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To The Section 316(b) Existing Facilities Rule Record

From Erik Helm, U.S. Environmental Protection Agency

Subject 316(b) Stated Preference (SP) Survey – Survey Methods and Model Results

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In this memorandum, EPA is documenting preliminary data, analysis, and results for the stated preference survey it conducted as part of the Final 316(b) Existing Facilities Rulemaking. This memorandum expands on the data, analysis and results of the survey presented in EPA's Notice of Data Availability. Stated preference surveys are a type of non-market valuation method used, in this case, to measure values associated with ecosystem improvements. The values individuals hold for ecosystem improvements are estimated by analyzing the selections that respondents make between hypothetical policy options and current conditions. The use of a stated preference survey reflects recent EPA guidelines for benefits analysis (USEPA 2010, p. 7-41) that recognize "advantages of [stated preference] methods include[ing] their ability to estimate non-use values and to incorporate hypothetical scenarios that closely correspond to a policy case."

EPA's estimated benefits of the proposed rule were partial estimates only. Specifically, the proposal included only a partial estimate of non-use values (e.g., values that people may hold for an environmental improvement that are not tied to any use of the resource such as recreation. For the proposed 316(b) rule, EPA employed a benefits transfer approach using an existing stated preference study conducted by Johnston et al. (2011a, b) which is closely related to the 316(b) policy context. Benefits transfer is the "practice of applying nonmarket values obtained from primary studies of resource or environmental changes undertaken elsewhere to the evaluation of a proposed or observed changes that is of interest to the analyst" (Freeman 2003, p.453). EPA used the best available scientific and economic methodologies for the benefit transfer but could only partially monetize benefits. The non-use values estimated through benefits transfer were limited to two of the seven benefits regions due to limitations of the study used for benefits transfer; EPA was unable to estimate non-use values for the other five regions. The estimates were also based on an assessment of a limited number of species within the two regions due to data limitations at the time of the proposal. [1] EPA is conducting the stated preference study (EPA ICR # 2402.01) to estimate total (use plus non-use) benefits of the ecological gains from the regulation of cooling water intake structures at NPDES-permitted facilities. EPA did not have sufficient time before the notice of proposed rulemaking to fully develop and deploy this survey and thus, derive estimates of the monetary value of reducing impingement and entrainment (I&E) mortality impacts.

This memorandum describes the methods EPA used to develop and implement the 316(b) stated preference survey and presents preliminary regional and national regression models based on data from the respondents. The preliminary results presented in this memorandum are estimated based on a choice experiment. Choice experiments, also called choice models, are a stated preference technique in which individual's values are estimated based on their choices over a set of hypothetical but realistic policy options. EPA undertook the Northeast version in advance of the other versions as a pilot study to inform potential changes to other survey versions, as described in the ICR for the 316(b) stated preference survey (EPA ICR # 2402.01) and as recommended in published guidance for stated preference survey design (Arrow et al. 1993; Bateman et al. 2002). At the time this memorandum was prepared, EPA had finished

[1] Refer to Chapter 8 of the Environmental and Economic Benefits Analysis (EEBA) (USEPA 2011a) for additional description of the benefits transfer approach used for the proposed rule.

fielding all five versions of the main mail survey (four regional and one national). EPA used regression models to produce preliminary estimates of annual household willingness-to-pay (WTP) (or implicit price) for a one percentage point improvement in environmental attributes included in the survey (fish saved, commercial fish populations, fish populations (all fish), and aquatic ecosystem condition). EPA also describes how it would use these implicit prices to estimate the benefits of regulatory options.

EPA is conducting a non-response study for each version of the survey, to learn whether respondents are fundamentally different from non-respondents. For the Northeast region, EPA used the non-response study results to develop weights that correct for any differences in respondent and non-respondent populations. The results enabled EPA to reduce the weight placed on overrepresented respondent groups, while increasing the weight placed on any underrepresented respondent groups. EPA presents separate implicit prices for the Northeast region based on the unweighted and weighted models. EPA currently is still fielding the non-response studies for the other three regional and national versions of the survey. Thus, EPA estimated only unweighted models for the Pacific, Inland, Southeast and National versions of the survey. EPA intends to complete weighted models for these three regions and the national surveys. After completing the non-response studies for all regions, reviewing public comment, and conducting additional scope and validity testing, EPA will present a more complete set of stated preference survey materials and model results for an external peer review. EPA will then determine what role, if any, the monetized benefits based on the stated preference survey should play in EPA's assessment of benefits for the final rule, and will include the complete results in its assessment as appropriate.[2]

1 Choice Experiment Framework

Stated preference surveys generally ask questions that elicit individuals' stated values for carefully specified changes in an environmental amenity (Freeman 2003). This value is typically estimated in terms of WTP, defined as the maximum amount of money (or some other commodity) that an individual or household would be willing to give up in exchange for a specified environmental change, rather than go without that change. Various question formats have been used in the stated preference literature to elicit WTP. Some types of stated preference surveys ask respondents to reveal their WTP using open-ended questions, payment cards, or bidding games. Increasingly, however, these original types of stated preference surveys have been replaced in the literature by methods grounded in random utility models (Hanemann 1984), in which respondents express their WTP through choices over hypothetical policy options. Advantages of these choice-based methods include similarity to familiar referenda or market choice contexts, in which individuals choose among alternative policy options or commodities at different costs (Freeman 2003), although responses to hypothetical choice questions are still not actual market transactions or referenda. Appropriately designed choice-based stated preference methods may reduce hypothetical biases that can result from asking survey questions versus assessing WTP through market transactions or binding referenda. Substantial research has been conducted over the past two decades on hypothetical bias in stated preference surveys. While many studies have found evidence of hypothetical bias (List and Gallet 2001), a recent meta-analysis indicates that "hypothetical bias in SP studies may not be as important" as some have argued previously (Murphy et al. 2005), mirroring similar findings in prior studies that compare hypothetical and actual referenda (see discussion in Johnston 2006). The 316(b) survey is designed as a choice experiment following established choice experiment methodology and

[2] EPA notes that the benefit estimates based on the stated preference survey, even when completed and peer reviewed, cannot be viewed as additive to those benefit values estimated at proposal because they represent both use and non-use willingness-to-pay.

format (Adamowicz et al. 1998; Louviere et al. 2000; Bennett and Blamey 2001; Bateman et al. 2002). Choice experiments, also called choice models, are a stated preference technique in which individual's values are estimated based on their choices over a set of hypothetical but realistic policy options. Under the choice experiment (or choice modeling) format, respondents are presented with a set of multi-attribute alternatives and asked to select their preferred alternative, much as one might choose a preferred option in a public referendum. This format has been applied to assess WTP for ecological resource improvements of a type similar to those at issue in the 316(b) policy case (e.g., Bennett and Blamey 2001; Hanley et al. 2006a, b; Hoehn et al. 2004; Johnston et al. 2002, 2011a, b; Milon and Scrogin 2006; Morrison and Bennett 2004; Morrison et al. 2002; and Opaluch et al. 1999).

Advantages of these choice-based methods include similarity to familiar referenda or market choice contexts, in which individuals choose among alternative policy options or commodities at different costs (Freeman 2003). Choice experiments allow survey respondents' to express WTP for a wide range of different potential outcomes of 316(b) policies, differentiated by their attributes.[3] This enables EPA to isolate the marginal effects of different possible policy outcomes on stated choices, and hence on estimated WTP, thereby estimating benefits for a wide range of potential policy outcomes. This is a primary factor distinguishing choice experiments from older forms of stated preference analysis, in which estimated WTP is typically contingent upon a single specification of ecological effects. The goal of the choice experiment is to collect data which can be used to estimate regression coefficients from mixed or conditional logit models for estimating WTP for multi-attribute policy alternatives, or the likelihood of choosing a given multi-attribute alternative, following standard random utility modeling procedures (Haab and McConnell 2002; Train 2009).

