warming faster than 99.9% of all other ocean regions on the planet (Pershing et al. 2015). This is having dramatic impacts across the food web, from the middle and upper trophic level organisms such as American lobster (*Homarus americanus*), Atlantic cod (*Gadus morhua*) and right whales (Greene 2016); to the zooplankton at the base of the food web such as calanoid copepods (Grieve et al. 2017; NEFSC 2018).

Whales and Fisheries Are On the Move

American lobster are experiencing strong population fluxes and redistributions with temperature warming. The southern New England lobster fishery has been severely limited by epizootic shell disease, which lobsters become susceptible to at warmer temperatures. In the Gulf of Maine, coastal waters remain cool enough and offshore, deeper waters have warmed enough for lobsters, and lobster fishing, to expand farther offshore. As a result, Maine lobster landings have increased steadily for the past 30 years, with an increasing portion of this caught 3 or more miles offshore over the past 10 years (Fig. 2). Note that Maine lobster landings did downturn sharply in 2017, and future trends are uncertain.

Prey Availability Drives Reproductive Success

It is essential to also recognize that environmental factors and lower trophic level dynamics also contribute to right whale birth and mortality rates. Changes in prey availability influence right whale health and reproduction. In particular, abundance of the copepod *Calanus finmarchicus* in the Gulf of Maine is a strong predictor of right whale reproductive success (Greene and Pershing 2004; Meyer-Gutbrod and Greene 2014; Meyer-Gutbrod et al. 2015).

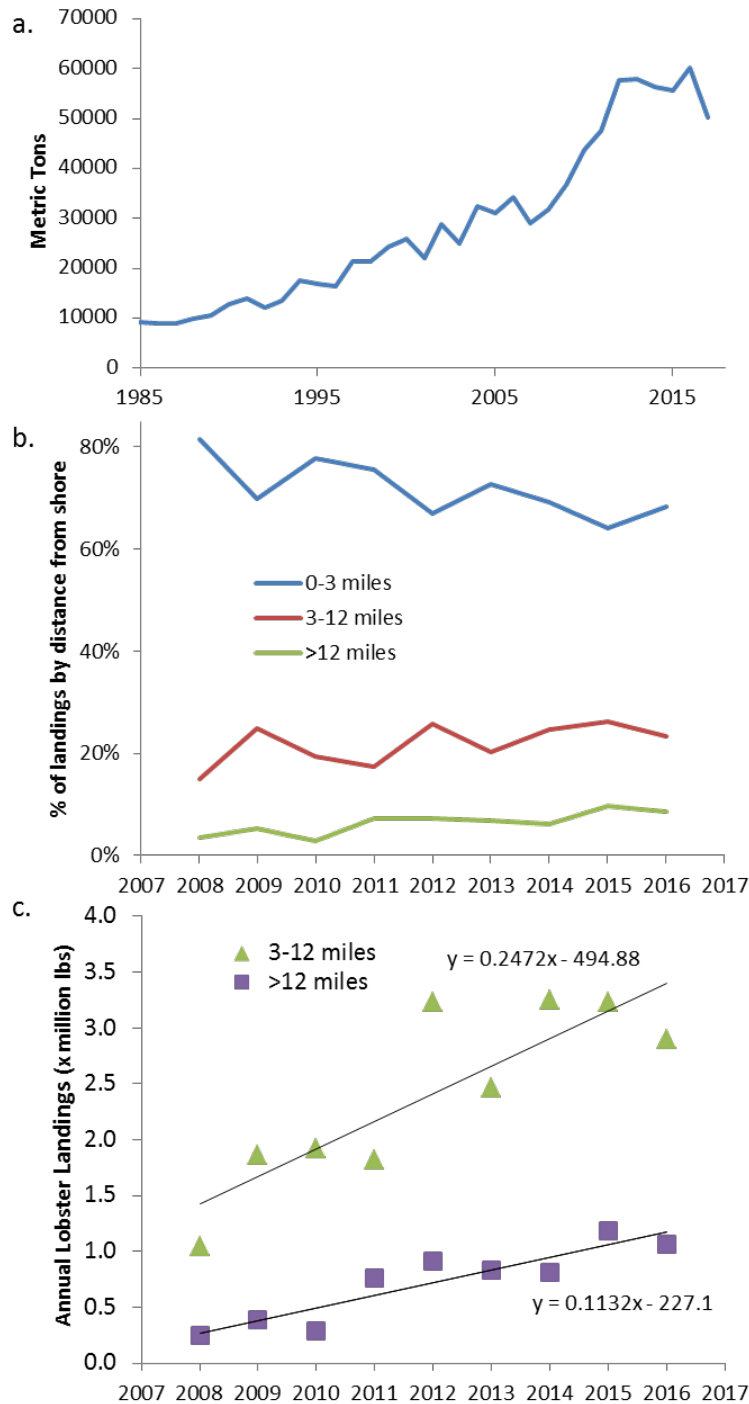


Fig 2. American lobster landings in Maine: a) total annual landings b) relative proportion of landing by distance from shore c) increase in landings from 3-12 and >12 miles offshore from Maine's 10% harvester reporting, no VTR data included.
<https://www.maine.gov/dmr/commercial-fishing/landings/>

Meyer-Gutbrod and Greene (2018) followed individual whales over the past three decades to evaluate the relationship of calving and mortality rates to prey availability. They found that prey availability is a driver of decadal differences in the right whale population's recovery. Periods of

low prey availability coincided with reduced birth rates (Meyer-Gutbrod and Greene 2018) and the interval between births has been observed to lengthen during periods when prey availability is low (Meyer-Gutbrod et al. 2015).

Similarly, years with few births contribute to years of decline or stagnation in population growth, indicating the pronounced effect of reproductive variability on species viability (Pace et al. 2017). That said, Meyer-Gutbrod and Greene (2018) modeled population growth rates under scenarios of high and low prey availability and found that the population should continue to grow even with poor prey availability and only fails to do so when whale mortalities reach 8 to 10 per year. It is worth noting natural mortality seems to be very rare in adult right whales: there has been no confirmed case of natural mortality in adult right whales in the past several decades (Corkeron et al. *Accepted with revision*; Henry et al. 2017; van der Hoop et al. 2013).

