No. 142, Original

In The
Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

DIRECT TESTIMONY OF ROBIN CANTOR, Ph.D.

October 26, 2016

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INTRODUCTION AND OVERVIEW

I, Robin Cantor, Ph.D., offer the following as my Direct Testimony:

1. I am an expert in applied economics, statistics, econometrics, and risk management, with specific expertise in environmental economics and the application of surveys. I have previously submitted expert reports and expert testimony on the proper use and implementation of surveys in the litigation context. I also have extensive experience evaluating economic damages in the context of disputes concerning energy, the environment, and human health effects.

2. I have been retained by the State of Georgia to offer an expert opinion regarding the survey methodology, findings, and opinions proffered by two of Florida's experts, Drs. Steven B. Scyphers and David L. Sunding.

3. Specifically, I have been asked by Georgia to consider the scope, scientific foundations, and reliability of the surveys and related analysis conducted by Drs. Sunding and Scyphers for this litigation. Both attempted to use surveys to support their opinions regarding the assessment of community valuation of natural resources and conservation in Apalachicola River and Bay (collectively, the "Florida ACF Region"). Yet neither Dr. Scyphers nor Dr. Sunding have proffered reliable survey evidence in support of their survey-based opinions. As a result, the specific surveys results contained in their expert reports cannot provide credible support either for their opinions or for any of Florida's claims concerning the impact of upstream water use by Georgia.

BRIEF BACKGROUND OF WORK EVALUATED

4. Florida's expert, Dr. Scyphers, implements a Computer Assisted Telephone Interviewing ("CATI") survey in an attempt to investigate sociocultural values in the Apalachicola region of Florida. Dr. Scyphers claims that his report "provides a sociocultural profile of communities in the Apalachicola River and Bay regions of coastal Florida and provides an assessment of their social vulnerability to environmental degradation." FX-799 (Scyphers Expert Report, at 5). He uses two telephone surveys—one of residents and one of commercial fisherman—in these areas of Florida as the foundation for his analysis. Dr. Scyphers claims that his surveys and sampling approach address the "social values, beliefs,

and concerns of local communities and commercial fishers." FX-799 (Scyphers Expert Report, at 8). Dr. Scyphers also conducted a literature review that he maintains was done "to contextualize and compare the results of the survey to other relevant studies and communities." FX-799 (Scyphers Expert Report, at 8).

5. Another of Florida's experts, Dr. Sunding, conducts an internet-based survey of households in Alabama, Georgia, and Florida to ask about their use of resources in the ACF Basin and "[t]o gauge the level of public support for measures to enhance dry year streamflows." FX-784 (Sunding Expert Report, at 8). As stated above, Dr. Sunding relies on responses to only 3 of 45 questions to inform the opinions stated in his report. Although Dr. Sunding generated a report in 2013 called "Recreational Use of the Apalachicola River: A Survey of Residents of Alabama, Florida, and Georgia" (hereinafter, the "2013 Sunding Report") that includes his full survey and results for the Apalachicola River, he omits this report, without explanation, from materials disclosed with his expert report. The omission is significant. This 2013 report was generated for the State of Florida—presumably in connection with this matter—and addressed the extent of recreational use of the Apalachicola River and the willingness of citizens of three states to support environmental measures that would prevent future water diversions. FX-800 (2013 Sunding Report). While Dr. Sunding examines both of these issues in his expert report for this litigation, he inexplicably fails to make use of all of his survey results.

6. Another Florida expert, Dr. Phaneuf, also relies on this 2013 Sunding Report for his work in this matter. FX-791 (Phaneuf Expert Report, at 38-39). This underlying survey work is instructive and, as shown below, includes results that contradict Dr. Sunding's and Dr. Phaneuf's opinions regarding the value of recreation that could be lost or restricted due to decreased water flow in the Apalachicola River region.

7. Drs. Scyphers and Sunding's surveys are purportedly intended to investigate values and behaviors of the population in the Florida ACF Region. I explain below the several reasons for which these surveys and survey results are flawed and unreliable as support for the opinions of these two Florida experts. Moreover, I demonstrate that the results in Drs. Scyphers' and Sunding's expert reports do not address and are not aligned with issues in this litigation. Although the surveys purport to explore values connected to environmental resources,

Drs. Scyphers and Sunding do not derive values (whether economic or non-economic) that can be attributed to changes in upstream water use by Georgia.

SUMMARY OF OPINIONS

8. Drs. Scyphers and Sunding proffer survey methodologies to support their opinions regarding Florida's claims, but none of the surveys were designed and directly implemented to estimate any economic or non-economic *losses* in the Florida portion of the ACF Region that might be attributable to water use in Georgia. Therefore, none of the surveys can reliably support any conclusions about how reduced water use in Georgia would lead to greater societal or cultural benefits to the Florida ACF Region. Similarly, none of the surveys inform any analysis regarding appropriate apportionment of water resources.

9. Even in the context of the objectives selected by Drs. Scyphers and Sunding, their survey methodologies fail to comply with recognized professional guidance for surveys. This guidance has been established to inform survey design and methodology and to support the reliability of survey results. I have identified numerous sources of error that affect survey reliability here—within two categories of survey error: **measurement error** relates to the data of interest, and **representation error** relates to the population of interest. The undeniable presence of error in all of Drs. Sunding and Scyphers' surveys renders the results unreliable, and none of these survey results can be used for the purpose of establishing socioeconomic losses associated with alleged environmental impact due to upstream water use in Georgia.

10. By his own admission, Dr. Scyphers is not conducting survey research. Rather, his work attempts to provide descriptive information regarding the limited range of communities that he chose in the Florida ACF region. His flawed survey methodology, however, yields results that cannot even be used to support a description of the studied communities. Moreover, in my opinion, his work produced nothing over and above what could have already been learned from readily available information on the communities in the Florida ACF Region.[1]

[1] *See*, e,g., Figures 1 -3, Scyphers Written Direct Testimony.

11. Specifically, Dr. Scyphers' two surveys suffer from the following significant flaws—categorized by measurement error and representation error—and accordingly, his results are unreliable:

(a) Measurement Error

- The surveys have no articulated hypothesis, purpose, or stated relevance to any issues in the litigation.

- The surveys were not properly designed or tested. The pre-survey, undocumented, non-systematic "scoping interviews" in the surveyed communities fail to support either the content validity of the surveys or the interpretation of survey results.

- The values measured by Dr. Scyphers' two surveys do not correspond to the "defining characteristics,"—as articulated by Dr. Scyphers—of the communities that Dr. Scyphers was attempting to assess. In other words, the survey questions measured values that did not correspond to what Dr. Scyphers himself said he was trying to measure.

- The surveys fail to use benchmarks or control groups to understand or contextualize the survey results.

- The surveys are subject to recall and processing error due to vague questions and failure to define key and complex concepts used in those questions.

(b) Representation Error

- The sets of respondents in both surveys do not conform to random samples, and therefore do not provide unbiased coverage of the target population being addressed.

- Dr. Scyphers' survey of residents suffers from a low response rate and potential non-response bias. Dr. Scyphers reports no response rate in his expert report, and his subsequent efforts to calculate a response rate are not consistent with conventional guidance for the calculation of survey response rates. His low response rates, and more importantly, high level of refusals, preclude any generalization of his survey results to any larger population of interest in this matter.

- Dr. Scyphers' survey results do not support his conclusion that Apalachicola River and Bay communities are threatened and, in fact, reveal that a large proportion of respondents are satisfied with the overall health of the Apalachicola region.

12. Dr. Sunding's survey, as used to support his opinions, suffers from the following significant flaws:

(a) General Flaws

- Without explanation, Dr. Sunding uses and interprets responses to only 3 questions out of a 45 question survey. He uses these three questions to estimate recreational visits to the ACF Region in the past three years and to estimate the level of support by Georgians for water restrictions in Georgia. Yet, he reported his full survey results in a 2013 document that was not discussed in his expert report or in his written direct testimony.

- Importantly, included in Dr. Sunding's 2013 report of survey results—but not in his expert report for this litigation—are results showing that a *low* proportion of Georgia respondents (9%) ultimately expressed their willingness to pay a certain amount to preserve the existing natural conditions of the Apalachicola River. Had Dr. Sunding reported these results, they would have undermined his ultimate conclusions regarding potential benefits in Georgia from preserving natural resources in Florida.

(b) Measurement Error

- Dr. Sunding's survey asks questions that require respondents to make cognitively demanding recollections and judgments; an analysis of the survey responses indicates that respondents did, in fact, have difficulty answering certain questions and providing meaningful answers. The problems observed in Dr. Sunding's full survey are consistent with concerns raised in the literature regarding surveys that probe environmental values. The problems observed in Dr. Sunding's full survey are also an indication of the problems embedded in Dr. Scyphers' work.

(c) Representation Error

- Dr. Sunding's survey asked different questions of different groups of respondents. This decision on Dr. Sunding's part to subdivide his sample affects the reliability of the survey responses to any given question. Importantly, because he subdivided his sample of respondents among questions, he relies on only 73 respondents for his opinion that 60 percent of more than 3.5 million Georgia households would support watering restrictions to protect the Apalachicola River. That sample size is less than one-tenth of the number of survey respondents required by conventional standards. The low sample count on this question, which is a central point of Dr. Sunding's analysis, prevents Dr. Sunding from reliably generalizing his survey results to all of Georgia.