Following standard choice experiment (or choice modeling) format (Adamowicz et al. 1998; Bennett and Blamey 2001), each respondent was asked to consider three potential policies, or choice options, (i.e., Option A, Option B, No Policy (current situation))—choosing the option that is most preferred, that is, provides the highest utility. Figure 1 is an example of a choice experiment question from the Northeast survey. Respondents may also choose to reject both policies and retain the status quo. The "no policy" or status quo option is included in the visible choice set following guidance from the literature, to ensure that WTP measures are well-defined (Louviere et al. 2000). The underpinning theoretical model is adapted from a standard random utility specification in which household h chooses among three choice options, ($j=A,B,N$), including two multi-attribute policy options (A, B) and a fixed "no policy" status quo (N) that includes no policy changes and zero household cost. Each choice option reflects a hypothetical but feasible outcome under various 316(b) regulatory alternatives. Following standard practice (Day et al. 2012; Poe et al. 1997; Layton 2000), respondents are presented with more than one choice question within the same survey. Other questions in the survey elicit information including whether the respondent is a user of the affected aquatic resources, household income, and other respondent demographics.

As shown in Figure 1, the effects of the policy options are described in terms of an annual household cost incurred indefinitely and four environmental endpoints, or attributes: (a) commercial fish populations, (b) fish populations (all fish), (c) fish saved, and (d) condition of aquatic ecosystems. Values are reflected in the survey by individuals' willingness to "vote" for policies that would increase their cost of living, in exchange for specified changes in the four environmental attributes. The definitions of the five attributes used to characterize policies are presented in Table 1. Table 1 also presents the baseline (status quo) attribute values included across survey versions. The regional versions (Northeast, Southeast, Inland, and

[3] Choice experiments following the random utility model are favored by many researchers over other variants of stated preference methodology (Adamowicz et al. 1998; Bennett and Blamey 2001), and may be viewed as a "natural generalization of a binary discrete choice CV [contingent valuation]" (Bateman et al. 2002, p. 271).

Pacific) present policy options and attibute values specific to the respondent's region, while the National survey presents policy options and attribute values for all U.S. waters.

The four environmental attributes were designed based on the Johnston et al. (2011a, b; 2012) Bioindicator-Based Stated Preference Valuation (BSPV) method which was developed to promote ecological clarity and closer integration of ecological and economic information within stated preference studies. Johnston et al. (2011a, b; 2012) was an EPA Science to Achieve Results (STAR) grant project. The BSPV method's focus on improved ecological valuation is an EPA priority as described in findings of EPA's Science Advisory Board Committee on Valuing the Protection of Ecological System and Services (USEPA 2009). In contrast to traditional stated preference valuation, BSPV employs a more structured and formal use of ecological indicators to characterize and communicate welfare-relevant changes. The welfare measures provided by BSPV method can be unambiguously linked to models and indicators of ecosystem function, are based on measurable ecological outcomes, and are more easily incorporated into benefit cost analysis. It also provides a means to estimate values for ecological outcomes that individuals might value, even though they may not fully understand all relevant ecological science. It begins with a formal basis in ecological science, and extends to relationships between attributes in respondents' preference functions and those used to characterize policy outcomes. Specific BSPV guidelines aim to ensure that survey scenarios and resulting welfare estimates are characterized by (1) a formal basis in established and measurable ecological indicators, (2) a clear structure linking these indicators to attributes influencing individuals' well-being, (3) consistent and meaningful interpretation of ecological information, and (4) a consequent ability to link welfare measures to measurable and unambiguous policy outcomes.

Question 4. Assume that Options A and B would require a different mix of filters and closed cycle cooling in different areas. Assume all types of fish are affected. How would you vote?

Policy Effect NE Waters	Current Situation (No policy)	Option A	Option B
Commercial Fish Populations (in 3-5 Years)	42% (100% is populations that allow for maximum harvest)	45% (100% is populations that allow for maximum harvest)	48% (100% is populations that allow for maximum harvest)
Fish Populations (all fish) (in 3-5 Years)	26% 100% is populations without human influence)	30% (100% is populations without human influence)	27% (100% is populations without human influence)
Fish Saved per Year (Out of 1.1 billion fish lost in water intakes)	0% No change in status quo	5% <0.1 billion fish saved	5% <0.1 billion fish saved
Condition of Aquatic Ecosystems (in 3-5 Years)	50% (100% is pristine condition)	52% (100% is pristine condition)	54% (100% is pristine condition)
$ Increase in Cost of Living for Your Household	$0 No cost increase	$48 per year ($4 per month)	$48 per year ($4 per month)
HOW WOULD YOU VOTE? (CHOOSE ONE ONLY)	☐ I would vote for NO POLICY	☐ I would vote for OPTION A	☐ I would vote for OPTION B

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Figure 1 – Example Choice Experiment Question from the Northeast Survey

Table 1—Definitions of Policy Attributes and Baseline (Status Quo) Values Included Across Survey Versions

Attribute	Definition	Northeast	Southeast	Pacific	Inland	National
Commercial Fish Populations	A score between 0 and 100 percent showing the overall health of commercial and recreational fishing populations. High scores mean more fish and greater fishing potential. A score of 100 means that these fish populations are at a size that maximizes long-term harvest: 0 means no harvest.	42%	39%	56%	39%	51%
Fish Populations (All Fish)	A score between 0 and 100 percent showing the estimated size of all fish populations compared to natural levels without human influence. A score of 100 means that populations are the largest natural size possible; 0 means no fish.	26%	24%	32%	33%	30%
Fish Saved (per Year)	A score between 0 and 100 percent showing the reduction in young fish lost compared to current levels. A score of 100 would mean that no fish are lost in cooling water intakes (all fish would be saved because of the new policy).	0%	0%	0%	0%	0%
Condition of Aquatic Ecosystems	A score between 0 and 100 percent showing the ecological condition of affected areas, compared to the most natural waters in the region. The score is determined by many factors including water quality and temperature, the health of aquatic species, and habitat conditions.	50%	68%	51%	42%	53%
Cost per Year	How much the policy will cost your household, in unavoidable ongoing prices increases for products and services you buy, including electricity and common household products.	$0	$0	$0	$0	$0

EPA estimated the commercial fish population score based on the average ratio of fish population to maximum sustainable yield (MSY) among commercially harvested species including commercially harvested species with stock assessment reports conducted by a reputable body such as NOAA or the Atlantic States Marine Fisheries Commission. For commercially targeted fish, "natural" population was calculated as a scalar multiple of MSY; typically, an unharvested population is believed to be approximately three times as large as MSY. The score was calculated by comparing the baseline population to this estimate of natural populations averaged across all species to obtain regional values. Changes in scores under regulatory options can be calculated by modeling commercial fish populations with implementation of the rule and comparing to natural populations.

The baseline value for "fish saved" is 0% for all regions, which reflects the status quo level of I&E mortality before the implementation of regulatory options. The estimates of "fish saved" due to 316(b) facilities at baseline are based on EPA's estimate of age-one-equivalent (A1E) losses, a metric used by EPA to standardize all I&E mortality losses into equivalent numbers of 1-year-old fish. This conversion allows losses to be compared among species, years, facilities, and regions. To obtain regional I&E mortality estimates, EPA extrapolated loss rates from facilities for which I&E mortality data are available (referred to as model facilities), to all in-scope facilities within the same region. Refer to Section 3 of the Environmental and Economic Benefits Analysis (EEBA) of the proposed rule (USEPA 2011a) for additional detail on EPA's assessment of baseline A1E losses and reductions in A1E losses under regulatory options. The introductory materials describe the age classes impacted due to cooling water intakes and the "fish saved" attribute is defined as "young fish lost compared to current levels." While the A1E terminology is not used specifically within the stated preference survey, pre-testing during focus groups and cognitive interviews indicated that participants understood the "fish saved" attribute and the concept of "young fish" as reflecting initial losses of eggs and other juvenile life stages.