Right Whales Follow Prey in a Changing Ocean

The copepod *C. finmarchicus* has shifted in distribution and abundance in recent years due to unprecedented warming in the Gulf of Maine, and this is likely to impact the right whale population (Greene 2016; Mills et al. 2013; Reygondeau and Beaugrand 2011). It appears that in the last decade (~2005-2015), that there has been a general decline in *C. finmarchicus* in the Gulf of Maine (2009-2014, but 2015 was average abundance) and on Georges Bank (below average abundance since 2008) (NEFSC 2018) as well as the Scotian Shelf (Johnson et al. 2017).

Changes in plankton forage species abundance likely played a role in the changing movement patterns of right whales that began sometime in the past 10 years. There have been decreases in both acoustic detections and physical observations of right whales in the northern Gulf of Maine and the Bay of Fundy, and a concurrent increase in sightings of many of the same animals in the Canadian Gulf of St. Lawrence (Daoust et al. 2018; Davis et al. 2017; Meyer-Gutbrod et al. 2018; Meyer-Gutbrod and Greene 2018).

During winter, whales are spending more time offshore in the mid-Atlantic, and less time on the coastal calving grounds just off the southeastern U.S., where in 2017 and 2018 calving has been quite poor.

Reproduction Requires Robust Females

Reproduction depends on adequate adult female health and body condition. Reproductive females are particularly vulnerable to prey reductions because pregnancy and lactation increases caloric demand and they have less access to prey during migration to calving grounds (Fortune et al. 2013; Miller et al. 2012; Rolland et al. 2016).

Several of the ecosystem shifts mentioned earlier are likely to have negative consequences for reproduction in right whales. First, a reduction in prey will have energetic costs for females. Northward shifts in the right whales' feeding grounds, as a result of changes in prey availability, will increase energetic cost of the calving migrations from the southern calving grounds off the coast of Florida and Georgia, particularly if animals do not adapt to also calve farther north.

The cost of entanglement has also been shown to have direct and indirect consequences for right whales (van der Hoop et al. 2017b; van der Hoop et al. 2017c). This will be detailed next, but in the Gulf of Maine where ecosystem shifts are occurring more trap fishing is also occurring offshore, increasing the overlap with right whale foraging areas.

Whales have also expanded their range, foraging into the Gulf of St. Lawrence. This increased the whales' exposure to risk from fixed gear fisheries. Some of this risk has reduced by strong protections put in place by the Canadian government during the spring of 2018 (DFO/TC Canada 2018; DFO Canada 2018).

Anthropogenic Stressors

In a review of mortality sources for all large whales, entanglement in fishing gear was the number one cause, followed by natural causes and then vessel strikes. An exception to this is the right whale for which there is very little evidence of natural mortality in adult whales, likely due to shortened life spans associated with anthropogenic causes (Corkeron et al. *Accepted with revision*), as all confirmed causes of adult mortality and serious injury since 1970 have been due to fishing gear and vessel strike (Henry et al. 2017; van der Hoop et al. 2013).

The relative contribution from these two causes was approximately equal through the year 2000 (van der Hoop et al. 2013), but entanglement events resulting in death or serious injury have increased steadily since then, while ship strike frequency has remained lower with no specific trend (Fig. 1). For the recent 19 known right whale mortalities (17 in 2017 and 2 to date in 2018), the cause of death could be determined for 10. Ship strikes are implicated in five blunt force trauma cases and entanglement in the remaining five. In 2017, seven other entangled whales were observed: three were disentangled, three shed the gear, and one was not seen again.

Ship Strikes

Reducing Risk

Ship strikes are currently the second most frequently documented cause of mortality in right whales. The per capita mortality frequency has not varied much, hovering around 0.34% deaths or serious injury events per year (Fig. 1). Several management actions were implemented in U.S. and Canadian waters beginning in 2008 to reduce the risk of collisions between right whales and large vessels. Major actions include:

- Voluntary two-way routes for commercial vessels off the Southeast U.S. and in Cape Cod Bay
- Modification of the Boston, Massachusetts Traffic Separation Scheme
- Canada and the International Maritime Organization established the voluntary Area To Be Avoided concept in the Roseway Basin
- Seasonal Management Areas in habitats off of Massachusetts, ports along the Mid-Atlantic coast, and the southeastern U.S. where vessels are required to slow to speeds less than 10 knots during transits for vessels 65 ft in length or longer

- Intermittent implementation of voluntary speed restrictions in Dynamic Management Areas within which right whale aggregations are observed outside the boundaries of the Seasonal Management Areas

Several analyses have been conducted to evaluate the effectiveness of these management efforts (Conn and Silber 2013; Lagueux et al. 2011; Silber et al. 2014; van der Hoop et al. 2012). In general, while these analyses were based on a short time-series of available data, collectively they suggest that after ship-strike rules put in place, a reduction in right whale mortality from ship strikes followed, and in general were at the lowest on record per capita from 2010 through 2016.

Responding to Changing Risk

In 2017, right whale deaths by ship strike increased when 5 ship-strike mortalities were confirmed, 1 in U.S. and 4 in Canadian waters (Fig. 1), likely caused in part when right whales began to spend more time in new areas with high vessel traffic and no speed restrictions. Increased survey effort in these areas also made it more likely that these events would be observed and reported.

Entanglement

Reducing Risk

Management efforts to reduce entanglement risks in U.S. waters have focused on gear technology to make entanglements less likely to harm or kill whales, restricting where and when gear that poses a threat can be used when whales are likely to be present, and reducing the amount of gear in the water column (Fig 3). Measures are recommended through a take reduction team, as mandated under the federal Marine Mammal Protection Act. Each team comprises a variety of experts and stakeholders, who assist NOAA Fisheries in developing a take reduction plan when necessary.

Since 1997, a series of rules have been implemented based on the take reduction plan (Fig. 3). These include the sinking groundline (2009) and vertical line (2015) rules. While there appears to have been a subsequent reduction in entanglements caused by groundline (Morin et al. 2018), which moved 27,000 miles of line from the water column to the bottom (NMFS, 2014), absolute entanglement rates appear to be on the rise (Fig 1).