BACKGROUND AND PROFESSIONAL QUALIFICATIONS

13. I received my Ph.D. in economics in 1985 from Duke University. During and immediately following my doctoral studies, I worked as a member of the research staff of the Energy and Economic Analysis Section of Oak Ridge National Laboratory, and afterwards worked there as a Technical Assistant to the Associate Director and as a Project Manager. I routinely reviewed, designed, and applied surveys in the course of my research on energy and environmental policy questions.

14. From 1992-1996, I was the Program Director for Decision, Risk, and Management Sciences, a research program of the National Science Foundation ("NSF"). At NSF, I was the Coordinator and grants manager for the NSF Human Dimensions of Global Change, the NSF Methods and Models for Integrated Assessment, and the NSF/EPA Decision Making and Valuation for Environmental Policy. All of these programs addressed environmental values from a variety of disciplinary perspectives, including but not limited to: economics, sociology, psychology, and decision sciences. In particular, the NSF/EPA program received several hundred proposals under my review, many of which focused on the science and application of survey methods to understand environmental values. I was responsible for reviewing these proposals and evaluating the appropriateness of survey methods therein.

15. I also served as a member of the Research Strategies Advisory Committee for the U.S. Environmental Protection Agency ("EPA") Science Advisory Board from 2001-2003. In that role, I reviewed and advised on numerous programs supporting the understanding of environmental values.

16. I am currently a Managing Director at Berkeley Research Group. As an applied economist, I specialize in health, environmental and energy economics; statistics; and risk management. I have more than 30 years of research, teaching, and consulting expertise. My responsibilities at BRG include conducting complex economic, statistical, and risk analyses for consulting, litigation support, and expert testimony, as well as managing a staff of internal and external professionals. I review, design, and apply surveys in the course of my research on environmental and other matters.

17. I have a faculty appointment in the Graduate Part-time Program in Environmental Engineering, Science and Management at Johns Hopkins University. I was the 2002 President of the Society for Risk Analysis, a professional society focused on environmental and health risk analysis, among other related areas. I am a fellow of the Society for Risk Analysis. I am president of the board for the Women's Council on Energy and the Environment.

18. I serve or have served on science review and advisory panels for the National Academies of Science, the National Science Foundation, the Johns Hopkins University Graduate Part-time Program in Environmental Engineering and Science, the Center for Climate and Energy Decision Making, the National Center for Environmental Decision-making Research, the Carnegie Council on Ethics and International Affairs, the National Oceanic and Atmospheric Administration, the National Academy of Public Administration, and the Consortium for International Earth Science Information Network. The scope of my advisory review for these organizations routinely involves survey methods to understand environmental values. I have also served on the editorial boards of the Journal of Risk Analysis and the Journal of Risk Research and provided peer reviews of survey methods in that capacity.

19. I joined other prominent economists and social scientists in an amicus curiae brief submitted to the U.S. Supreme Court in *Tyson Foods, Inc. v. Bouaphakeo et al.* (No. 14-1146), regarding the reliability of "average" or statistical evidence that is sometimes based on survey data in class actions.

20. I have published scholarly articles on numerous areas of economic analysis. My publications include refereed journal articles, book chapters, expert reports, reports for federal agencies, a coauthored book on economic exchange under alternative institutional and resource conditions, and an edited book on product liability. I have submitted analyses, testimony, and affidavits in federal arbitration, regulatory and Congressional proceedings, as well as in federal and state courts. I have been qualified in state and federal courts as an expert in applied economics, economic damages, and economics—including microeconomics, econometrics, cost benefit analysis, cost benefit methodologies, risk management, and insurance claims analysis. I have conducted and testified on the economic analyses of environmental damages. I have reviewed, designed, and applied survey methods, specifically in the context of environmental

values, and have published this work in peer-reviewed journals and other publicly available literature.

USE OF SURVEYS IN THE ENVIRONMENTAL VALUATION CONTEXT

21. Dr. Scyphers and Sunding largely ignore available methodologies for measuring environmental value. Surveys can be used in the environmental valuation context to help establish or refute claims about the characteristics of respondents, such as beliefs, attitudes, behavior, and values. In the specific context of assessing the importance of environmental resources for communities and economies, there is a large body of literature that defines methods for designing survey questions and estimating environmental damages.[2]

22. A scientific survey first requires planning and identification of its purpose. Key components of that planning include identifying what information is being sought, identifying which populations are relevant for the purposes of the survey, and defining the testable hypotheses. A clear understanding of what is being asked, and of whom, supports the reliability and fit of the responses for the survey's purpose.

23. The challenges of using surveys to ascertain environmental values are also well-documented. Surveys designed to collect the stated preferences of respondents for how much they value an environmental resource often rely on hypothetical questions. Hypothetical questions ask respondents to express their preferences against the background of a set of assumed conditions. Considerations in the evaluation of surveys designed to investigate respondents' preferences include framing issues (information in the question influences the response), strategic behavior and yea-saying (response bias to show support for the topic referenced by the survey introduction or questions) and the related influence of incentives (affecting truthful responses), treatment of "Don't Know" or refused responses, validity factors (gauging whether the survey statistic reliably reflects the intended concept or measure), and hypothetical bias (systematic differences from actual behaviors).

[2] 2009 EPA, "Valuing the Protection of Ecological Systems and Services; Diamond, Shari Seidman. 2011. "Reference Guide on Survey Research" in National Research Council of the National Academies. Reference Manual on Scientific Evidence. 3rd Ed. Washington, DC: The National Academies Press.

24. Dr. Sunding uses hypothetical questions to collect preference information from his survey respondents. Dr. Sunding presents background information in his survey on the water bodies at issue that I understand may be inconsistent with the technical facts[3] and may have biased respondents' perceptions of the environmental issues. For example, his survey introduction says:

> Over time, *there have been* reductions in the amount of fresh water flowing from the Apalachicola River, Chattahoochee River, and Flint River to the Gulf of Mexico. Reductions of water from the rivers and floodplain *can alter* the home of native fish, oyster and plants that use the river and floodplain for food and shelter.
>
> In the future, more water from the three rivers *is expected to be used* to support urban growth and farming. *This will result* in a reduction in fresh water flowing from the rivers to the Gulf of Mexico. FX-784 (Sunding Report, at App. C) (emphasis added).

Following this introduction, Dr. Sunding asks survey respondents hypothetical questions about "how [their] household[s] could possibly help", such as Question W4:

> *Would your household support or oppose a surcharge on your monthly water bill if the funds went to preserve the existing natural conditions of [D1: the Apalachicola River, the Chattahoochee River, and the Flint River] [D2: the Apalachicola River]?* FX-784 (Sunding Report, at App. C).

25. Dr. Scyphers also asks several hypothetical questions about the future, such as Question 31 of his Bay/River survey, in which he asks for respondents' level of agreement with this statement:

> *If the fisheries and seafood resources of Apalachicola Bay declined substantially, it would harm your community's well-being*. FX-799 (Scyphers Expert Report, at App. 5).

[3] GX-866 (May 20, 2016 Defensive Expert Report of Dr. Philip Bedient).

Similarly, Question 26 of Dr. Scyphers' Commercial Fishermen survey asks respondents for their level of agreement with the following question:

> *If the fisheries and seafood resources of Apalachicola Bay declined substantially, it would harm my economic livelihood?* FX-799 (Scyphers Expert Report, at App. 5).

26. Hypothetical questions, such as these, can lead to several sources of error that can ultimately affect the reliability of survey results. **Measurement** and **Representation** are the two dimensions of total survey error affecting the reliability of information and the inferences that can be made from survey results. **Measurement** addresses what data is of interest. **Representation** addresses what population is of interest. These two dimensions factor into every part of survey methodology—from survey scope, to survey design, to the ultimate results being supported by a survey. Both dimensions have multiple components that are sources of possible error.

27. Both **measurement error** and **representation error**, explained in detail below, have implications for both hypothetical questions and other types of questions:

(a) Measurement Error

28. *Content Validity* addresses how well the survey questions relate to the values they are intended to measure. Content validity is unlikely to be achieved when questions use undefined terms or concepts that are subject to varying interpretations by survey respondents. For example, in Question 46 of his Commercial Fisherman survey, Dr. Scyphers asks:

> Suppose that *declining environmental conditions* led to *poor fishing years* becoming *more common*. How many consecutive years do you believe you would be able to *maintain your fishing business*? FX-799 (Scyphers Expert Report, at App. 5) (emphasis added).

Nearly 28 percent of the respondents were unable to provide a numeric response to this question. The italicized terms above illustrate that Dr. Scyphers included four concepts in one question, all of which are undefined and likely subject to wide-ranging interpretations by respondents.

29. *Recall/Processing Error* addresses how well respondents are able to understand and provide information sought by the investigator. For example, in Question 15 of his Bay/River survey, Dr. Scyphers asks respondents:

> *How important are oysters for healthy fish, shrimp and crab populations?* FX-799 (Scyphers Expert Report, at App. 5).

Approximately 16 percent of respondents could not provide a tractable answer to this question. As presented, the question could easily have been misunderstood both by respondents knowledgeable about factors affecting the health of marine organisms and by those with no knowledge of these factors.