The baseline fish populations (all fish) score was calculated in a fashion similar to commercial fish population score based on species with population estimates published in the literature including commercially or recreationally harvested species with stock assessment reports and threatened species with assessment reports. Current populations were compared to estimates of natural population size "without fishing". For regulatory options, changes in fish populations can be modeled with compliance and compared to natural populations.

EPA estimated the baseline values for the aquatic ecosystem score, by identifying studies in a region that apply or define various multimetric indices of water quality, such as Indices of Biotic Integrity (IBIs) from the published literature or from state reports. EPA took a wide geographic sampling of these indices, converted output values to scores between 0 and 100, and averaged across all outputs within the region to obtain regional values. Changes under the regulatory options can be evaluated based on changes in the multimetric indices.

2 Experimental Design

Following established practices, EPA used an experimental design to generate multiple unique combinations of policy options for different respondents to compare. Respondents were presented with three separate policy questions in the survey, each with a unique combination of policy options. The experimental design specifies how attribute levels were "mixed and matched" within choice questions, thereby developing an empirical data framework with appropriate statistical properties to allow for analysis of respondent's choices (Louviere et al. 2000).

EPA applied a fractional factorial experimental design representing a subset of all possible combinations of environmental attributes and household cost, allowing for efficient estimation of particular effects of interest (Louviere et al. 2000) and reducing the cognitive burden faced by respondents (Holmes and Adamowicz 2003). It was used to construct choice questions with an orthogonal (independent) array of attribute levels, with questions randomly divided among distinct survey versions (Louviere et al. 2000). The fractional factorial experimental design was generated using a D-efficiency criterion for main effects estimation (Kuhfeld 2010; Kuhfeld and Tobias 2005). A more efficient design enables model coefficients (and hence estimated willingness to pay) to be estimated with greater precision (i.e., lower standard errors or variability) for any given number of observations. It also minimizes correlation between attributes across survey questions (i.e., attributes do not "move together" across different survey questions), so that the unique effect of each attribute on respondents' choices can be isolated.[4]

[4] EPA removed dominated pairs where one option is superior to the other in all attributes. Focus groups showed that respondents react negatively and often protest when offered dominated pairs. Given that such choices provide negligible statistical information compared to choices involving non- dominated pairs, they are typically avoided in choice experiment statistical designs.

The attribute levels included across options pairs in the survey versions are summarized below in Table 2. As described in Section 1, each choice question includes two choice options (Option A and Option B), characterized by the five attributes in Table 1, with values differing between the two choice options. The resulting experimental design is characterized by 72 unique Option A vs. Option B pairs, each corresponding to a choice question defined by an orthogonal array of attribute levels for the two policy options. Following guidance from the literature, EPA designed the attribute to illustrate realistic policy scenarios that "span the range over which we expect respondents to have preferences, and/or are practically achievable" (Bateman et al. 2002, p. 259). Choice scenarios represent each ecological attribute in relative terms with regard to upper and lower reference conditions (i.e., best and worst possible in the affected area), as defined in survey informational materials. The survey also presents the cardinal basis for relative scores where applicable, e.g., change in fish saved per year is illustrated both in terms of numbers of age-one equivalent fish and in terms of a percentage of current estimated mortality. Relative scores represent percent progress towards the upper reference condition (100%), starting from the lower reference condition (0%). This approach is based on BSPV methods of Johnston et al. (2011a, b; 2012).

As described above, the experimental design for each the four regional and national surveys is characterized by 72 unique A vs. B option pairs. Each pair represents a unique choice modeling question, with a unique set of attribute levels distinguishing options A and B. It is standard practice to include more than one choice question in each survey, increasing the information obtained from each respondent (Poe et al. 1997; Layton 2000); this has been described as a "fundamental element of … choice experiments" (Day et al. 2012, p. 73). EPA randomly assigned the 72 option pairs to 24 distinct survey booklets for each of the four regional and the national surveys, with three option pairs (i.e., choice questions) per survey booklet. All 72 profiles included in each of the four regional and national survey versions are presented in Appendix A. The 24 versions of the booklets for each of the regional and the national surveys were randomly assigned to households in the mail sample.

Focus groups showed that respondents react negatively and often protest when offered choices in which one policy option dominates the other in all attributes. Following guidance from the literature (Hensher and Barnard 1990), EPA constrained the design to eliminate such dominant/dominated pairs. EPA also eliminated non-credible pairs where one of the options offers both a greater reduction in fish losses and a smaller increase in the population in order to avoid protest bids and confusion among respondents (Bateman et al. 2002).

Table 2—Attribute Levels Assigned Across Policy Options and Survey Versions

Attribute	Baseline (Status Quo)[a]	Max Change Assigned	Attribute Levels Assigned to Option A vs. Option B Pairs					
			1	2	3	4	5	6
Commercial Fish Populations *(Score showing the overall health of commercial and recreational fish populations)*								
Northeast	42%	6%	43%	45%	48%	-	-	-
Southeast	39%	6%	40%	42%	45%	-	-	-
Pacific	56%	6%	57%	59%	62%	-	-	-
Inland	39%	6%	40%	42%	45%	-	-	-
National	51%	6%	52%	54%	57%	-	-	-
Fish Populations (all fish) *(Score showing the estimated size of all fish populations compared to natural levels without human influence)*								
Northeast	26%	4%	27%	28%	30%	-	-	-
Southeast	24%	4%	25%	26%	28%	-	-	-
Pacific	32%	4%	33%	34%	36%	-	-	-
Inland	33%	4%	34%	35%	37%	-	-	-
National	30%	4%	31%	32%	34%	-	-	-
Fish Saved per Year *(Score showing the reduction in young fish lost compared to current levels)*								
Northeast	0%	95%	5%	50%	95%	-	-	-
Southeast	0%	90%	25%	55%	90%	-	-	-
Pacific	0%	95%	2%	50%	95%	-	-	-
Inland	0%	95%	55%	75%	95%	-	-	-
National	0%	95%	25%	55%	95%	-	-	-
Aquatic Ecosystem Condition *(Score showing the ecological condition of affected areas, compared to the most natural waters in the region)*								
Northeast	50%	4%	51%	52%	54%	-	-	-
Southeast	68%	4%	69%	70%	72%	-	-	-
Pacific	51%	4%	52%	53%	55%	-	-	-
Inland	42%	4%	43%	44%	46%	-	-	-
National	53%	4%	54%	55%	57%	-	-	-
Household Costs *(The increase in annual household cost, in unavoidable price increases)*								
Northeast	$0	$72	$12	$24	$36	$48	$60	$72
Southeast	$0	$72	$12	$24	$36	$48	$60	$72
Pacific	$0	$72	$12	$24	$36	$48	$60	$72
Inland	$0	$72	$12	$24	$36	$48	$60	$72
National	$0	$72	$12	$24	$36	$48	$60	$72

[a] Each question includes a "no policy" option, characterized by the baseline levels for each attribute and a household cost of $0.