Increase in Entanglement Risk

Fewer but Stronger Lines in US Waters

There may also have been unintended consequences of the 2015 vertical line rule. The rule required ‘trawling up’ (using more traps per trawl) in some regions. While this reduced the number of lines, it also meant that lines had to be stronger to accommodate the increased load of multiple traps. This natural adaptation, and the fact that stronger rope was available, contributed to an increase in the severity of entanglements as found by Knowlton et al. (2016), who observed very little evidence of entanglement with ropes weaker than 7.56 kN (1700 lbsf).

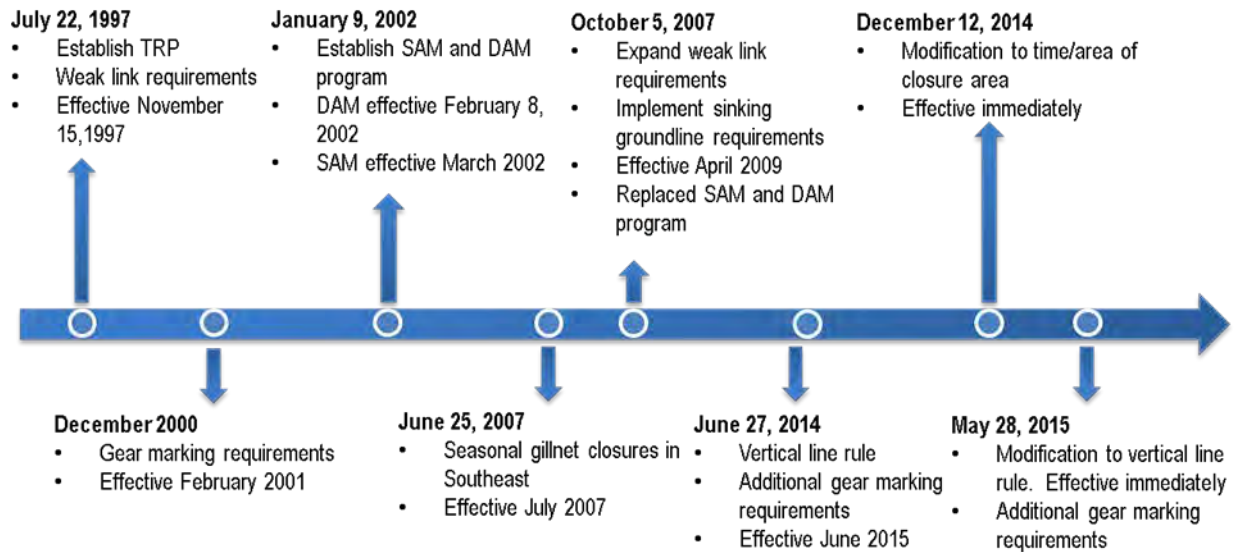


Fig 3. Timeline of significant management actions focused on reducing fishing entanglement

Entanglement Trends Upward

Knowlton et al.(2012) showed that nearly 85% of right whales have been entangled in fishing gear at least once, 59% at least twice, and 26% of the regularly seen animals are entangled annually. These findings represent a continued increase in the percentage of whales encountering and entangling in gear, which grew from to 61.5% in 1995 (Hamilton et al. 1998), to 75.6% in 2002 (Knowlton et al. 2005), confirming further the growing severity of the problem.

More Vertical Line in Right Whale Habitat

Rough estimates are that approximately 622,000 vertical lines are deployed from fishing gear in U.S. waters from Georgia to the Gulf of Maine. Notably until spring of 2018, very few protections for right whales were in place in Canadian waters. In comparison to recent decades, more right whales now spend significantly more time in more northern waters and swim through extensive pot fishery zones around Nova Scotia and into the Canadian Gulf of St. Lawrence (Daoust et al. 2018).

Taken together, these fisheries exceed an estimated 1 million vertical lines (100,000 km) deployed throughout right whale migratory routes, calving, and foraging areas. Figure 4 illustrates the scale of the challenge by providing fishery statistics for the various regions (data sources provided in Appendix 1).

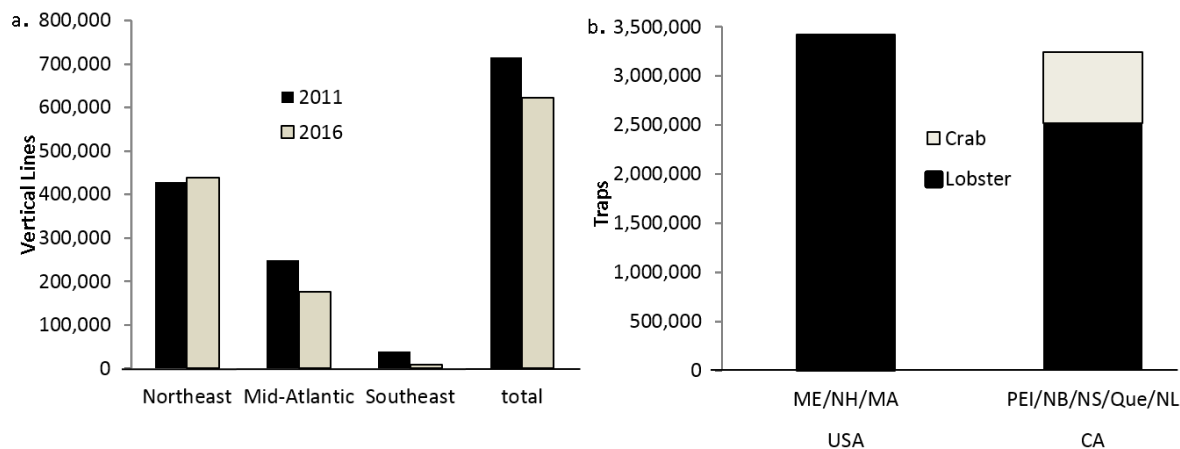


Fig 4. Index of fishing effort. a) The change in number of vertical lines in US waters from 2011 to 2016, b.) The approximate number of traps in USA Northeastern states and Canadian provinces. Data sources in Appendix 1.