(b) Representation Error

30. *Response Error & Non-response Bias* address the potential for non-respondents in the survey to answer individual questions, or even the entire survey, in a systematically different way from respondents. For example, the educational background of respondents could create systematically biased responses compared to the potential (but undocumented) answers of non-respondents. Non-response bias can therefore affect the validity of applying survey results to a broader population beyond the actual survey sample. Dr. Scyphers' expert report failed to report his response or refusal rates or provide any analysis of the potential systematic non-response bias and representation error. While his direct testimony mentions the response rate, it similarly fails to provide any analysis of how response bias and, more importantly, his unconventionally high refusal rate, could have compromised the reliability of his results.

31. *Coverage Error* addresses whether the target population is adequately reflected by the sample. Where differences between the target and sample population do exist, "weighting" is a method often used to adjust for those differences. For example, if there are 50 percent men in the target population but only 30 percent men in the survey sample, weighting would provide more weight to the responses of the men in the sample so that their answers reflect 50 percent of the result. Dr. Scyphers provides no analysis of whether his weighting of survey responses was sufficient to address any error caused by the coverage factor. As just one example, Dr. Scyphers' selection of the four southernmost counties is a likely source of coverage error for the eight ACF counties in Florida. This possible coverage error is significant in the context of

Dr. Scyphers' failure to address his extremely low response rates, as discussed in more detail below.

32. *Sampling error* addresses the margin of error of statistics generalized to the target population. Because the survey sample is usually only a microcosm of the target population, there is always some error associated with the generalization of survey results from this partial view to the larger group. The larger the sampling error, the less reliable the survey results are for drawing inferences about the larger target population. Adequate sample size and random selection are critical determinants of sampling error. As discussed in greater detail below, Dr. Scyphers does not randomly sample counties from the Apalachicola region, and Dr. Sunding draws conclusions from survey questions with small sub-sample sizes.

33. An extensive literature acknowledges that, due to the various sources of survey error, such as those detailed above, certain biases and validity problems can affect survey answers regarding values for complex changes in environmental services, making them nothing more than "opinions invented on the fly." *See, e.g.*, JX-65 (Hausman, Jerry, *Contingent Valuation: From Dubious to Hopeless* (2012), at 47).

34. Above, I discussed sources of error in surveys, generally, and referred to specific examples of error in Dr. Scyphers' work, in particular, to help explain surveys and error in the context of valuation. Below, I will discuss in greater detail the various and multiple sources of measurement and representation error affecting the reliability of the results in Drs. Scyphers' and Sunding's surveys.

EVALUATION OF DR. SCYPHERS' SURVEY AND OPINIONS

I. Dr. Scyphers Designed Two Surveys to Measure "Societal Values," "Environmental Connectedness," and "Concern" in Apalachicola Bay and River Communities in Florida

35. Dr. Scyphers' "Bay/River survey" was administered to residents of the four southernmost counties of the Apalachicola Region. The four surveyed counties were grouped into two separate areas—River counties (Calhoun and Liberty) and Bay counties (Franklin and Gulf). The survey contained a total of 44 questions. Approximately 1,200 responses out of approximately 38,000 contact attempts were completed. Responses were then weighted by age, gender, education, and race.

36. A second survey was administered to commercial fishermen in Franklin, Gulf, Liberty and Bay counties ("the commercial fisherman survey"), using telephone numbers for oyster harvester and seafood products licensees acquired from the State of Florida's Fish and Wildlife Conservation Commission. Approximately 90 responses out of approximately 2,600 contact attempts were completed. Responses from the commercial fisherman survey, unlike responses from the Bay/River survey, were not weighted.

37. Notably, neither set of respondents to Dr. Scyphers' surveys conform to a random sample. As discussed above, random samples are important in survey design to provide unbiased coverage of the target population.

38. Using the results of his surveys, Dr. Scyphers attempts to measure societal values, environmental connectedness, and concern in the Apalachicola Bay and River communities. He also attempts to draw conclusions about changes in how these communities value environmental resources over time. However, his surveys cannot be reliability used for either of these purposes.

II. Dr. Scyphers' Surveys are Flawed and Unreliable

(a) Measurement Error: Dr. Scyphers' surveys were not properly designed or tested

(i) Pre-test of Survey Questions Was Inadequate

39. Scoping interviews and pre-testing of survey questions are methods used to reduce content validity error. Dr. Scyphers claims to have conducted "several scoping interviews in the communities of interest" prior to conducting his surveys, FX-799 (Scyphers Expert Report, at 16) but, by his own admission, those scoping interviews were not systematically documented.

40. In his deposition testimony, and again in his direct testimony, Dr. Scyphers indicated that he cannot provide supporting documentation for the scoping interview stage of his survey design methodology. Scyphers Dep. Tr. 39:7-40:16; Scyphers Written Direct Testimony at ¶ 29. Additionally, Dr. Scyphers testified that a local contact and Florida agency employee, Mr. Lee Edmiston, introduced him to approximately 15 community stakeholders, Scyphers Dep. Tr. 33:13-35:12, and Dr. Scyphers conducted interviews with these stakeholders as well as

perhaps a dozen additional people he met "opportunistically" while spending three days in the community. Scyphers Dep. Tr. 35:1-7; 38:10-14.

41. According to literature on survey methodology, the data collected from pre-testing surveys in the field, when done properly, is extremely useful for assessing the quality of the survey design and the survey results. Without any documentation of Dr. Scyphers' pre-testing process, there is no way to know how, if at all, the scoping interviews affected Dr. Scyphers' final survey instruments or his interpretation of survey results. To adequately address content validity of the surveys and interpretation of the survey results, Dr. Scyphers' scoping interviews should have been systematic and documented.

(ii) Content Validity Was Inadequately Investigated

42. *No explanation of survey purpose and its relevance to the litigation*: In addition to the lack of rigor for pre-testing, Dr. Scyphers provided no foundation for the logic of his surveys. In deposition, he testified that his analysis did not contain any hypotheses and that his survey was not designed to test a hypothesis. Scyphers Dep. Tr. 144:11-145:14; Scyphers Written Direct Testimony at ¶ 22. He fails to explain the purpose of his surveys for this litigation and how these surveys are relevant to support or refute Florida's allegations. This information is necessary to understand *what* he wanted to ask respondents, *whether* they can provide responsive answers, and *whether* inferences can be made about the population from the answers provided.

43. *Measures used in the survey instrument do not match the "defining characteristics of natural resource communities," as articulated by Dr. Scyphers*: Dr. Scyphers' survey design also lacks a clear foundation in relevant research questions. His survey questions do not directly test for or result in information for understanding values related to environmental change. Dr. Scyphers states that his "survey instrument was designed to measure environmental connectedness and place attachment, ecological satisfaction and concern, social capital, recreational behaviors, and expected impacts of environmental degradation." FX-799 (Scyphers Expert Report, at 17). He also discusses certain social science literature that relates "defining characteristics of natural resource communities" to a diverse set of findings. FX-799 (Scyphers Expert Report, at 10-12). However, his list of defining characteristics—resource dependency,

environmental connectedness and place attachment, social capital, ecological knowledge, social resilience and vulnerability, and social disruption—does not match his list of measures for his surveys. For example, as shown in **Cantor Demo. 1**, "recreational behaviors" is not listed among the defining characteristics, but is listed among the measures. Therefore, there is no clear mapping from the defining characteristics to the measures. Without such mapping, it is unclear how Dr. Scyphers' survey questions address what he claims to be investigating.

Demo. 1: Dr. Scyphers' Measures, Characteristics, and Concepts

Characteristics [1]	**Measures** [2]	**Concepts** [3]
Ecological Knowledge	Ecological Satisfaction and Concern	Apalachicola Oysters and Community Economy
Environmental Connectedness and Place Attachment	Environmental Connectedness and Place Attachment	Apalachicola Oysters and Community Identity
Resource Dependency	Expected Impacts of Environmental Degradation	Apalachicola Oysters and Family Values
Social Capital	Recreational Behaviors	Bay/River and Community Economy
Social Disruption	Social Capital	Bay/River and Community Identity
Social Resilience and Vulnerability		Environmental Satisfaction
		Fisheries Community Concern
		Fisheries Personal Concern
		Oyster Ecological Knowledge
		Place Attachment
		Tupelo Honey and Community Economy
		Tupelo Honey and Community Identity
		Tupelo Honey and Family Values

Sources:
[1] Scyphers Report at p. 11.
[2] Scyphers Report at p. 17.
[3] Scyphers Report at pp. 17-18.

Demo. 1 is a copy of Exhibit 4 from my Expert Report (GX-867). It contains characteristics, measures, and concepts from Dr. Scyphers' Expert Report (FX-799).

44. *No explanation of how either measured or defining characteristics relate to environmental values affected by upstream water use*: Even in the one instance where Dr. Scyphers links one of the defining characteristics discussed in his opinions—place attachment—to a measure in his surveys, Dr. Scyphers fails to relate this characteristic to environmental values supposedly affected by Georgia's upstream water use. **Cantor Demo. 2** shows Dr. Scyphers' place attachment question from his Bay/River survey. FX-799 (Scyphers Expert Report, at App. 5).

Demo. 2: Question 6 of Dr. Scyphers' Bay/River Survey

How do the following statements reflect your feelings about your community?
Q6 For the outdoor and recreational activities I enjoy most, no other place can compare to the Apalachicola **Bay** area. (Bay) For the outdoor and recreational activities I enjoy most, no other place can compare to the Apalachicola **River** area. (River)

Demo. 2 is a copy of Question 6 from the Bay/River Survey in Appendix 5 of the Dr. Scyphers' Report (FX-799).