3 Pretests and Pilot Tests

Following recommended methods for stated preference survey design (cf. Arrow et al. 1993; Bateman et al. 2002; Bennett and Blamey 2001; Kaplowicz et al. 2004), EPA extensively pre-tested the survey during six focus groups, with 8 to 10 participants each, and a set of eight one-on-one cognitive interviews (EPA ICR # 2090-0028). Each focus group was conducted following standard, accepted practices in the stated preference literature, as outlined by Mitchell and Carson (1989), Desvousges et al. (1984), Desvousges and Smith (1988) and Johnston et al. (1995). Each cognitive interview included one participant, allowing for in-depth exploration of the cognitive processes used by respondents to answer survey questions, without the potential for interpersonal dynamics to sway respondents' comments (Kaplowicz et al. 2004).

Focus groups and cognitive interviews also included questions following the verbal protocols suggested by Schkade and Payne (1994), in which respondents were asked to talk through the process used to answer choice questions. They were conducted in several regions to account for the potentially distinct information relevant to survey design. Transcripts from these seven focus groups can be found in the docket for the ICR (ICR # 2402.01).

Participants in focus groups and cognitive interviews completed draft survey questionnaires and provided comments and feedback on concerns such as whether (1) questions and survey information were readily understood, (2) respondents were interpreting questions similarly to how EPA interprets them, (3) responses or survey interpretations showed any evidence of heuristics or survey biases, including hypothetical bias, (4) respondents were addressing choice questions in a manner commensurate with utility maximization and neoclassical WTP estimation, and (5) respondents were following instructions provided in the survey instrument and responding to questions accordingly. Responses to the survey choice questions from participants in the focus groups and cognitive interviews could not be included in model estimation because the draft surveys completed during pre-testing differ somewhat from the final survey. EPA modified the survey several times based on the results of these pre-tests to minimize potential biases and to ensure shared and accurate interpretation of survey language among the respondents. Results from focus groups and cognitive interviews provided evidence that respondents answer the stated preference survey questions in ways appropriate for stated preference WTP estimation, and that their responses generally do not reflect the biases noted above.[5] The amount of pre-testing conducted for stated preference surveys varies within the literature and tends to be related to the complexity of the survey instrument (i.e., more complex survey instruments addressing complex ecological issues require more pre-testing and subsequent revisions). EPA believes that the amount of time and number of focus groups applied in survey design compares favorably to stated preference analyses in the peer reviewed literature.

Stated preference surveys also require the provision of information to enable respondents to comprehend the potential implications of their hypothetical choices. For example, in this case, respondents may not be aware that cooling water intake structures potentially can kill large numbers of fish, eggs, and larvae, or that the vast majority of those organisms are species that provide no consumptive use (e.g., commercial or recreational fishing) to humans. Even if they are aware of this issue in a general way, it is unlikely that most of them will have previously considered what preserving those species is worth to them. Elicitation of informed responses requires the provision of background information to respondents including the general context and scope of the issue. Following standard practices in stated preference survey design, EPA pretested the information provided to respondents in focus groups and cognitive interviews to determine what quantity and types of information respondents needed to feel confident and well-informed in their responses (DCN 11-4710). For example, EPA explains in the introductory materials accompanying the four regional and national survey versions that the number of “young adult fish” lost in coastal and fresh waters due to cooling water use (also called “age-one-equivalents”) includes eggs and larvae. Without this educational material, survey respondents might not realize that reported effects on “fish saved per year” in the valuation questions partially result from reduced mortality of eggs and larvae. The presentation of this type of background information, if not properly vetted in the survey instrument development process, could result in focusing respondent attention on particular environmental amenities

[5] For example, participants took the survey questions seriously, indicating that hypothetical bias may not be a significant design issue. Many participants were confident when asked whether their choices would be different if they knew the vote was binding; one participant stated that “*No. It would have been the same actually*.” The transcripts can be found in the docket for the ICR (ICR # 2402.01)

to the exclusion of other market and non-market goods that may also be important to some respondents' decision making with regard to the choice questions.

The final survey instrument is built upon an earlier version initially developed as part of the Phase III 316(b) rulemaking. Twelve focus groups were conducted for the Phase III survey, which was peer reviewed in January 2006 (Versar 2006). See EPA ICR #2155.01 for details. The current survey incorporates both the results of prior focus groups and recommendations received from that peer review panel.[6]

Consistent with established best practices for stated preference surveys, EPA has sought to minimize possible biases by careful and thorough construction and testing of the survey instrument. The Agency recognizes that potential biases may still remain and may influence the results of the study. While EPA believes that the study incorporates current best professional practice in the conduct of stated preference studies, EPA acknowledges that the results of any empirical study depend on the methodology applied.

4 Sampling Design and Sample Frame

The stated preference study was designed as a mail survey sent to households in different regions throughout the country. The target population for the stated preference survey is all individuals from continental U.S. households who are 18 years of age or older. The population of households is stratified into four survey regions: Northeast, Southeast, Inland, and Pacific. These regions are defined by state boundaries and differ from the 316(b) benefits regions used in the EEBA for the proposed rule. Alaska and Hawaii were excluded because they include only four in-scope non-recirculating facilities, represent a small percentage of overall household population, and are separated geographically from the states which comprise each region. EPA is also administering a national version of the survey that does not require stratification. See Table 3 for a list of states included in each survey region.

The survey instrument and sampling were designed to maximize the response rate and minimize the potential non-response bias following Dillman's mail survey approach (Dillman et al. 2009). Dillman et al. (2009) is among the most definitive sources for survey logistics management. Under this approach households selected for the mail survey sample were sent a series of mailings:

1. Preview letter: respondents receive a preview letter that notifies the household that it has been selected and briefly describes the survey;
2. First survey mailing: the survey booklet was sent to selected households one to two weeks after the preview letter;
3. Postcard reminder: a postcard reminder was sent one week after the first survey mailing;
4. Second survey mailing: the survey booklet was sent to those households who did not respond to the first mailing three weeks after the first survey mailing;
5. Second reminder: a follow up letter was sent one week after the second survey mailing.

EPA developed target sample sizes for each region to provide statistically robust results while minimizing the cost and burden of the survey to individual respondents.[7] The target sample sizes refer to *completed*

[6] Transcripts from the previously conducted focus groups for the Phase III analysis can be found in the docket for EPA ICR #2155.02 (Besedin et al. 2005).

[7] EPA included three choice questions within each survey, to increase information obtained from each respondent. It is standard practice within choice experiment and dichotomous choice contingent valuation surveys to include more than one choice question in each survey (Poe et al. 1997; Layton 2000). Including more than three choice questions may have negatively

mail surveys. They are presented in Table 3 along with the number of households selected to receive a survey. EPA selected a total target sample of 2,000 completed surveys across all four regional surveys. These 2,000 surveys were allocated across the four regions based on the number of households in each region relative to the total number of household in the continental U.S. In addition, a minimum number of completed surveys were required for each region. Monte Carlo experiments indicate that approximately 6 to 12 completed responses are required for each profile (unique set of choice options) in order to achieve large sample statistical properties for choice experiments (Louviere et al. 2000, p. 104, citing Bunch and Batsell 1989). As described previously, the experimental design includes 72 option profiles. Following this guidance, the experiment design will require 12 completed surveys for each of the 72 profiles for a total of 864 profile responses per region (72×12=864). A minimum of 288 completed surveys are required for each region because each survey version includes 3 profiles (864÷3=288). Based on this allocation, the sample sizes range from a high of 732 to a low of 288 households. If we are estimating a population percentage, then the margin of error for the sample percentage based on these sample sizes ranges from 3.6 to 5.8 percentage points at the 95% confidence level.[8]

The allocation of the 2,000 completed surveys across the four regions resulted in target sample sizes of 417 for the Northeast version, 562 for the Southeast version, 289 for the Pacific version, and 732 for the Inland version. EPA is also implementing a national version of the mail survey with a target sample size of 288 completed surveys. EPA mailed the survey to 7,840 households in total, anticipating a response rate of 30 percent.[9] The sample for the national survey version is being distributed among the study regions based on the percentage of regional survey sample to ensure that respondents to the national survey version are distributed across the continental U.S. Table 3 presents the states included in each region, the total number of households in each region, the target number of completed surveys, and the number of surveyed households for each region. Households were randomly selected from the U.S. Postal Service Delivery Sequence File (DSF).The DSF covers over 97% of residences in the U.S. including city-style addresses and PO boxes, and covers single-unit, multi-unit, and other types of housing structures. Responses to the mail survey are discussed in the following section.