Closures Are Effective, But May Not be Enough

A great deal of effort has been put into identifying entanglement ‘hot-spots’: relatively small areas where focused management measures can have minimal impact to fishing while providing great benefit to whales. Clear examples of this approach include the seasonal closure of Cape Cod Bay, and now the static closure within the Area 12 fishing zone of the Canadian Gulf of St. Lawrence. Both are relatively small areas where a significant portion (30 to 50+ %) of the right whale population has reliably occurred for several weeks to months over the past few years. Management actions have a population level benefit with impacts restricted to very local portions of fisheries. While still difficult choices, this has been the preferred management approach.

However, these closures, while likely very effective regionally, may not be enough. Each vertical line out there has some potential to cause an entanglement. With a 26% annual entanglement rate in a population of just over 400 animals, this translates to about 100 entanglements per year, which is significant for such a small population. But from the perspective of an individual fixed gear fisherman, they may never encounter a right whale. With more than 1 million lines out there, any single line has perhaps a 1 in 10,000 chance of entangling a whale in any one-year period. This can vary somewhat from regions with high to low densities of lines and/or whales.

However, in general, this means a fisherman and his or her descendants could go several generations without ever entangling a right whale. Given this, it’s easy to believe that ‘*all these entanglements are happening somewhere else*’ regardless of where one fishes. Being able to directly link an entanglement with specific gear deployed at a specific place in time is rare, but by mapping known locations of gear that led to the entanglement of a right whale, one can see that there is no place within the fished area along the East Coast of North America for which entanglement risk is zero (Fig 5).

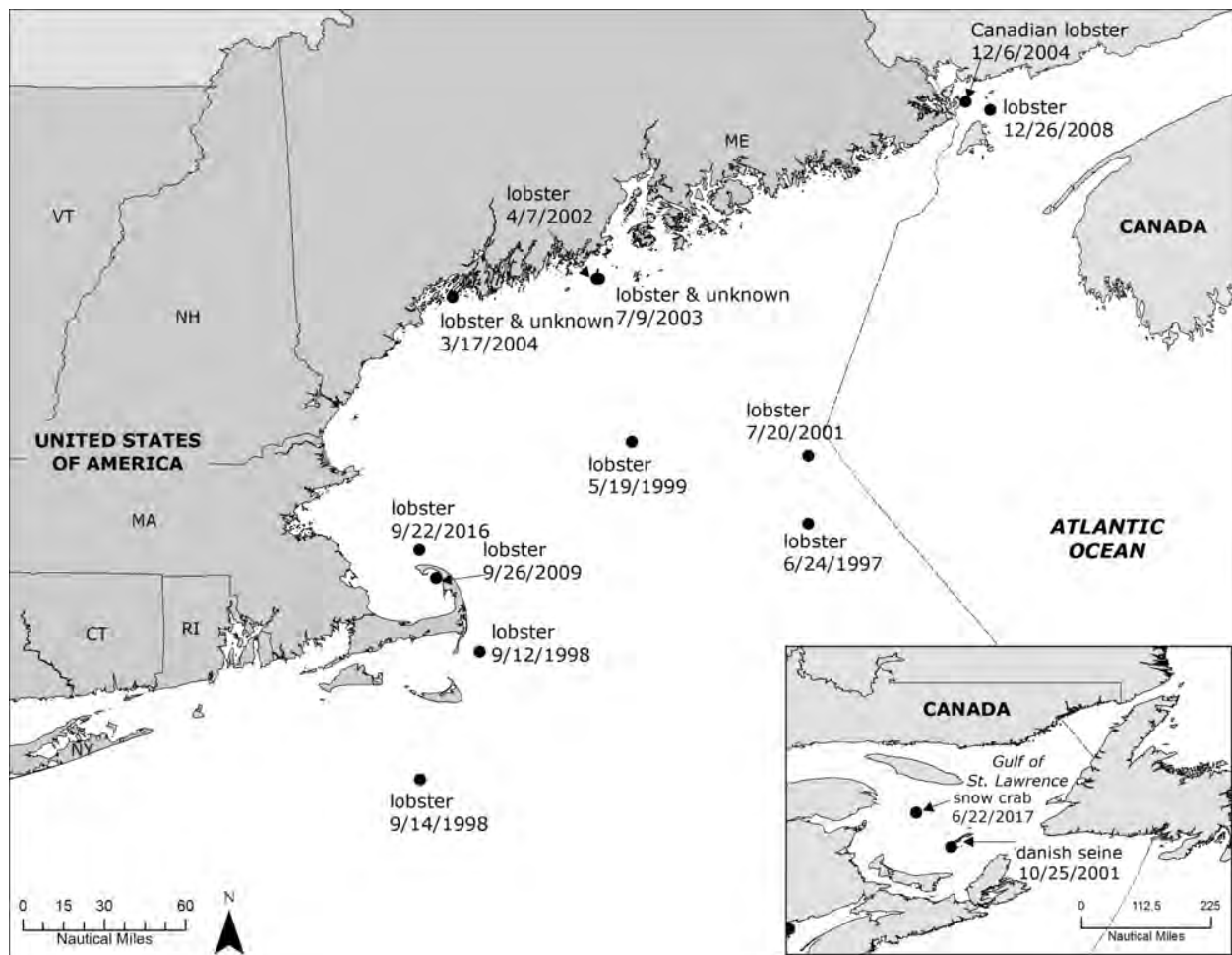


Fig 5. Right whale entanglements from 1997 through 2017 for which the set location and type of gear are known, and gear was recovered from a whale.

Sublethal Challenges- Skinny Whales and Few Calves

Fundamentally, a population increases when there are more births than deaths. Much attention has been paid to direct mortality caused by ship strikes and entanglement, but less focus has been put on the secondary effects of these and other variables where animals survive but fail to thrive because of the harm done. This is particularly evident in calving among mature females.

Biological Cost of Stressors

The abundance of photographs of known individual right whales taken over several decades have been used to develop health indicators associated with natural and human-caused stressors (Schick et al. 2013). This has been refined into a quantitative health score, including a predictive threshold below which females seem incapable of having a calf (Miller et al. 2012; Rolland et al. 2016).