45. According to Dr. Scyphers, place attachment is a motivator for adaptation and collective actions to ensure that certain ways of life are sustained. Although he measures respondents' level of agreement to a place attachment statement—"no other place can compare"—that level of agreement is not linked to and therefore may have nothing to do with water resource availability or water use in Georgia. Ultimately, Dr. Scyphers' place attachment question might record a sense of community identity, but there is no connection to how that identity might be affected or not affected by the availability of water resources or upstream consumptive use of water.

46. *Failure to use benchmarks or control groups*: Dr. Scyphers also failed to use control groups or benchmarks to understand and contextualize his survey results, and he admitted this failure in deposition. Scyphers Dep. Tr. 207:2-6. Control groups are used throughout science to ensure that there is a clear link between the factor of interest and results. Control is critical to the ability to isolate the impact of the factor of interest—in this case, upstream water consumption's alleged impact on environmental values in the Florida ACF Region.

47. In his own prior work, Dr. Scyphers considered control groups and implemented comparative methods to investigate differences among respondents. Prior testing of similar communities can provide a useful benchmark against which to test the reliability of current survey results. In this case, Dr. Scyphers had such a benchmark available to him, but did not use it. If Dr. Scyphers had considered benchmarks in his report, he may have realized that his current results regarding environmental dependence are inconsistent with similar tests in his prior work.

48. In my report, I analyzed the effect of the environmental dependence of respondents on specific survey results from Dr. Scyphers Bay/River survey. In approximately 34 percent of the comparisons, respondents in occupations dependent on the environmental resources answered questions in ways that were statistically significantly different from respondents with no environmental dependence. In contrast, Dr. Scyphers' prior investigations of communities along the Gulf of Mexico found that approximately 7 percent of comparisons for questions similar to the current survey were statistically significant. Had Dr. Scyphers used his prior work as a benchmark for his current survey results, he would have discovered this inconsistency.

49. Surprisingly, Dr. Scyphers testified that "[a] control group was considered but not utilized because there is simply not a reasonably comparable community suitable for comparison." Scyphers Written Direct Testimony at ¶ 26. However, it is clear that Dr. Scyphers ignored his own work on this issue and provided no analysis or evidence in support of his statement in his direct testimony.

50. In sum, without stated hypotheses, survey measures that correlate with concepts or values purportedly being measured by the survey, control groups, or benchmarks, Dr. Scyphers' surveys cannot be the basis for any conclusions about the significance of any concepts that he attempts to measure—including "concern," "societal values," and "environmental connectedness." Moreover, his survey certainly is not useful for showing any causal relationships between Georgia's water use and impact on Florida, and he revealingly never posits any such relationship.

51. Dr. Scyphers surveys also suffer from other content validity problems. In his discussion of survey results, Dr. Scyphers purports to test the strength of the relationship between the concept variables in diagrams that he presents in his report. The diagram results are purely descriptive and do not address the impacts of degradation to environmental resources. As a result, the relevance of those results for this litigation is unclear. In addition, Dr. Scyphers fails to relate the diagram variables to the "defining" characteristics and measures he is purportedly investigating. Scientific conclusions cannot be reached from these results because there is no

benchmark or control to which they are being compared and, more importantly, these results are not placed in any context that would be relevant to this litigation.

(iii) Recall/Processing Error

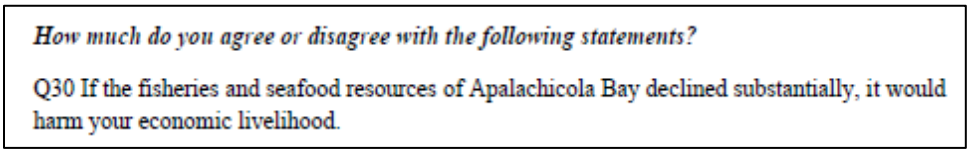
52. Another possible source of error is recall/processing error. Many of the concepts probed by Dr. Scyphers' survey are complex and would likely be difficult to assess if respondents are unfamiliar with the question concepts or information requested. Confusion with survey wording or concepts can lead to processing error. Survey practitioners recognize four groups of cognitive processes that can affect processing errors: **comprehension** (in which respondents interpret the questions), **retrieval** (in which they recall the information needed to answer them), **judgment** (in which they combine or summarize the information they recall), and **reporting** (in which they formulate their response and put it in the required format).

53. Dr. Scyphers' survey likely suffers from processing errors because of his vague questions and failure to define key concepts used in survey questions that are subject to varying interpretations by respondents, including "community identity" or "communit[y] well-being." FX-799 (Scyphers Expert Report, at App. 5). Undefined terms could easily have been inconsistently interpreted, confusing, misunderstood, or simply unfamiliar to respondents. Survey practitioners caution that when respondents believe they ought to understand terms in survey question or are embarrassed to ask for clarification, they may "muddle through on their own." Groves, et al. 2009, *Survey Methodology*, 2nd Ed. at 227.[4] If there is ambiguity about the meaning of the key concepts used in survey questions, the results of these questions may not provide meaningful measures of their intended concepts.

54. For example, Dr. Scyphers' survey design begins by asking respondents to reflect their *feelings* for a number of questions (as shown in **Cantor Demo. 2** above), after which they are asked to consider poorly defined hypothetical situations in which environmental resources "declined substantially", as shown in **Cantor Demo. 3.** FX-799 (Scyphers Expert Report, App. 5).

[4] In addition, Dr. Scyphers used scaled response options that can produce biased results according to survey methodology literature. Dr. Scyphers attempts to minimize my concerns by limiting them to the economics surveys, which is incorrect.

Demo. 3: Question 30 of Dr. Scyphers' Bay/River Survey



How much do you agree or disagree with the following statements?

Q30 If the fisheries and seafood resources of Apalachicola Bay declined substantially, it would harm your economic livelihood.

Demo. 3 is a copy of Question 30 from the Bay/River Survey in Scpyhers' Appendix 5.

55. Dr. Scyphers' survey questions also demand substantial recall from respondents. For example in Question 18 of his Bay/River survey, he asked: "*Do you fish more or less than you did to 5 to 10 years ago?*" FX-799 (Scyphers Expert Report, at App. 5). This question is demanding because it provides the respondent with two reference points in time. Dr. Scyphers has no way of determining which reference point is used by a respondent or if a point in the interval between those two reference points is being selected. Because the Apalachicola Region periodically experiences natural environmental disasters, the assumed point or period of time that is embedded in the answer is important.

56. Dr. Scyphers should have been aware of these potential recall and processing issues, yet he reports no investigation of alternative wording or expanded descriptions of the complex concepts probed with respondents. Given the poorly defined, hypothetical questions in his surveys, it is difficult, if not impossible, to determine any effect of changes in upstream water use on respondents' perceptions and values. Dr. Scyphers can only speculate that such effects exist at the community level in the counties he surveyed.

(iv) Dr. Scyphers' Survey Results Contradict His Conclusions:

57. Drawing upon his selected literature, Dr. Scyphers himself states that "[h]istorically, the Apalachicola ecosystems, fisheries, and fishing communities have a long history of enduring stress and investing in restoration." FX-799 (Scyphers Expert Report, at 16). In fact, he lists several events and stressors that have impacted the Apalachicola region in his report, including: the implementation of a "Commercial Fishing Entanglement Net Ban," "Multiple Tropical Storms & Hurricanes," the "Deepwater Horizon Oil Spill," "Drought & Reduced River Discharge," and the "Oyster Fishery Decline & Economic Disaster Declaration." FX-799 (Scyphers Expert Report, at 15-16) (emphasis omitted). In his deposition, Dr. Scyphers testified to the Apalachicola River and Bay Region's enhanced ability to deal with disturbances

and stressors, such as these, due to the region's high level of social capital. Scyphers Dep. Tr. 188:13-189:8.

58. Yet Dr. Scyphers' ultimate conclusion, based on his survey evidence and review of selected literature, is that communities in the Florida ACF Region are vulnerable and that the well-being of these communities is being threatened. This conclusion is contrary to Dr. Scyphers' own review of the selected literature and is contradicted even further by his survey results.

59. Dr. Scyphers' survey results contradict his conclusion that the Apalachicola communities are threatened and in fact reveal that a large proportion of respondents are satisfied with the overall health of the Apalachicola region. Dr. Scyphers' results on questions regarding satisfaction with the overall health of the Apalachicola region indicate that:

- A majority of surveyed Apalachicola residents are "very satisfied" or "somewhat satisfied" with the overall health of water resources (**55.8** percent of Bay residents, **76.3** percent of River residents, and **48.2** percent of commercial fisherman) FX-799 (Scyphers Expert Report, at App. 5);

- A large portion of surveyed Apalachicola residents felt that they could get work elsewhere if their jobs were eliminated (**63.9** percent of Bay residents, **71.4** percent of River residents, and **48.8** percent of commercial fishermen). FX-799 (Scyphers Expert Report, at App. 5).

60. In addition to these questions, which indicate that Apalachicola residents and fishermen themselves view their communities as resilient, Dr. Scyphers also finds "robust" rates of social capital and cooperation among the commercial fisherman. Furthermore, he opines that these are key characteristics of community sustainability and successful resource management. FX-799 (Scyphers Expert Report, at 25). These results from Dr. Scyphers' surveys contradict his conclusions on community vulnerability.