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affected the response rate by increasing burden on respondents and including fewer would have increased survey costs by requiring additional households.

[8] Margin of error was calculated assuming that the population percentage selecting a specific answer (e.g., "yes") in a binary question is 50% (i.e., worst case scenario). The range of the margin of error (3.6 to 5.8%) is based on the sample sizes for each region. For example, the sample percentage selecting a specific response to a binary question based on a sample of 732 households has a margin of error of plus or minus 3.6% at a 95% confidence level whereas the sample percentage selecting a specific response based on a sample of 288 households will have a margin of error of plus or minus 5.8%.

[9] The number of intended completed questionnaires for each survey region was rounded up so that the same number of households were sent each of the 24 survey versions.

Table 3—Target Sample Sizes and Geographic Stratification Design

Survey Region	States Included	Household Population	Target Sample Size [a,b]	Number of Surveyed Households [c]
Northeast	CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT	23,281,296	417	1,440
Southeast	AL, FL, GA, LA, MS, NC, SC, TX, VA	31,378,122	562	1,920
Inland	AR, AZ, CO, ID, IA, IL, IN, KS, KY, MI, MN, MO, MT, ND, NE, NM, NV, OH, OK, SD, TN, UT, WI, WV, WY	40,852,983	732	2,480
Pacific	CA, OR, WA	16,158,206	289	1,040
Total for Regional Surveys Versions	U.S. (excluding AK and HI)	111,670,607	2,000	6,880
National Survey Version	U.S. (excluding AK and HI)	111,670,607	288	960

[a] Target sample sizes presented here refer to *completed* mail surveys.

[b] The sample is allocated to each region in proportion to the total number of households in that region, with at least 288 completed surveys in each region, the number required to estimate the main effects and interactions under an experimental design model.

[c] The number of intended completed questionnaires for each survey region was rounded up so that the same number of households were sent each of the 24 survey versions.

5 Mail Survey Responses

At the time this memorandum was written, EPA had received a total of 2,313 completed mail surveys across all versions. **Error! Reference source not found.** summarizes the number of completed surveys received and the response rate (minus undeliverable surveys across the survey versions). The average response rate across all versions was 33 percent. This response rate is comparable to various other recent mail surveys in the stated preference literature (e.g., Hanley et al. 2006a; Johnston and Duke 2009; Johnston and Bergstrom 2011; Boyle and Ozdemir, 2009). Responses to the mail survey and non-response survey were entered into an electronic database suitable for use with a statistical analysis software package. Table 5 provides demographic characteristics of survey respondents in each survey region.

Table 4—Completed Surveys Received and Response Rates by Survey Version

Survey Version	Households Surveyed	Completed Surveys Received [a,b]	Response Rate [a]
Northeast	1,440	421	31%
Southeast	1,920	506	30%
Pacific	1,040	311	32%
Inland	2,480	787	36%
National Survey Version	960	288	34%

[a] The number of undeliverable surveys was subtracted from surveys mailed when calculating the response rate for each survey region. Undeliverable surveys are those surveys that were returned to sender.

The survey data indicate that respondents appear to have been evaluating trade-offs between costs and benefits of policy options presented to them, not simply selecting “no policy” or the same policy option for all three choice questions. The survey data also indicate that WTP is strongly responsive to scope (i.e., the quantity of environmental improvements across different attributes). Responses also reveal, as suggested in focus groups, that respondents appear to understand and distinguished between different types of outcomes from 316(b) regulation. As with any mail survey, some respondents did not complete all questions. However, about 90% responded to the choice experiment questions (questions 4, 5, and 6 of the survey). As desired for a choice experiment of this type, EPA does not see evidence of clear correlations between respondents’ choices across policy questions. About 17% of respondents selected “no policy” (i.e., status quo) for all three choice questions and about 56% of respondents selected a new policy (either Option A or Option B) for all three choice questions. Thus, more than a quarter of respondents made selections of both policy and status quo in their trio of choice questions. Results of this nature indicate that the experimental design (the selection of the attribute values and household costs) correctly spans and brackets the values respondents hold for this resource. This feature allows for robust estimates of WTP based on the survey results. If the survey had used lower monthly household costs, it’s more likely that a larger group of respondents would have selected Options A or B, making it difficult to distinguish between respondents with positive, but low, WTP and high WTP. On the other hand, if EPA had used higher monthly costs and most respondents had selected the status quo, it would be difficult to distinguish between respondents with zero WTP and those with positive WTP that is below the levels implied in the choice question.

Question 8 of the survey asked respondents to rate their understanding of the survey material, confidence in their responses, and thoughts on potential bias. Responses to Question 8 are summarized in Table 6 and Figure 2. The vast majority of respondents selected “strongly agree”, “agree”, or “neutral”, with a small minority selecting “disagree” or “strongly disagree”. These responses indicate that for the most part, respondents understood the survey materials and were confident in their responses.

Table 5—Demographic Characteristics of Survey Respondents by Survey Region [a]					
Statistic	**Northeast**	**Southeast**	**Pacific**	**Inland**	**National**
Average age of respondents	54.6	54.3	52.8	53.7	54.2
Percent of respondents under 65 [b]	74.6%	74.1%	76.1%	76.3%	72.7%
Percent male respondents	63.9%	62.3%	62.7%	64.6%	60.4%
Percent currently employed	63.6%	59.2%	65.0%	64.4%	60.2%
Percent employed under age 65	76.9%	75.0%	80.3%	76.9%	72.5%
Highest Level of Education					
Less than High School	4.2%	4.4%	1.7%	1.8%	4.7%
High School or Equivalent	15.7%	16.0%	13.6%	16.8%	17.0%
High School +Technical School	10.2%	11.4%	7.5%	13.8%	9.4%
One or More Years of College	23.9%	24.1%	26.4%	24.5%	22.0%
Bachelor's Degree	22.7%	25.8%	28.8%	22.4%	30.7%
Graduate Degree	23.2%	18.3%	22.0%	20.7%	16.2%
Hispanic or Latino Origin	5.1%	9.9%	13.3%	3.4%	7.0%
Racial Category [c]					
American Indian or Alaskan Native	3.1%	3.9%	3.6%	3.2%	3.0%
Black or African American	7.5%	14.7%	3.6%	6.6%	10.2%
Native Hawaiian or Other Pacific Islander	1.3%	0.0%	0.4%	0.5%	1.5%
Asian	5.7%	2.6%	10.9%	2.8%	4.5%
White [d]	86.6%	82.3%	84.7%	91.0%	83.4%
Average Household Size	2.5	2.5	2.6	2.5	2.7
Number of household members 16 or older	2.0	1.9	1.9	1.9	1.9
Total Household Income [e]					
Average	$88,880	$75,588	$96,144	$73,567	$79,496
Standard Deviation	$69,309	$62,618	$71,282	$57,261	$60,972
Consume commercially caught fish or seafood	91.9%	89.3%	90.4%	89.7%	92.0%
Consume recreationally caught fish or seafood	46.4%	59.5%	50.5%	61.0%	57.7%

Notes:
[a] Respondents did not answer a given demographic question were excluded when calculating percentages.
[b] Compares to 83.21% for 18+ population nationally (excluding HI and AK) based on Census 2010.
[c] Racial percentages sum to more than 100% due to some individuals checking more than one racial category box. The survey did not have a box specifically indicating two or more races.
[d] Compares to 74.9% nationally (excluding HI and AK) based on Census 2010. However, the racial categories presented in this table are different from the census categories. Unlike the census, EPA does not present a separate category for respondents selecting more than one race. The census also includes an "other category" which was not included in the 316(b) stated preference survey.
[e] The survey asked respondents to select one of eight categories for annual household income. The average and standard deviation reported here were calculated using the midpoint of each range. $250,000 was used for the highest income category included in the survey ("$250,000 or more").