We understand that right whales are exposed to numerous sublethal stressors, including fluctuating food resources (Meyer-Gutbrod and Greene 2014) and even underwater noise (Rolland et al. 2012). Several recent studies have also focused on sublethal effects of entanglement, the first of which includes increased swimming energy costs from dragging gear (van der Hoop et al. 2016). Even if disentangled, there are several injuries that can have costs lasting long after disentanglement. These include trauma wounds from rope cuts that may or may not eventually heal, and damage to baleen plates that can prevent efficient filter feeding for many years since these plates grow slowly.

Recent studies have also shown that even without accounting for injury, the drag from carrying rope and other gear for long periods of time can be energetically more expensive for a female than the migratory and developmental costs of a pregnancy (van der Hoop et al. 2017a; van der Hoop et al. 2017b; van der Hoop et al. 2017c).

Biological Demands of Right Whale Pregnancy

While serious injuries represent 1.2% of all entanglements, there are often sublethal costs to less severe entanglements. Should an entanglement occur but the female somehow disentangles and recovers, it still has the potential to reset the clock for this “capital” breeder. She now has to spend several years acquiring sufficient resources to get pregnant and carry a calf to term, the probability of a subsequent entanglement is fairly high, and this will create a negative feedback loop over time, where the interval between calving becomes longer. This is certainly a contributing factor in the longer calving interval for females, which has now grown from 4 to 10 years (Pettis et al. 2017).

Figure 6 demonstrates a simple model for estimating the probability that an animal will NOT become entangled over time. Similar to asking what are the odds of NOT getting ‘heads’ in 10 coin tosses, this model simply asks what are the odds of not getting entangled over time if there is a 74% chance of not getting entangled each year (Knowlton et al. 2012). Historically the median calving interval of a female right whale is 3 to 4 years (Pettis et al. 2017). The model estimates that animals have a about a 30 to 40% chance of not getting entangled during that period, or, conversely, a 60 to 70% chance of getting entangled.

With the calving interval now nearly twice as long as in the past, half as many calves are being born. So while entanglements often do not kill an animal, they may have a large impact by reducing or preventing births in the population. There is an additional variable, stress, which is much harder to quantify but known to have costs in mammals that are foraging in an environment with some mortality threat (Hernández and Laundré 2005).

It is difficult to tease out the relative effects of poor foraging conditions and the energetic costs of entanglement on the increased frequency of thin whales and the subsequent decrease in calving. Both are likely having some influence. While there are dozens of documented cases of

ship strikes and entanglement linked to right whale mortality, to date there is no confirmed observation of a right whale starving to death from poor forage.

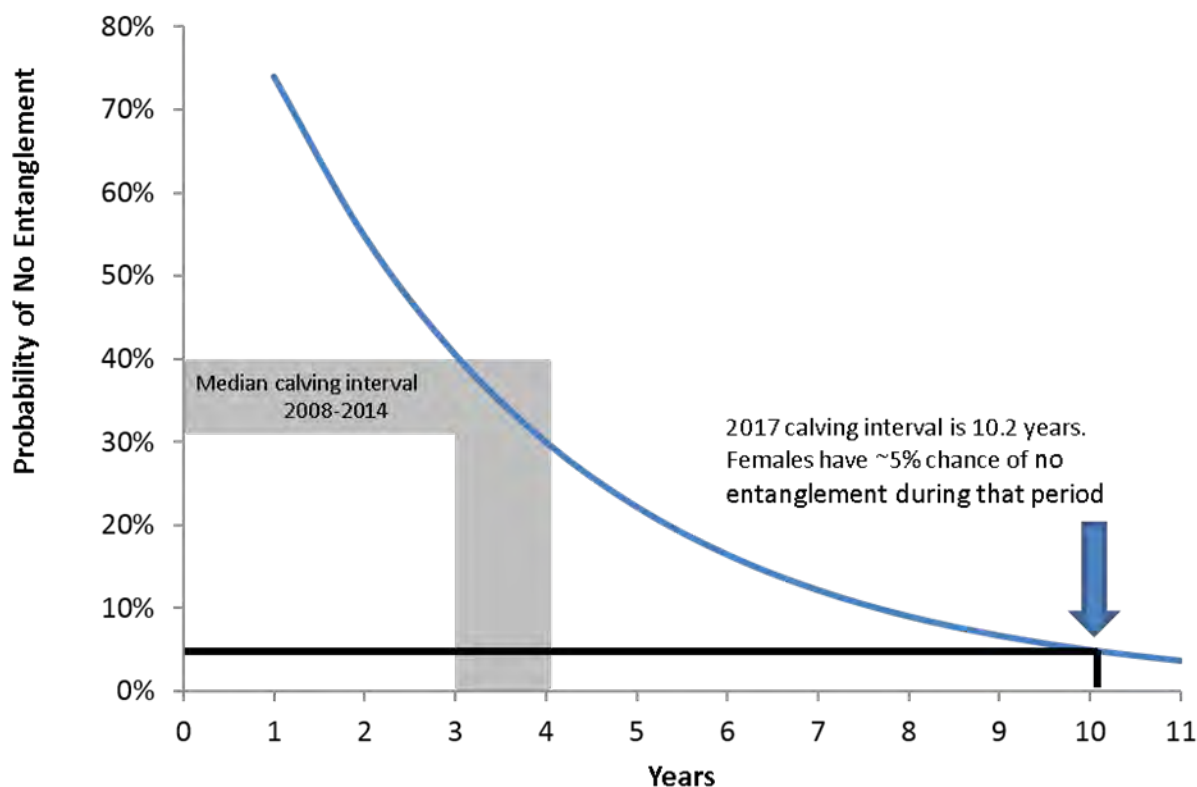


Fig 6. Cumulative annual probability of no entanglement (annual rate = 74%)

HOW LONG DO NORTH ATLANTIC RIGHT WHALES HAVE?

A Long-Lived Animal

Right whales have the potential to be a very long-lived species. In the southern hemisphere where shipping and fishing pressures are much lower, there is little evidence of human activities causing right whale mortality. There is also little evidence of natural mortality in adult animals (Corkeron et al. *Accepted with revision*). Since the ban on commercial whaling of Southern right whales in 1935 (Gambell 1993) these animals have not yet lived long enough to die of natural causes.