(b) Representation Error: Dr. Scyphers' surveys fail to represent the population of interest

(i) Coverage Error:

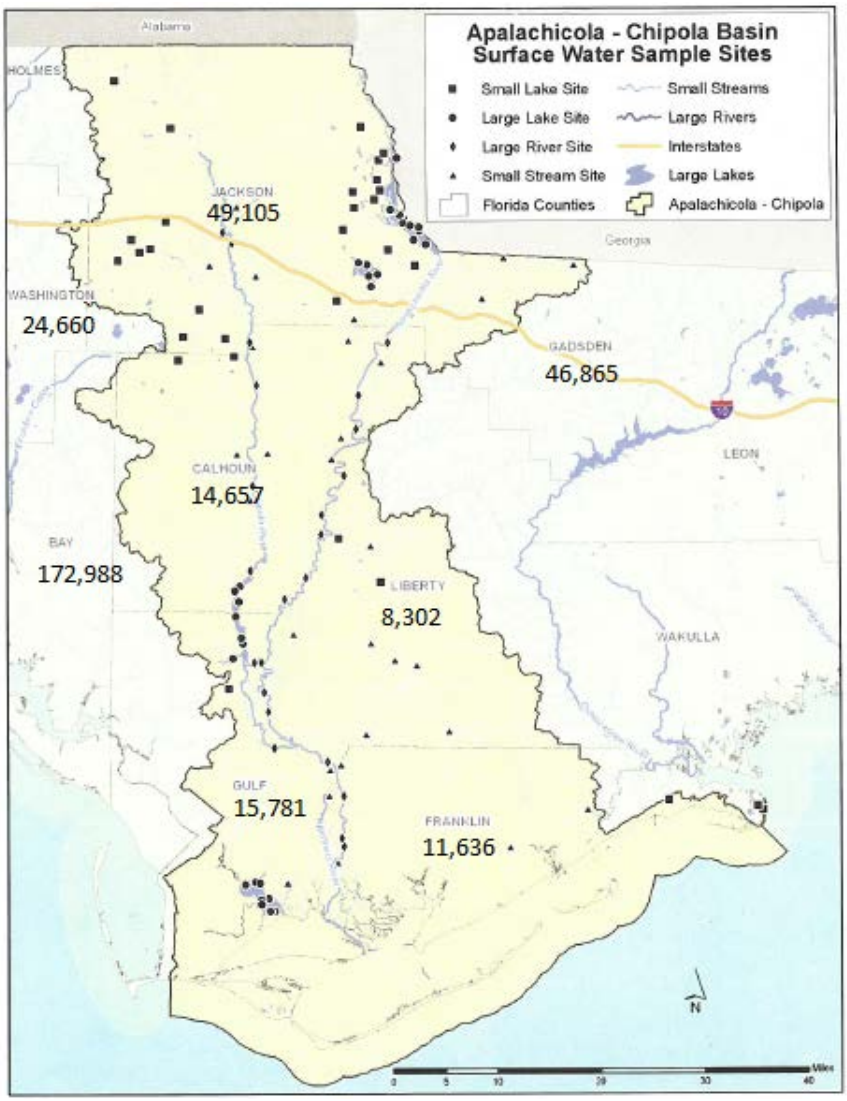
61. Random samples are used in surveys to ensure respondents are representative of the background population and inferences based on their responses can be generalized to the

population. Importantly, Dr. Scyphers' survey is not administered to all counties in the Florida ACF Region or even to a random sample of the counties. Scyphers Dep. Tr. 92:5-11, as I demonstrate in **Cantor Demo. 4**. Dr. Scyphers' expert report nevertheless suggests that he is generalizing his results to the Apalachicola region. For example, Dr. Scyphers concludes from his survey that "[t]he people of the *Apalachicola River and Bay region* highly value and are dependent upon healthy ecosystems" and "[c]ommercial fisheries in the *Apalachicola region* are characterized by trans-generational family legacies, significant social capital and cooperation, and strong fishing traditions (e.g., boat building and tong harvesting)." FX-799 (Scyphers Expert Report, at 29-30) (emphasis added). Additionally, Dr. Scyphers' direct testimony also indicates that he is generalizing his results to the entire Florida ACF Region. Scyphers Written Direct Testimony at ¶ 7.

62. In his deposition, Dr. Scyphers testified that his work applied only to the four southernmost counties, Scyphers Dep. Tr. 88:17-20, but this is incorrect. As I pointed out in my deposition, the commercial fishermen survey, which supports all four of Dr. Scyphers' opinions, was administered to four counties, one of which was different from the counties included in the Bay/River survey. Cantor Dep. Tr. 176:14-23. Therefore, Dr. Scyphers' survey consists of a total of **five** counties.

63. In his written testimony, Dr. Scyphers stated that he selected the four counties for the Bay/River survey "because they include the communities most closely tied to the ecosystems of the Apalachicola Bay and River." Scyphers Written Direct Testimony at ¶ 23. The use of this selection criterion by Dr. Scyphers is essentially equivalent to either assuming his conclusions before data collection or biasing his sample selection from the outset. The value of Dr. Scyphers' survey results is even more questionable if it was truly meant to apply only to the four counties as he claims. These four counties represent approximately 15 percent of the population in the Florida ACF region, and have fairly particular demographics within that region.

Demo. 4: Map of Apalachicola-Chipola Basin showing Eight Counties and Corresponding Populations



Demo. 4 is a map created by the Florida Department of Environmental Protection ("FDEP") (GX-983), over which I have overlaid county population values reported by the United States Census Bureau, American Community Survey 2010-2014 5-Year Data Profiles, available at https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2014/ (last visited Apr. 29, 2016).

64. For example, **Cantor Demo. 5** shows that the demographics of Gadsden County differ significantly from the sample of river county respondents even after weighting respondents to correct for representation error. Notably, the population in Gadsden is approximately **two times** the combined populations of the surveyed river counties. Compared to the weighted survey responses from Dr. Scyphers' River/Bay survey for respondents in river counties (i.e., Calhoun and Liberty), residents in Gadsden County differ significantly in their demographic

profiles as measured by sex, education, and race. This comparison suggests that Dr. Scyphers' collected responses are poorly suited to reflect the region as a whole. In deposition, Dr. Scyphers himself admitted that the survey results cannot be extrapolated to other counties in the Florida ACF Region. Scyphers Dep. Tr. 166:8-15.

Demo. 5: Comparison of Dr. Scyphers' Survey Sample Weighted Demographics for River Communities and Gadsden County ACS Demographics

		Dr. Scyphers' Pooled Weighted River Survey Results [6]	American Community Survey: Gadsden
Census Population			
2015 Estimate	[1]	22,793	46,036
Sex *			
Male		59%	50%
Female		41%	50%
Age			
[15]18-24	[2]	13%	15%
25-44		35%	31%
45-64		34%	36%
65+		17%	18%
Education *	[3]		
Less than high school		7%	23%
High school diploma or GED		35%	35%
Some college or 2 year degree		48%	26%
Bachelor's degree		7%	10%
Graduate degree		2%	6%
Race *			
White		77%	33%
Black		16%	55%
Hispanic		6%	10%
Native American		1%	0%
Asian		0%	1%
Other	[4]	0%	1%
Median Income	[5]		
$20,000 to $39,999			$36,146
$40,000 to $59,999		X	

Notes:
[*] An asterisk indicates that the ACS demographic distribution for Gadsden county is statistically significantly different from the associated distribution of Dr. Scyphers' weighted survey River respondents (significance level of $\rho = 0.05$).
[1] U.S. Census Bureau 2015 population estimates reported for River counties surveyed by Dr. Scyphers (Calhoun and Liberty) and Gadsden County.
[2] Dr. Scyphers' survey was limited to respondents 18 and older. Dr. Scyphers' survey River respondents are categorized into the same age brackets as shown in Table 2 of Dr. Scyphers Report. ACS age brackets are consolidated to match the age brackets shown in Table 2 of Dr. Scyphers Report. The 15-19 and 20-24 ACS age brackets are consolidated. ACS proportions are adjusted to reflect the proportion of respondents age 15 or older.
[3] ACS reports education demographics for respondents 25 and older. ACS education brackets are consolidated to match the education brackets shown in Table 2 of Dr. Scyphers Report.
[4] For ACS demographics, "Other" includes the following races: "Native Hawaiian and Other Pacific Islander alone," "Some other race alone," and "Two or more races."
[5] For Dr. Scyphers' survey, the median income bracket is shown. The ACS median household income is reported.
[6] Pooled weighted demographics are responses for all survey respondents in Calhoun and Liberty counties weighted by Dr. Scyphers' survey weight. "DK" and "NA" responses are not included in the demographics.
Sources: Scyphers Report at p. 19 and Appendix 5; FL-ACF-04142492.SAV; United States Census Bureau, American Community Survey 2010-2014 5-Year Data Profiles, *available at* https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2014/ (last visited Apr. 29, 2016); United States Census Bureau, Annual Estimates of the Resident Population for Counties: April 1, 2010 to Jul 1, 2015, *available at* http://www.census.gov/popest/data/counties/totals/2015/CO-EST2015-01.html (last visited May 11, 2016).