Table 6—Summary of Responses to Questions Regarding Survey Understanding and Bias Across All Survey Regions

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The survey provided enough information for me to make informed choices	5.5%	12.0%	26.9%	43.8%	11.8%
I feel confident about my answers	1.2%	4.2%	21.7%	46.5%	26.5%
Information in the survey was easy for me to understand	3.9%	9.7%	22.4%	43.7%	20.3%
Information in the survey was fair and unbiased	4.8%	8.1%	38.7%	35.3%	13.0%
Questions were easy for me to understand	2.9%	10.9%	20.9%	45.0%	20.3%
I would vote the same way in a public vote	0.9%	1.8%	18.8%	45.0%	33.4%
The effect of the proposed policies depends on many factors	0.9%	1.2%	10.7%	46.7%	40.5%
Future ecological conditions are never 100% guaranteed	0.8%	1.5%	8.5%	39.8%	49.3%

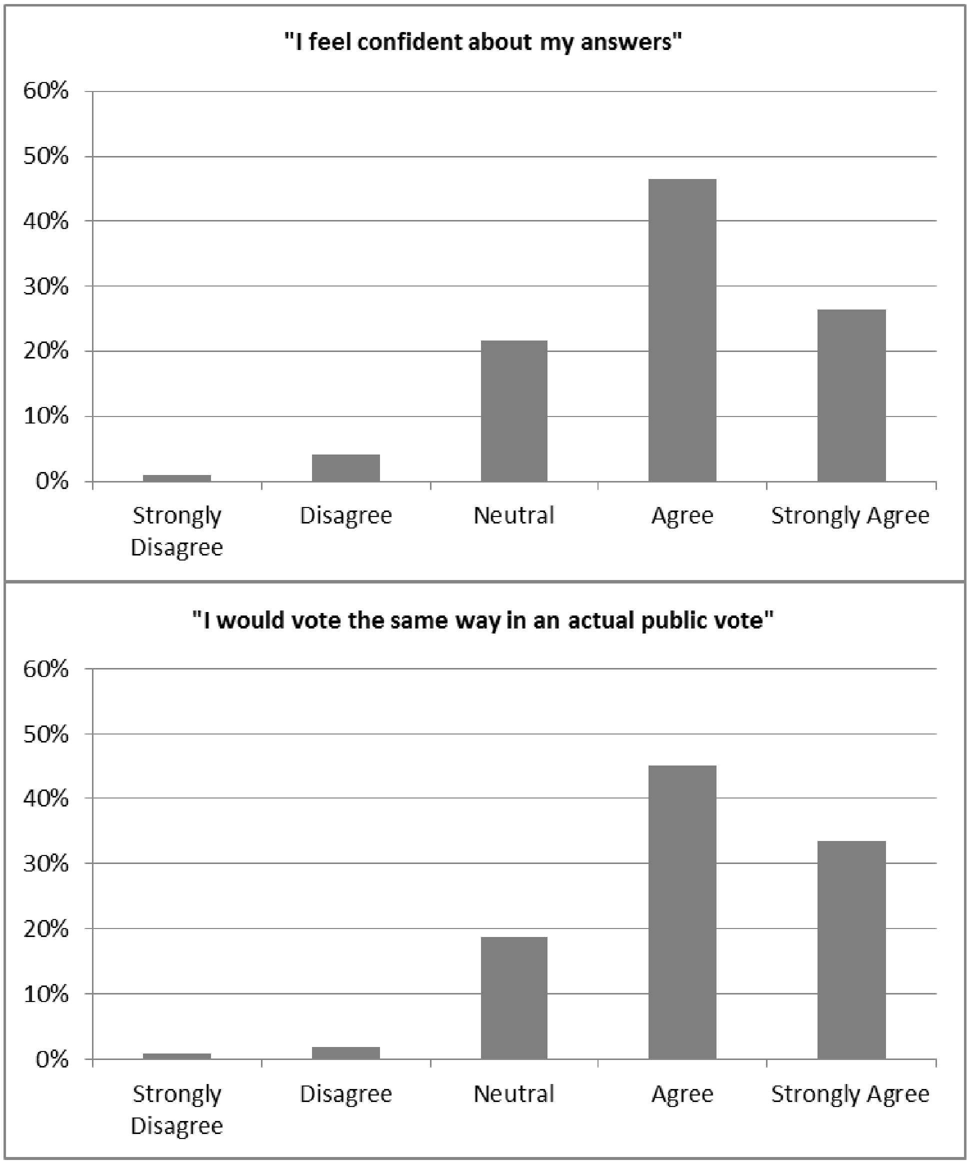

Figure 2 – Summary of Responses to Questions Regarding Respondent Confidence Across All Survey Regions

6 The Random Utility Model

6.1 Model Estimation for each Survey Region

EPA's analysis of the 316(b) stated preference survey data is grounded in the random utility model of Hanemann (1984) and McConnell (1990). The use of the random utility model is standard in the stated preference literature for attribute-based experiments such as choice experiments, and allows well-defined welfare measures, i.e., WTP, to be derived from choice experiment models (Bennett and Blamey 2001; Bateman et al. 2002). From a purely mechanistic perspective, survey results will be used to derive total values following standard practice for choice experiments (Adamowicz et al. 1998). Under the random utility model, "utility is the sum of systematic [or observed] and random [or unobserved] components" (Holmes and Adamowicz 2003, p. 189). The individual choices are treated as systematic (i.e., deterministic) while the random component reflects researcher uncertainty about the choice (i.e., to capture all factors that influence the choices that are observed or known by the respondents but unobserved by the researcher) (Holmes and Adamowicz 2003).

The random utility models for all four regions and the national survey were estimated using maximum likelihood mixed logit. The mixed logit model is an approach for modeling preference heterogeneity based on the assumption that individual's preferences are randomly distributed and that heterogeneity in population preferences can be captured by estimating the mean and variance of the random parameter distributions (Holmes and Adamowicz 2003). As described by Hensher and Greene (2003), "the mixed logit model offers an extended framework within which to capture a greater amount of behavioral choice making. Broadly speaking the mixed logit model aligns itself much more with reality than most discrete choice models with every individual having their own inter-related systematic and random components for each alternative in their perceptual choice set(s)" (p. 170). It is a highly flexible model that "obviates the three limitations of standard logit by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time" (Train 2009, p.134). The mixed logit model allows for the possibility of preference heterogeneity but cannot attach specific parameter values to particular individuals. That is, the mixed logit (ML) model relaxes the assumption of respondents being identical (required for multinomial logit estimation), replacing it with less restrictive assumption that respondents are identically distributed. The theory and methods of mixed logit modeling are well-established (Train 2009), and it has now become standard practice in many areas of research (Hensher and Greene 2003). These models allow for coefficients on attributes to be distributed across sampled individuals according to a set of estimated coefficients and researcher-imposed restrictions. The model is evaluated numerically using random draws because choice probabilities take the form of an integral over a mixing distribution which does not have a closed form (Train 2009). The likelihood simulation for the models used 300 Halton (random) draws.