Meyer-Gutbrod and Greene (2018) demonstrated that even under poor foraging conditions, right whales should be able to recover if annual human-caused mortality is kept somewhere below 8-10 deaths per year. This means that in the absence of human-caused mortalities, right whales could potentially endure several decades under poor foraging conditions and still recover once environmental conditions improve. However, in the current situation in the northern hemisphere,

where animals are living much shorter lives, there is great cause for concern that the risk of extinction is much higher than in the southern hemisphere, where animals are not regularly subject to human caused mortality.

An Illustration of Potential Decline, 2017-2067

A Matrix Model

In order to measure current population trends, we used a three-stage (calf, juvenile, adult) matrix population projection model (Caswell 2006) for female right whales, derived from Corkeron et al. (*Accepted with revision*), to project the future abundance of right whales. Survival values used for input into the population projection model were calculated using a Cormack-Jolly-Seber (Pace et al. 2017) variant of a mark-resight model (see Appendix 2 for details) and determined the population is declining at 2.33% per year.

We started the model estimating an abundance of 160 females alive at the end of 2017. With approximately 1.5 males per female (Pace et al. 2017), 160 females would result in an overall species abundance of about 400. It is possible that this abundance estimate may be marginally low, but since the model overestimates calving success, we assumed that these biases should cancel each other out.

Using the stage derived from the matrix model, we assumed that the 2017 starting population of 160 females was composed of 10 calves, 60 juveniles, and 90 adults. We ran 1000 stochastic projections forward 50 years (Fig. 7). We then extracted median and 95% quantile estimates of projected abundance from those projections, and estimates of the number of adult females remaining, for 5, 10, 15, 20, 25 and 50 years. Results are shown in the Table.

Results

The model projects that in 2067, 50 years from 2017, there would be 49 female North Atlantic right whales remaining, of which only 32 would be adults. In 20 to 25 years (2037-2042) there would be fewer than 50 adult females. In the near term, at the current rate of decline, all recovery in the population over the past 3 decades will be lost by 2029, with the population returning to the 1990 estimate of 123 females.

Notably, the model does not adjust for varying environmental conditions, which are known to fluctuate on a decadal time scale for North Atlantic Ecosystems (Nye et al. 2014) and are presently unfavorable. This approach may overestimate the rate of population decline but not the overall trajectory.

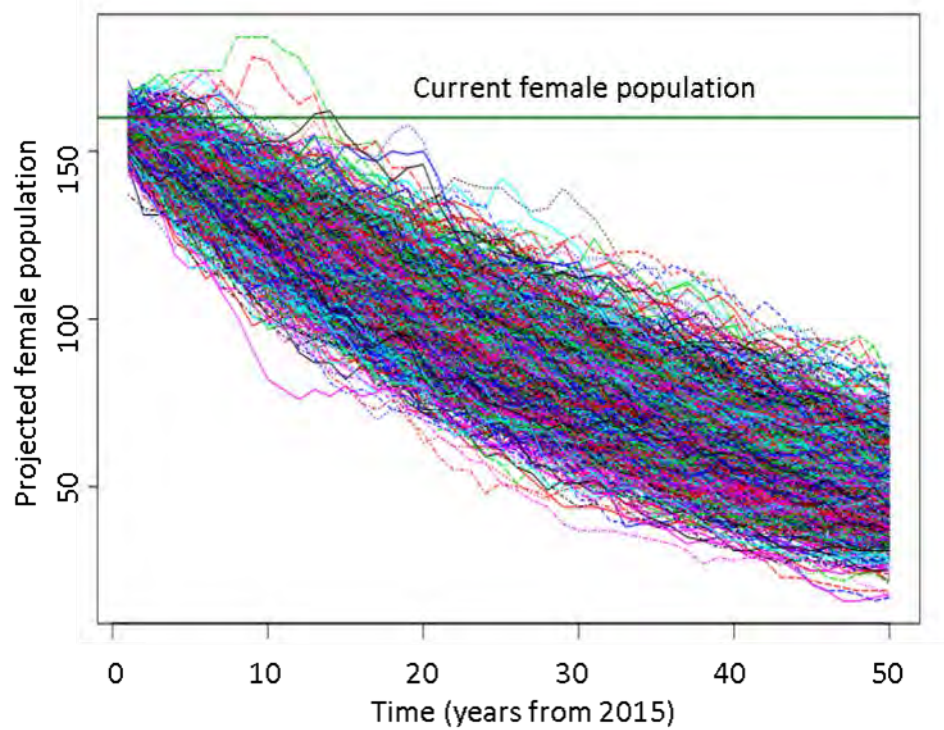


Fig. 7 Matrix population projection model output of North Atlantic right whale female population trend under current population conditions.

Table of matrix projection model output of female North Atlantic population trends for 5-year intervals, 2017-2067

Years from 2017	Number of females	Cis	Number of adult females
5	144	126 to 161	75
10	129	107 to 150	67
15	114	91 to 141	59
20	102	77 to 130	53
25	90	66 to 119	47
50	49	27 to 76	32

The threshold for functional extinction is very hard to define and likely varies by species. If the population declines to the 1990 level, there is a new threat: a repeated genetic bottleneck. Genetic bottlenecks happen when a population is so small that the genetic make-up of remaining group is not the same as that of the initial population. The effect of repeated bottlenecks is likely to mean that if the population returned to the 1990 level, that group would have less genetic diversity than the group that existed in 1990. This can lead to reduced resilience and contribute to increased risk of extinction (Amos and Harwood 1998; Melbourne and Hastings 2008).

INDICATORS OF SUCCESSFUL MANAGEMENT MEASURES

Determining the management actions necessary to reverse the current population trend is beyond the scope of this document. However, the scale of the actions will need to be quite significant to be successful. Entanglement has increased dramatically and ship strikes continue to occur.

The population decline began in 2010 (Fig. 1), when entanglement was occurring at a rate of 26% among sighted animals per year (Knowlton et al. 2012). Since then, the right whale range expansion has put them in the path of more shipping and more fishing gear – encountering almost twice the amount of gear owing to expansion of more fishing farther offshore in US waters and northward into Canadian waters (Fig. 4).