Demo. 5 is adapted from Exhibit 3 of my expert report (GX-867). It compares the demographics of the river counties in Dr. Scyphers' Bay/River survey to the American Community Survey demographics for Gadsden County.

(ii) Response Error & Non Response Bias:

65. Even if Dr. Scyphers' work applied only to the four southernmost counties, his survey results would still suffer from a low response rate and potential non-response bias. Response rates are used to describe the ratio of the completed surveys relative to the eligible survey respondents. Dr. Scyphers does not calculate any response rates in his expert report. In deposition, however, he testified that he was relying on the American Association for Public Opinion Research ("AAPOR") to calculate a response rate. Scyphers Dep Tr. 209:4-19. AAPOR provides six different methods for calculating response rates. **Cantor Demo. 6** shows the equations for the minimum and the maximum response rates using AAPOR's methods. Importantly, all of the variations on the response rate formula include non-contact ("NC") in the denominator of the calculation. Using any of these variations, Dr. Scyphers' survey suffers from response rates that are lower than conventional guidance. Consequently, the results cannot be reliably generalized even to the populations of the four counties in Dr. Scyphers' surveys.

Demo. 6: American Association for Public Opinion Research (AAPOR)
Calculating Response Rates from Final Disposition Codes

Code	Definition
RR	Response rate
I	Complete interview
P	Partial interview
R	Refusal and break-off
NC	Non-contact
O	Other
UH	Unknown if household/occupied HU
UO	Unknown, other

AAPOR Response Rate	Formula
RR1	$\frac{I}{(I+P)+(R+NC+O)+(UH+UO)}$
RR6	$\frac{(I+P)}{(I+P)+(R+NC+O)}$

Demo. 6 contains information regarding response rate calculations from the American Association for Public Opinion Research, "Standard Definitions: Final Disposition of Case Codes and Outcome Rates for Surveys," (JX-157) at 61-62. These calculations are regularly published by AAPOR and were revised in 2016.

66. Survey methodologists have recognized that an increasing disadvantage of telephone surveys is the potential for low response rates and high refusal rates due to call-screening technologies and the proliferation of telephone surveys. Under these conditions, non-response bias might affect results *systematically* because there is a risk that the views of non-respondents are not properly represented by respondents.

67. Researchers should therefore include information about the response rate to address coverage of the sample in the context of the target population and potential biases in the responses. OMB guidance specifically advises practitioners to plan for non-response analysis of the survey design if expected rates are 70 percent for item (individual question) non-response and 80 percent for overall survey non-response. GX-867 (Cantor Expert Report, at 21-22). In his deposition, Dr. Scyphers testified that response rates are certainly one factor in determining whether or not the results of a survey are reliable and that a low response rate could indicate the survey results are unreliable. Scyphers Dep. Tr. 112:17-113:6. Despite recognizing this problem, Dr. Scyphers failed to include any information on response rates or the potential for non-response bias in his expert report.

68. Although Dr. Scyphers does not include any response rates in his report, he testified that he achieved high response rates at his deposition—36 percent for the community survey and 42 percent for the fisherman survey. Scyphers Dep. Tr. 208:24-209:3. In his direct testimony, Dr. Scyphers calculates the response rate by taking the total number of completed and partially completed surveys and dividing it by the total number of completed surveys, partially completed surveys, and refusals. As in his deposition, he cites to AAPOR as an authority. However, he fails to include non-contact respondents in his response rate calculations. Scyphers Written Direct Testimony at ¶ 31. As noted above, the denominator of the response rate for *all six* variations of AAPOR's response rate calculation guidelines contains the number of non-contacted but eligible respondents (e.g., eligible respondents for which survey administers left a voicemail).

69. Dr. Scyphers is quite mistaken about his achieved response rates. His testimony confuses the response rate with another measure—the cooperation rate. The cooperation rate measures how many people actually completed the survey in comparison to how many people

were contacted. Scyphers Dep. Tr. 214:19-215:8. Contacted respondents are generally less than the eligible respondents, and eligible respondents are the appropriate denominator for calculating response rates. In other words, generally completed surveys are a *lower* proportion of the eligible respondents than the contacted respondents, and therefore, response rates are generally lower than cooperation rates. The result of this confusion is that Dr. Scyphers greatly *overestimates* his claimed response rate.

70. In my report, I found that Dr. Scyphers' response rates were much lower than his estimates: an approximately 4 percent response rate for the Bay/River survey and approximately 5 percent response rate for the Commercial Fishermen survey. When calculated using the AAPOR definitions, which Dr. Scyphers purportedly relied upon, Dr. Scyphers' response rates are still far below the rates he claimed in his deposition. His current survey of residents achieved a response rate between 3 and 14 percent for the Bay/River survey and a response rate between 4 and 18 percent for the Commercial Fishermen survey, as shown in **Cantor Demo. 7**. The minimum and maximum calculations demonstrate that Dr. Scyphers' response rates were much lower than the established guidance.

Demo. 7: AAPOR Response Rate Calculation
Based on Disposition Report from Scyphers Expert Report Appendix 5

AAPOR Rate	Bay/River Survey	Commercial Fishermen Survey
RR1	3.5%	4.0%
RR6	13.3%	17.5%

Sources: American Association for Public Opinion Research, "Standard Definitions: Final Disposition of Case Codes and Outcome Rates for Surveys," (Revised 2016) at pp. 61-62, 75; Scyphers Report at Appendix 5.

Demo. 7 contains a calculation of response rates using the AAPOR methods for RR1 and RR6 and the disposition sheet in Appendix 5 of the Scyphers Report (FX-799).

71. In my deposition, a new disposition sheet was received with disposition counts that differed from those in Dr. Scyphers' expert report. It is still unclear whether Dr. Scyphers is relying on this disposition sheet or his prior disposition sheet, given that he cites to neither in his written direct testimony. The new disposition sheet shows differences between these disposition counts and the counts reported in Appendix 5 of Dr. Scyphers' report that remain unexplained.

For example, the total count of "No Answer" changed from 17,301 to 3,793 for the Bay/River survey and changed from 1,039 to 142 for the Commercial Fishermen survey, which I demonstrate in **Cantor Demo. 8** below. The unexplained variance renders the UNF data collection process fundamentally unreliable, only further undermining the purported basis for Dr. Scyphers' opinions.

Demo. 8: Disposition Report from Scyphers Expert Report Appendix 5 vs. Disposition Report from Cantor Deposition Ex. 14

		Bay/River Survey			Commercial Fishermen Survey		
Code	Disposition	Count from Scyphers App. 5	Count from Cantor Dep. Exh. 14	Change	Count from Scyphers App. 5	Count from Cantor Dep. Exh. 14	Change
1	No Answer	17,301	3,793	-13,508	1,039	142	-897
2	Left a Voicemail	6,049	377	-5,672	381	6	-375
3	Busy Dial Tone	4,127	902	-3,225	368	21	-347
4	Disconnected	3,937	3,937	0	454	454	0
5	Business/Govt' Agency	518	518	0	3	3	0
6	Refusal 'Said No'	2,315	2,315	0	47	47	0
7	Hard Callback	0	0	0	0	0	0
8	Spanish Respondent	17	17	0	0	0	0
9	Callback	1,292	79	-1,213	150	20	-130
10	Deaf/Language Barrier (Non-Spanish)	43	43	0	2	2	0
11	Fax/Modem	232	232	0	1	1	0
12	Not A Resident [1]	430	430	0	135	135	0
13	Partially Complete	88	88	0	6	6	0
14	Hung Up On Intro	1,342	1,340	-2	11	11	0
15	Privacy Director	65	65	0	5	5	0
16	Do Not Call List	258	258	0	9	9	0
20	Complete	1,205	1,205	0	85	85	0
21	Not Qualified For Survey	222	221	-1	38	38	0
22	Quota Cell Full	0	0	0	0	0	0
23	Spanish Callback	11	11	0	2	2	0
24	Spanish No Answer	9	9	0	0	0	0
	TOTAL	39,461	15,840		2,736	987	

Notes:
[1] For the Commercial Fishermen Disposition Report in Appendix 5 of Scyphers' expert report, disposition code 12 is "Licensee does not live there".

Sources: Scyphers Report at Appendix 5; Cantor Deposition Exhibit 14.

Demo. 8 contains the disposition counts from Appendix 5 of the Scyphers Report (FX-799) and from Cantor Deposition Exhibit 14 (FX-652). The change represents the counts from Cantor Deposition Exhibit 14 less the counts from Appendix 5 of the Scyphers Report (FX-799).

72. Even using the "new" disposition information, the so-called response rates that Dr. Scyphers' reported in his written testimony are lower than recommended by OMB guidance. Notwithstanding the differences in the disposition sheets, the response rate that Dr. Scyphers stated in his testimony is incorrect because he used the formula for the cooperation rate and not the formula for the response rate. Scyphers Written Direct Testimony at ¶¶ 31-32. More

importantly, Dr. Scyphers does not provide any analysis or discussion of his Bay/River survey's high refusal count (nearly 3,660 refusals and hang ups after the introduction of the survey) that is more than three times the fully completed survey count (1,205), which is indicative of non-response bias. GX-867 (Cantor Expert Report, at 22).