Economic theory provides guidance regarding some, but not all, aspects of model specification for mixed logit models within stated preference choice experiments. For example, the parameter on program cost is expected to have a negative sign, reflecting a positive marginal utility of income. To allow for this, preliminary models included specifications in which the coefficient on cost was modeled as (1) fixed, (2) lognormal, and (3) bounded triangular. These are among the most common specifications that impose the desired sign on the cost coefficient (Hensher and Greene 2003; Johnston and Bergstrom 2011). Coefficients on all variables except that on program cost (*cost*) are specified as random with a normal distribution.

EPA tested various statistical models based on survey data for the Northeast region. Comparison of model outputs for the Northeast survey suggest that the best overall model fit and greatest robustness of results (or stability across model specifications) is achieved when cost is modeled as fixed. The Northeast model with a lognormal distribution of cost and free correlation of random parameters converged with a slightly lower overall model χ^2 (512.36, d.f. = 27) than the model with a fixed cost coefficient and free correlation. In addition, resulting WTP estimates are sensitive to assumptions made regarding observations in the tails of the distribution (cf. Hensher and Greene 2003; Johnston and Bergstrom 2011). Given that mixed logit models such as these are nonlinear and estimated using simulated likelihood methods, it is possible for a seemingly less constrained model (e.g., with a lognormal cost distribution) to converge with a lower log likelihood χ^2 than an otherwise parallel model with a fixed cost coefficient. The Northeast model, in which the parameter on cost is specified with a bounded triangular distribution, also converges with a lower model χ^2. This is likely due in part to additional necessary constraints imposed on this model to ensure a parameter estimate in the positive domain (e.g., the model is constrained such that the parameter estimate is equal to the spread; because of this constraint, free correlation among random parameters is disallowed).

Although similar results and WTP estimates are generated with all preliminary model specifications, the illustrated model leads to somewhat more conservative WTP estimates than other model variants. The model allows free (unrestricted) correlation among all model parameters. The results of the models for each region are presented in Table 8 through Table 12. The definition of variables included the model are presented in Table 7. Mixed logit model statistics suggest good statistical fit across the survey versions. Across the models the χ^2 values ranged from 389.97 to 989.68 (all with d.f. = 21, p<0.0001) and pseudo R^2 ranged from 0.22 to 0.29. See Table 8 through Table 12 for detail on the significance of the model estimated for each survey version. Direct comparisons of statistical fit measures across different choice experiments in the literature can be misleading and should be viewed with extreme caution. Many measures of model fit are not directly comparable across different datasets or models. Nonetheless, the overall statistical fit of the model appears broadly similar to choice experiments found in the published literature addressing environmental improvements both worldwide and in the U.S. Johnston et al. (2011a,b), in a similar survey of ecological improvements, report a χ^2 of 533.62 (d.f. = 12, p<0.0001) and a pseudo R^2 of 0.30. By way of comparison using a commonly reported measure of model fit (pseudo or McFadden R^2), Campbell et al. (2009) report a pseudo R^2 of 0.20; Carlsson et al. (2003) report pseudo R^2 values between 0.12 and 0.27; Do and Bennett (2009) report pseudo R^2 between 0.07 and 0.18; and Colombo and Hanley (2008) report values between 0.16 and 0.36. Other measures of fit are also similar—although again caution must be exercised when drawing conclusions from any such comparisons across models.

Table 7—Variables Included with the Preliminary Random Utility Models for the Regional and National Surveys

Question	Variable Definition
Random parameters in utility functions	
CONSTANT	Alternative specific constant (ASC) associated with the status quo, or choice of neither plan.
COM_FISH	Score showing the overall health of commercial and recreational fish populations.
FISH_POP	Score showing the estimated size of all fish populations compared to natural levels without human influence.
FISH_SAV	Score showing the reduction in young fish lost compared to current levels.
AQUATIC	Score showing the ecological condition of affected areas, compared to the most natural waters in the region (e.g., Northeast).
Nonrandom parameters in utility functions	
COST	The increase in annual household cost, in unavoidable price increases for products and services, including electricity and common household products.

Table 8—Preliminary Results for the Northeast Region [a,b]

Variable	Coefficient [c]	Standard Error	Coefficient/St. Error	P-value P[|Z| > z]
Random parameters in utility functions				
CONSTANT	-0.08269	0.36139	-0.229	0.8190
COM_FISH	0.20338	0.05351	3.801	0.0001
FISH_POP	0.07493	0.08347	0.898	0.3693
FISH_SAV	0.03044	0.00519	5.868	0.0000
AQUATIC	0.20973	0.08991	2.333	0.0197
Nonrandom parameters in utility functions				
COST	-0.02792	0.00447	-6.239	0.0000
Derived standard deviations for parameter distributions				
sdCONSTANT-	0.03823	1.05647	0.036	0.9711
sdCOM_FISH-	0.17539	0.28451	0.616	0.5376
sdFISH_POP-	0.17880	0.31559	0.567	0.5710
sdFISH_SAV-	0.05615	0.01159	4.845	0.0000
sdAQUATIC-	0.26680	0.33937	0.786	0.4318

[a] The mixed logit results have a χ^2 of 518.40 (d.f. = 21, p<0.0001) and a pseudo R^2 of 0.22.

[b] EPA received a total of 421 completed surveys for the Northeast region. Not all of these observations were data entered at the time of model estimation for this memorandum due to time constraints. The preliminary Northeast model was estimated based on 394 observations. The additional survey responses will be included in the analysis for the final rule.

[c] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

Table 9—Preliminary Results for the Southeast Region [a,b]

Variable	Coefficient [c]	Standard Error	Coefficient/St. Error	P-value P[|Z| > z]
Random parameters in utility functions				
CONSTANT	0.08004	0.34193	0.234	0.8149
COM_FISH	0.12104	0.04574	2.646	0.0081
FISH_POP	0.12531	0.07138	1.756	0.0791
FISH_SAV	0.02568	0.00536	4.788	0.0000
AQUATIC	0.23161	0.07885	2.937	0.0033
Nonrandom parameters in utility functions				
COST	-0.03487	0.00351	-9.925	0.0000
Derived standard deviations for parameter distributions				
sdCONSTANT-	0.02489	1.16784	0.021	0.9830
sdCOM_FISH-	0.09525	0.16377	0.582	0.5608
sdFISH_POP-	0.09301	0.13918	0.668	0.5040
sdFISH_SAV-	0.06804	0.00952	7.146	0.0000
sdAQUATIC-	0.12186	0.12918	0.943	0.3455

[a] The mixed logit results have a χ^2 of 683.29 (d.f. = 21, p<0.0001) and a pseudo R^2 of 0.24.

[b] EPA received a total of 506 completed surveys for the Southeast region. Not all of these observations were data entered at the time of model estimation for this memorandum due to time constraints. The preliminary Southeast model was estimated based on 470 observations. The additional survey responses will be included in the analysis for the final rule.