It is logical to conclude that to reverse the right whale decline, it may be necessary to reduce the impacts of entanglements and other harmful human interactions with right whales across their expanded range to pre-2010 levels. For recovery it may be necessary to go further, considering more modifications to fishing and shipping practices to compensate for potentially reduced forage opportunity and increased migratory costs.

Several biological indicators can be recommended for monitoring the short- and long-term effectiveness of any management actions that might be put in place to reduce the rate of both ship strikes and fishing gear entanglement.

Short-term indicators include fewer observed numbers of ship strikes and entanglements. These could be noticeable within 6 months to 1 year, but there is considerable variation around detectability of these events and the results will initially have a great deal of uncertainty. It takes approximately 1 year to conduct a population assessment and determine any changes in abundance. The assessment will alleviate some the uncertainty in detecting mortality risks that that might be mitigated by management actions. It should be noted that number of mortalities is the bluntest indicator of management success.

However, teasing the relative effects of management actions and natural variability on population size and condition will take several years of data and analysis. Metrics such as the frequency of scarring, improvements in body condition, and overall health scores could be detectable under stable environmental conditions in 2 to 3 years. Similarly, if environmental conditions are adequate for females to accumulate enough resources to calve, it will likely take at least 2 to 4 years to separate the impact of management action that reduced the frequency of, say, costly entanglements from the impact of natural variability. Ultimately, confidence in any estimate of population trajectory will emerge over 5 to 10 years.

In an ideal situation, evidence of human-caused injuries and mortality decreases, body condition improves, and the birth rate exceeds the death rate, resulting in more North Atlantic right whales.

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APPENDIX 1 Data Sources for Figure 4

Several data sources were used to construct Fig 4. All vertical line estimates in 4A were provided by Industrial Economics. Trap counts provided in 4B were acquired from a variety of sources. Raw trap counts were provided for Maine and Massachusetts. Trap counts for New Hampshire and all Canadian provinces were generated by multiplying license counts by trap limits. These were quite variable across regions, in which case the multiplier used is reported in the Table in the report.

Location	species	# traps	data year	Source
Maine	Lobster	2,901,000	2016	https://www.maine.gov/dmr/commercial-fishing/landings/documents/lobster.table.pdf
New Hampshire	Lobster	133,700	2010	https://www.greateratlantic.fisheries.noaa.gov/protected/whaletrp/trt/meetings/2012/meeting/Day%202/day_2_1c_new_hampshire_alwtrp_proposal.pdf
Massachusetts	Lobster	383,447	2011	http://www.lobstermen.com/wp-content/uploads/2009/10/MASS-LOBSTER-INDUSTRY-2012.pdf
Canada	species	# license	2016	Source
Nova Scotia	lobster	3,249	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
	crab	748	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
New Brunswick	lobster	1,460	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
	crab	123	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
Prince Edward Island	lobster	1,245	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
	crab	39	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
Quebec	lobster	591	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
	crab	382	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
Newfoundland	lobster	2,353	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
	crab	3,379	2016	http://www.dfo-mpo.gc.ca/stats/commercial/licences-permis/species-especes/se16-eng.htm?
Canada	species	trap limit range	trap multiplier used	Source
Nova Scotia- GOSL	lobster	225-300	275	http://dfo-mpo.gc.ca/fm-gp/peches-fisheries/comm/atl-arc/lobster-notice-avis-homard-neiges-en.html
Nova Scotia- GOSL	crab	75-150	150	http://dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/snow-crab-neige/snow-crab-neiges2013-eng.htm
Nova Scotia- east	crab	30-60		
New Brunswick	lobster	240-300	275	http://dfo-mpo.gc.ca/fm-gp/peches-fisheries/comm/atl-arc/lobster-notice-avis-homard-neiges-en.html
	crab	75-150	150	
Prince Edward Island	lobster	240-300	275	http://dfo-mpo.gc.ca/fm-gp/peches-fisheries/comm/atl-arc/lobster-notice-avis-homard-neiges-en.html
	crab	75-150	150	
Quebec	lobster	235	235	http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/lobster-homard/index-eng.htm
	crab		200	
Newfoundland	lobster	185	235	https://thisfish.info/fishery/atlantic-lobster-canada-fa11/
		100-425		http://vaves-vagues.dfo-mpo.gc.ca/Library/282426.pdf
	crab	200	200	http://dfo-mpo.gc.ca/decisions/fm-2018-gp/atl-07-eng.htm

APPENDIX 2 Model Inputs and Methods used for Population Projection

In order to determine current rate of population decline we used a simple, three-stage matrix population projection model (Caswell 2006) for female right whales, derived from Corkeron et

al. (*Accepted with revision*), to project the future abundance of North Atlantic right whales. The model's three stages are: calf, juvenile and adult. Survival values used for input into the population projection model are derived from survival estimates calculated using a Cormack-Jolly-Seber (as opposed to the published Jolly-Seber, Pace et al 2017) variant of a mark-resight model (see Appendix 1 for details). We used the lower 95% credibility intervals of the median estimates of survival for 2011-2015 from the model. These were: calves: 0.86137, juveniles: 0.92684, and adult females: 0.92684. The matrix projections also assume: a calving interval of 4.75 years (the mean of median inter-calf intervals for calving females 2011-2017, from the 2017 North Atlantic Right Whale Report Card (Pettis et al. 2017), ; females maturing at 11; and a current maximum longevity of 50. With no calves born this year, this calving estimate is arguably optimistic, but the inter-calf interval estimate for 2018 would be undefined, and so is unusable. Survival and transition probabilities for stages were calculated as described in Corkeron et al. (*Accepted with revision*). The model was run in R 3.4.3 (R_Core_Team 2017), using the libraries *diagram* (Soetaert 2017), *popbio* (Stubben and Milligan 2007) and *popdemo* (Stott et al. 2016).

The matrix used for analyses is:

	calf	immat	adlt
calf	0.00000	0.00000	0.10526
immat	0.86137	0.86254	0.00000
adlt	0.00000	0.06430	0.92443

This gives an intrinsic rate of increase of 0.9767, or a decline of 2.33% per year.