III. Because Dr. Scyphers' Surveys are Flawed, His Opinions Regarding Societal Values are Unsubstantiated

73. In summary, Dr. Scyphers' survey suffers from the following errors:

- Undocumented and potentially incomplete pre-testing methodology;
- No control group or stated hypothesis to understand the relevance for this litigation;
- Vague questions and undefined key concepts that can cause recall/processing errors;
- An unclear population of interest; and
- An inadequate response rate, from which the results cannot be reliably generalized to even the smallest potential population of interest.

74. The combination of these errors renders Dr. Scyphers' survey unreliable to support his opinions that "most residents and communities in the Apalachicola Bay and River region heavily depend on the health of these ecosystems for their sociocultural well-being and identity." FX-799 (Scyphers Expert Report, at 7) (emphasis omitted). Additionally, as discussed above, information that Dr. Scyphers gleaned from literature on the region and the results from Dr. Scyphers' own survey undermine some of his conclusions.

EVALUATION OF DR. SUNDING'S SURVEY AND OPINIONS

I. Dr. Sunding Designed a Survey, Apparently to Demonstrate Environmental Values in Households in both Georgia and Florida.

75. Dr. Sunding's survey methodology appears to have been designed to support an investigation of the environmental values of households in both Georgia and Florida. Dr. Sunding's survey was administered to 1,367 residents representing both rural and urban centers in Alabama, Florida, and Georgia. The households to which the survey was administered were part of the KnowledgePanel® which is organized by the survey research firm GfK-

Knowledge Networks. GfK-Knowledge Networks maintains a standing panel of households recruited and compensated to take surveys through an internet website. These households are recruited to be representative of 97 percent of households in the United States but are not necessarily representative at the individual state level. Fifty percent of respondents were randomly selected and asked about the entire ACF Region (including Georgia, Florida, and Alabama), while the other 50 percent were asked about the Apalachicola River alone. An additional segmentation was applied to respondents from Georgia who were asked similar questions with different formats, but Dr. Sunding does not explain whether this assignment was random. The survey contained a total of 45 questions—35 asked to all respondents, 6 asked to Georgia respondents (Group A), and 4 asked to Georgia respondents (Group B).

76. Without any explanation, Dr. Sunding fails to use or interpret most of the responses in his survey. He disregards the large majority of survey results and uses only 3 survey responses to estimate recreational visits to the ACF region in the past three years and to estimate the level of support by Georgians for water restrictions in Georgia.

77. In addition, Dr. Sunding did not directly elicit information from respondents to measure the reduced value of environmental benefits in Florida from upstream water use in Georgia. He also did not ask Florida residents about their willingness to support measures restricting residential water use. Nor did he ask Florida residents about Florida population and tourism growth and development in coastal communities, oyster harvesting, or other anthropogenic stressors in the ACF Region, which might be relevant to measuring the value of environmental benefits from changes in Georgia's upstream water use. Such questions might have revealed how well the Florida households understood the relationships between activities in their own state and environmental degradation in the ACF Region as a whole. In addition, such questions would have been helpful to investigate the value of additional environmental protection that comes at a cost to local activities in Florida.

II. Dr. Sunding's Survey Suffers from Measurement Errors and He Inaccurately Represents His Survey Results

(a) Measurement Error: Dr. Sunding's Survey Responses Reveal Confusion with Questions about the Recreational Benefits of the Apalachicola River

(i) Recall/Processing Error:

78. As noted previously, the literature identifies a number of concerns about surveys attempting to investigate environmental values. My analysis of the full scope of Dr. Sunding's survey responses reveals that respondents had difficultly answering certain questions and providing meaningful answers. My observations, explained below, are consistent with the reliability concerns raised by the literature.

79. Dr. Sunding's survey elicits information regarding past expenditures for visits to the ACF Region that required difficult recollections and judgments to be made by respondents, such as those shown in **Cantor Demo. 9**, below. Questions E1D_2, 9 and 15 in **Cantor Demo. 9** are examples of questions that Dr. Sunding asked respondents about their expenses in visiting the Apalachicola Region or the Apalachicola River.

Demo. 9: Dr. Sunding's Expense Survey Questions

Fuel Expenses

Question E1D_2: How much did you or any member of your household spend on gasoline, diesel fuel, or any other fuels?

State	N	Refusals	<= 1¢	> 1¢ & <= $5	Percent
All States	492	32	29	13	15%

Grocery Expenses

Question E1D_9: What were the expenses, including taxes? (For food or beverages at grocery stores, convenience stores, or liquor

State	N	Refusals	<= 1¢	> 1¢ & <= $5	Percent
All States	317	11	4	12	9%

Entertainment Expenses

Question E1D_15: How much did you or any member of your household spend? (For entertainment and admissions.)

State	N	Refusals	<= 1¢	> 1¢ & <= $5	Percent
All States	139	5	3	10	13%

Notes:
[1] Survey responses displayed are unweighted and aggregated across states and survey subgroups.

Sources: Sunding Report at Appendix C;
BrattleGroup_FloridaAndGeorgiaSurvey_Main_Client_wgtd.dta.

Demo. 9 is adapted from Exhibit 9 of my expert report (GX-867) and contains summary statistics for Questions E1D_2, E1D_9, and E1D_15 of Dr. Sunding's survey.

80. Several of Dr. Sunding's survey measures appear to have suffered from the recall and processing error that are typical in responses to these types of questions, as demonstrated through certain expenditure responses that appear to be reported with error between 9 and 15 percent of the time. When asked about expenditures related to gasoline or other fuels for their visit to the area of interest, 29 respondents indicated they spent less than one cent and 42 respondents indicated they spent less than five dollars. These responses likely are not accurate or realistic, given what is generally known about travel expenditures.

81. Dr. Sunding also includes questions in his survey that require respondents to recall information over various time periods, ranging from 1 to 5 years. When dealing with periods that are that lengthy and varied, responses can suffer from recall error.

82. For example, Dr. Sunding's survey responses regarding where respondents had visited the Apalachicola River area in the past three years appear to be reported with frequent error. As shown in **Cantor Demo. 10**, in 23 to 38 percent of the answers, respondents indicated places for their visits that were not in the area specified by the question, were in an area explicitly ruled out by the question, or otherwise could not provide a meaningful answer.

Demo. 10: Percent of Error by State for Responses to Question E1C Regarding the Apalachicola River

State	Percent of Error
GA	37.50%
FL	23.21%
AL	27.78%

Source: Sunding Report at Appendix C; BrattleGroup_FloridaAndGeorgiaSurvey_Main_Client_wgtd.dta.

Demo. 10 contains the percent of erroneous responses for Question E1C from Dr. Sunding's survey.

(b) Representation Error:

(i) Sampling Error:

83. Dr. Sunding's survey questions also suffer from representation error. He did not ask all respondents all questions. Instead, he divided his sample of respondents into groups and asked different questions to different groups. As a result, the answers to a specific question

come from a group of respondents that is much less than the overall sample count. Dr. Sunding's decision to subdivide his sample affects the reliability of the responses to any given question. Consequently, he relies on only 73 respondents for his opinion that 60 percent of more than 3.5 million Georgia households would support watering restrictions to protect the Apalachicola River. This sample size is less than *one-tenth* of the number of survey respondents required by the conventional standards used routinely in surveys for margins of error. GX-867 (Cantor Expert Report, at 28). I can only infer from Dr. Sunding's silence in his Direct Testimony on this point that he agrees with my criticism that 73 survey responses are insufficient to generalize to 3.5 million Georgian households.

84. In my deposition, I was asked if it would be proper to "add" the respondent count across different versions of the question of interest. Cantor Dep. Tr. 51:14-53:5. This would not be appropriate, as Dr. Sunding's results show significantly different responses for different versions of the same question. Cantor Dep. Tr. 51:14-53:5. Dr. Sunding's results also reinforce how sensitive the responses in his survey are to small changes in survey design and the wording of survey questions. Such sensitivity to question wording suggests that adding the respondent counts across even apparently similar questions is inappropriate because respondents are clearly interpreting the questions differently.

85. In addition, Dr. Sunding's survey script indicates to respondents that the conservation policies discussed in his survey are "to ensure that additional water" is available in the rivers of interest in times of drought. FX-784 (Sunding Expert Report, at App. C). Importantly, Dr. Sunding's questions about support for mandatory water conservation measures address only successful environmental policies. I understand that there is no agreement that reduced water use in Georgia will affect the available water in the Apalachicola River.[5] Because Dr. Sunding did not allow for uncertainty in framing his questions about various policies, we do not know whether respondents would have indicated the same levels of support for policies with uncertain success and/or uncertain environmental impacts for the rivers of interest.

[5] GX-866 (May 20, 2016 Defensive Expert Report of Dr. Philip Bedient).

86. Nonetheless, Dr. Sunding uses his 60% result to reach two major conclusions: (a) "Because a reduction in outdoor water use is not associated with any fiscal costs, and the welfare costs of such a reduction would largely or entirely be offset due to the preference of urban Georgia consumers to minimize downstream impacts to Florida, I do not include the welfare cost from my February 29, 2016 report in the possible combinations of measures to reduce streamflows presented later in my testimony." Sunding Written Direct Testimony at ¶ 79; and (b) "The fact that a majority of the Georgia residents would be willing to reduce their own water use on behalf of environmental preservation also serves as a rational basis for distributing the costs of conservation policy across a broad swath of the Georgia population." Sunding Written Direct Testimony at ¶ 112. Based on his analysis of the costs of achieving 2,000 cfs of reductions, Dr. Sunding concludes that these measures can be implemented at a cost of approximately $10 per year per Georgia household. Sunding Written Direct Testimony at ¶ 113. These two conclusions, however, are inconsistent with other survey results that Dr. Sunding chose to omit from his analysis of the welfare costs.

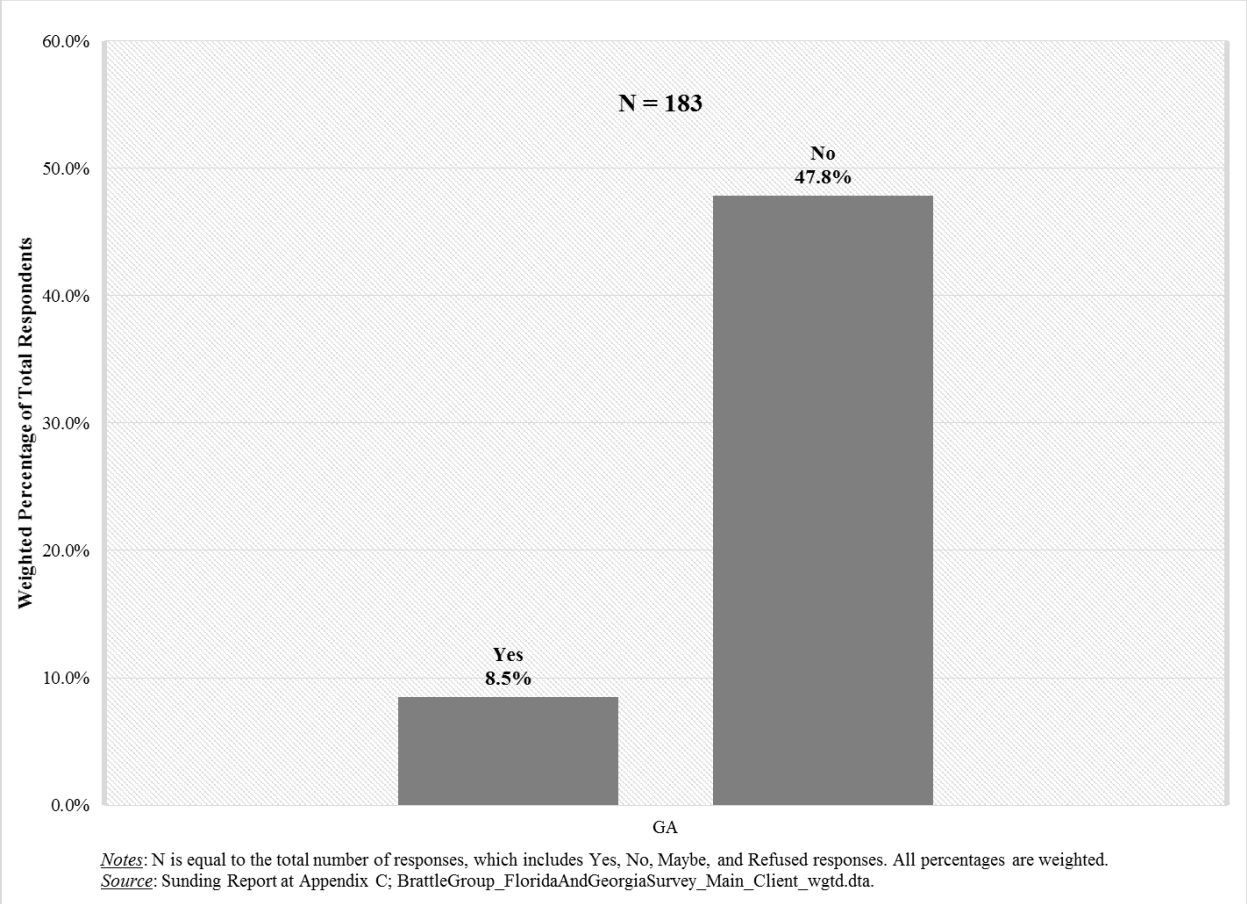
III. Dr. Sunding Omits Estimates of Environmental Values That Do Not Support His Conclusions

87. As mentioned above, Dr. Sunding administered a very lengthy and detailed survey that included approximately 45 questions. Dr. Sunding's survey is designed to demonstrate environmental values in households in both Georgia and Florida. However, Dr. Sunding disregards the large majority of survey results and uses only 3 survey responses to estimate recreational visits in the past three years and to estimate the level of support by Georgian respondents for water restrictions in Georgia.

88. Dr. Sunding asked several questions directly focused on environmental value as part of his initial survey work. That work is collected and analyzed in a separate report on the survey, FX-800 (2013 Sunding Report), but was not included or disclosed as part of his expert report. As shown in **Cantor Demo. 11,** the environmental value analysis omitted by Dr. Sunding in his expert report, but included in Dr. Sunding's 2013 report, shows that a low proportion of Georgian respondents—approximately 9 percent—affirmatively expressed their willingness to pay an amount to preserve the existing natural conditions of the Apalachicola River. This is a significant omission because it undermines the results proffered by Dr. Phaneuf

regarding environmental benefits and further suggests that residents in Georgia will suffer a welfare loss from reductions in water use, contrary to what Dr. Sunding claims. In addition, the high proportion of respondents who declined to contribute (approximately 48 percent) undermines Dr. Sunding's "rational basis" for distributing the costs of his conservation policy across the Georgia population. Sunding Written Direct Testimony at ¶ 112.

Demo. 11: Fraction of Georgian Respondents Willing to Contribute for the Apalachicola River
(Adapted from Dr. Sunding's 2013 Report, Figure 9)



Demo. 11 is adapted from Figure 9 of the 2013 Sunding Report (FX-800) and presents summary statistics for Question W0 of Dr. Sunding's survey.

89. Subsequently, Dr. Sunding poses similar willingness-to-pay questions to the same group of respondents as those shown in Cantor Demo. 11, but with alternative types of payment specified in the question. Although the respondents are more supportive of contributing when the amount of contribution is indicated, it does not overcome the substantial reluctance of many

respondents to contribute at all (Question W0: 92%; Question W4: 78%; Question W5: 49%), as shown in the table below, **Cantor Demo. 12.**

Demo. 12: Percentages of Respondents Not Affirmatively Willing to Contribute for Questions W0, W4, and W5 of Dr. Sunding's Survey (Adapted from Dr. Sunding's 2013 Report at Appendix C)

Question		Percent
W0: Would your household be willing to contribute any money to preserve the existing natural conditions of the ACF rivers or the Apalachicola River?	[1]	91.5%
W4: Would your household support or oppose a surcharge on your monthly water bill if the funds went to preserve the existing natural conditions of the ACF rivers or the Apalachicola River?	[2]	77.9%
W5: Would your household support or oppose a one dollar increase in your monthly water bill if that money were used to acquire water and land to preserve the ACF rivers or the Apalachicola River?	[2]	48.5%

Notes:
[1] Percentage of respondents that chose either "No", "Maybe", or "Refused."
[2] Percentage of respondents that chose either "Strongly oppose", "Somewhat oppose", "Neither support nor oppose", or "Refused."
[3] All percentages are weighted responses from Georgian respondents asked about the Apalachicola River.
Sources: Sunding Report at Appendix C;
BrattleGroup_FloridaAndGeorgiaSurvey_Main_Client_wgtd.dta.

IV. Dr. Sunding's Reported Survey Results Do Not Support His Opinions Regarding the Environmental Value of the Apalachicola River

90. In summary, Dr. Sunding's survey suffers from the following errors:

- Expenditure questions indicate that some respondents have difficulty processing the information and cannot provide reasonable estimates;
- Questions that require respondents to recall information over various time periods, for which some respondents provide invalid responses; and
- Small sub-sample sizes for questions from which Dr. Sunding extrapolates to conclusions for an entire state.

91. Dr. Sunding's survey results cannot be used reliably to claim that "sixty percent of Georgia residents said they would support twice-weekly lawn watering restrictions specifically to benefit the Apalachicola River in Florida." FX-784 (Sunding Expert Report, at 8) (emphasis omitted). In contrast, his omitted survey results provide a basis to reject the claim that "a majority of residents of all three states would be willing to make personal sacrifices to reduce diversions and keep water in streams in dry periods." FX-784 (Sunding Expert Report, at 8).

CONCLUSION

92. Neither Dr. Scyphers nor Dr. Sunding have proffered a survey methodology or results that can reliably support their conclusions about societal values in the Florida portion of the ACF Basin and whether those values are affected by upstream water use in Georgia. Neither survey actually addresses the benefits that would be gained in Florida if Georgia restricted its water use. Even in the context of the research objectives selected by Drs. Scyphers and Sunding, their survey methodologies fail to comply with recognized professional guidance that has been established to support the reliability of survey results. I have demonstrated numerous measurement and representation sources of error in both surveys that render their results unreliable for establishing Florida's claims regarding socioeconomic losses from the alleged environmental impact and damages due to upstream water use in Georgia.

LIST OF EXHIBITS CITED

- **GX-867**: This is a true and accurate copy of the expert report I submitted in this case.

- **GX-983**: This exhibit is a true and accurate copy of a map created by the Florida Department of Environmental Protection ("FDEP") that shows the 8 counties in the Florida portion of the Apalachicola-Chipola Basin. Such data is typically relied upon by experts in my field, and I relied on this data to inform my opinions.