To develop a stochastic projection from this model, we took a starting abundance estimate of 160 females alive at the end of 2017, as the unusually high observed mortality of right whales that year (Meyer-Gutbrod and Greene 2018) meant that starting earlier would not capture one important recent anthropogenic impact on this species. With approximately 1.5 males per female North Atlantic right whale now (Pace et al. 2017), 160 females would give an overall species abundance of ~400. It is possible that this abundance estimate may prove to be marginally low, but as the model overestimates calving success, we assume that these biases should cancel each other out. When an abundance estimate for 2017 is available (by October-November 2018) the model can be revised.

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APPX-001376

EXHIBIT 13

IN THE UNITED STATES DISTRICT COURT

DISTRICT OF MAINE

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INTERNATIONAL ASSOCIATION OF)
MACHINISTS AND AEROSPACE)
WORKERS, LOCAL LODGE 207, f/k/a,)
IAMAW MAINE LOBSTERING UNION –) CASE NO. 1:21-CV-00275-LEW
LOCAL 207, et al.,)
)
Plaintiffs,)
)
v.)
)
GINA M. RAIMONDO, in her official)
capacity as Secretary, U.S. Department of)
Commerce, et al.,)
)
Defendants.)

DECLARATION OF MICHAEL ASARO, PH.D.

I, Michael Asaro, declare as follows:

1. I have been a National Marine Fisheries Service (NMFS) employee since 2010. Since May 26, 2020, I have held the position of Economist for the Protected Resources Branch at the Northeast Fisheries Science Center in Woods Hole, Massachusetts. Prior to this, I was the Marine Mammal and Sea Turtle Branch Chief in the Protected Resources Division of the Greater Atlantic Regional Fisheries Office (GARFO) in Gloucester, Massachusetts, a position I held from June 2017 until I started at my current position in 2020. I submit this declaration to respond to the declaration of Senator Troy Jackson, in particular his description of statements he attributed to me at a meeting in March 2019.

2. In my former position as Marine Mammal and Sea Turtle Branch Chief, I managed the implementation of conservation programs to protect North Atlantic right whales

under both the Endangered Species Act and the Marine Mammal Protection Act. This included coordinating the Atlantic Large Whale Take Reduction Team (ALWTRT), a group of government officials, fishing industry representatives, environmental advocacy groups, and scientists tasked under the Marine Mammal Protection Act to work with NMFS to develop a plan to reduce the level of serious injury and mortality of North Atlantic right whales, humpback whales, and fin whales from commercial gillnet and trap/pot fisheries.

3. In early 2019, when Senator Jackson's staff requested a meeting with me and other NMFS officials, NMFS had been working with the ALWTRT to determine if additional measures were needed to address fisheries impacts on North Atlantic right whales in light of scientific information indicating that the right whale population had been in decline since 2010. Over a series of meetings in 2017 and 2018, the ALWTRT had been discussing various proposals to reduce both the number and severity of North Atlantic right whale entanglements with fishing gear.

4. I have reviewed the Declaration of Hon. Troy Jackson submitted to the Court in this case. I remember the meeting with Senator Jackson and Mr. David Sullivan of the Maine Lobstering Union described in paragraphs 4-7 of Senator Jackson's Declaration. I attended the meeting with my NMFS colleagues Sarah Bland, Peter Burns, and Kate Sampson. The discussions at that meeting focused on right whales and management measures as they could affect the in-shore lobster fishery off the coast of Maine, not the off-shore waters where the new LMA 1 restricted area sits.

5. I remember that Mr. Sullivan and Senator Jackson asked me for specific sighting evidence of right whales in Maine waters and specific entanglement mortality events attributed to Maine fishing gear. Senator Jackson's declaration incorrectly indicates that I said there were

no confirmed sightings of right whales in federal waters in the Gulf of Maine. I would not have said this, because it is simply not true. NMFS has decades of confirmed sightings of right whales in both federal and Maine state waters of the Gulf of Maine.

6. In this discussion with Mr. Sullivan and Senator Jackson, I did indicate that areas like Cape Cod Bay off Massachusetts have regular feeding aggregations consisting of a large percentage of the right whale population at certain times of the year, but that this was not the case in the waters off of Maine. This, however, was not a concession that there are no right whales observed off the coast of Maine, only that they are not present in dense feeding aggregations. In fact, as recently as September 16, 2021, there was a right whale sighted in Casco Bay, and on September 20, 2021, there was a mother-calf right whale pair seen in the vicinity of the LMA 1 closure area.

7. After this discussion on the presence of right whales off the Maine coast, I recall that Mr. Sullivan asked me to explain why NMFS does not conduct regular aerial surveys of Gulf of Maine waters off the Maine coast if right whales are present in these waters. I explained that the goal of aerial surveys is to capture as many photographs of unique individual right whales as possible. Because of unique markings on each right whale, scientists are able to identify whales individually, and this information is used to determine population abundance estimates (i.e., how many whales there are in the population). I explained that the purpose of these flights is to support our population abundance estimate, therefore we perform regular aerial surveys in areas where we would expect to find dense aggregations of right whales. Aerial surveys are not conducted to confirm presence or to determine geographical distribution of right whales. Acoustic information is a more cost effective means to determine presence or

geographical distribution of whales, and we have more than two decades of acoustic data confirming right whale presence in waters off the Maine coast.

8. Mr. Sullivan then asked me to provide information on confirmed right whale entanglements with Maine lobster gear. I explained to Mr. Sullivan that there are some entanglements that have been attributed to Maine lobster gear, but the vast majority of entanglement events go undetected, or when gear is found it cannot be attributed to any fishery because of the lack of any identifying features. I explained that the better way to think of this issue is to consider where the most risk exists in terms of vertical lines in the water column, because we have to assume that right whales can be anywhere on the East Coast—including waters off the coast of Maine—and very few entanglement events can be conclusively attributed to any specific fishery or location. I noted that the vast majority of vertical lines on the East Coast belong to the Gulf of Maine lobster fishery, and therefore they represented a significant risk for entanglement with right whales. This was the same approach that the ALWTRT used in its analysis of risk reduction measures at its meetings during that time.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge.

Executed in Harwich, Massachusetts on this 8th day of October, 2021.

ASARO.MICHAEL.J
OSEPH.1386604874
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ASARO.MICHAEL.JOSEPH.138660
4874
Date: 2021.10.08 12:13:57 -04'00'

Michael Asaro, Ph.D.