[c] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

Table 10—Preliminary Results for the Pacific Region [a,b]

Variable	Coefficient [c]	Standard Error	Coefficient/St. Error	P-value P[|Z| > z]
Random parameters in utility functions				
CONSTANT	0.24593	0.54100	0.455	0.6494
COM_FISH	0.10278	0.10424	0.986	0.3241
FISH_POP	0.14215	0.15130	0.940	0.3475
FISH_SAV	0.05323	0.01141	4.664	0.0000
AQUATIC	0.20853	0.16636	1.254	0.2100
Nonrandom parameters in utility functions				
COST	-0.02226	0.00483	-4.606	0.0000
Derived standard deviations for parameter distributions				
sdCONSTANT-	0.02585	1.92718	0.013	0.9893
sdCOM_FISH-	0.20354	0.15901	1.280	0.2005
sdFISH_POP-	0.14019	0.36490	0.384	0.7008
sdFISH_SAV-	0.13881	0.05278	2.630	0.0085
sdAQUATIC-	0.18715	0.50826	0.368	0.7127

[a] The mixed logit results have a χ^2 of 455.32 (d.f. = 21, p<0.0001) and a pseudo R^2 of 0.29.

[b] EPA received a total of 311 completed surveys for the Pacific region. Not all of these observations were data entered at the time of model estimation for this memorandum due to time constraints. The preliminary Pacific model was estimated based on 274 observations. The additional survey responses will be included in the analysis for the final rule.

[c] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

Table 11—Preliminary Results for the Inland Region [a,b]

Variable	Coefficient [c]	Standard Error	Coefficient/St. Error	P-value P[|Z| > z]
Random parameters in utility functions				
CONSTANT	-0.25032	0.35323	-0.709	0.4785
COM_FISH	0.09898	0.03205	3.088	0.0020
FISH_POP	0.11198	0.05370	2.085	0.0370
FISH_SAV	0.02470	0.00427	5.788	0.0000
AQUATIC	0.08669	0.06599	1.314	0.1890
Nonrandom parameters in utility functions				
COST	-0.03186	0.00272	-11.709	0.0000
Derived standard deviations for parameter distributions				
sdCONSTANT-	0.02650	2.01575	0.013	0.9895
sdCOM_FISH-	0.07322	0.16944	0.432	0.6656
sdFISH_POP-	0.06925	0.20775	0.333	0.7389
sdFISH_SAV-	0.05182	0.00773	6.706	0.0000
sdAQUATIC-	0.52674	0.40309	1.307	0.1913

[a] The mixed logit results have a χ^2 of 989.68 (d.f. = 21, p<0.0001) and a pseudo R^2 of 0.22.

[b] EPA received a total of 787 completed surveys for the Inland region. Not all of these observations were data entered at the time of model estimation for this memorandum due to time constraints. The preliminary Inland model was estimated based on 752 observations. The additional survey responses will be included in the analysis for the final rule.

[c] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

Table 12—Preliminary Results for the National Survey Version [a,b]				
Variable	**Coefficient [c]**	**Standard Error**	**Coefficient/St. Error**	**P-value P[|Z| > z]**
Random parameters in utility functions				
CONSTANT	-0.06065	0.60390	-0.100	0.9200
COM_FISH	0.17407	0.06579	2.646	0.0082
FISH_POP	0.25141	0.12384	2.030	0.0423
FISH_SAV	0.03938	0.01084	3.631	0.0003
AQUATIC	0.14043	0.13630	1.030	0.3029
Nonrandom parameters in utility functions				
COST	-0.03539	0.00461	-7.674	0.0000
Derived standard deviations for parameter distributions				
sdCONSTANT-	0.02280	1.82792	0.012	0.9900
sdCOM_FISH-	0.13724	0.52054	0.264	0.7921
sdFISH_POP-	0.11719	0.56426	0.208	0.8355
sdFISH_SAV-	0.10766	0.05600	1.922	0.0545
sdAQUATIC-	0.16083	1.21828	0.132	0.8950

[a] The mixed logit results have a χ^2 of 389.97 (d.f. = 21, p<0.0001) and a pseudo R^2 of 0.24.

[b] EPA received a total of 288 completed surveys for the National version. Not all of these observations were data entered at the time of model estimation for this memorandum due to time constraints. The preliminary N model was estimated based on 270 observations. The additional survey responses will be included in the analysis for the final rule.

[c] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

The variable for fish saved (*fish_sav*) is significant in all five models, commercial fish populations (*com_fish*) is significant in four of the five models, fish populations (all fish) (*fish_pop*) is significant in three of the five models, and aquatic ecological condition (*aquatic*) is statistically significant in two of the five models. The significance of these attributes suggests positive implicit prices (WTP for changes in the attributes alone). Analogous outcomes are common in choice experiments across the literature addressing aquatic ecological improvements, with the substantial majority of choice attributes found to have statistically significant impacts (e.g., Johnston et al. 2011a,b; Carlsson et al. 2003; Do and Bennett 2009). The alternative specific constant (ASC) (*constant*) is a fixed coefficient estimated within choice experiments that is designed to capture "systematic but unobserved information about why respondents chose a particular option (that is, unrelated to choice set attributes)" (Bennett et al. 2001). The ASC was not significant in any of the five models, which should be viewed as a desirable result. ASCs only become statistically significant in choice experiment models when elements other than the independent variables, or choice attributes, in the model influence respondents' choices (Kerr and Sharp 2006). Here, no such statistically significant effects were found. In other words, respondents are not willing to pay a positive or negative amount for a regulation that has no effects on ecological attributes. EPA views this as a desirable result.

As noted above, all variables except cost represent percent progress towards the upper ecological reference condition (100%). Hence, these coefficients may be directly interpreted as the relative marginal utility derived from a one percentage point change in each ecological attribute. In the estimated Northeast model, for example, marginal utility is greatest (per percentage point change) for increases in aquatic ecological condition (*aquatic*), with lower (but still statistically significant) impacts associated with changes in commercial fish populations (*fish_pop*) and the number of fish saved (*fish_sav*). As noted above, the percentage differences across the options presented were much larger for the number of fish saved (*fish_sav*) than for the other variables. Following recommended practice in stated preference valuation, these variations correspond with realistic ecological and policy expectations for regulatory outcomes (Bateman et al. 2002).

EPA notes that these model results are preliminary. At the time this memorandum was written, EPA had not completed the fielding and analyzing data from the non-response studies for the Southeast, Pacific, Inland and National survey versions. The models summarized in Table 8 to Table 12 do not include any weighting based on non-response studies. EPA intends to complete the non-response follow up studies for the other regions to estimate weighted models that would correct for potential non-response bias if needed. EPA also intends to apply a number of validity tests to examine the robustness and theoretical consistency of estimated WTP equations after the non-response studies have been completed for all versions. When these efforts are completed, EPA intends to post these findings on its website[10], and subject the complete survey results and analysis, including scope and validity testing, to external peer review.

6.2 Model Sensitivity to Scope

The role of external scope tests within choice modeling has been given relatively little attention in the literature (cf., Heberlein et al. 2005). Unlike open-ended contingent valuation questions, choice experiments provide a direct mechanism for respondents to react to the scope and scale of resource changes, by enabling respondents to compare policy options with different levels for each attribute. Hence, as noted by Bennett and Blamey (2001, p. 231), "internal scope tests are automatically available from the results of a [choice modeling] exercise." Within a choice modeling context, external scope tests may also be confounded by differences in the implied choice frame (Bennett and Blamey 2001). These caveats aside, an external scope test can provide some insight into response patterns, and many view these tests as a "stronger" form of validation than internal scope tests. EPA therefore implemented some preliminary external scope tests to evaluate this form of validity using the Northeast survey data.

The illustrated split-sample external validity test for the Northeast mail survey data is based on the concept that, if all else is orthogonal (effectively equal), a choice option with a greater number of fish saved should be chosen more often than a choice option with a lesser number of fish saved. To distinguish this from the "internal" scope tests automatically performed by choice experiments, it is implemented using a split sample of choice options viewed in isolation. To implement the test, we first create a dataset *only* of observations on Option A for all survey responses, along with the dummy (0-1) variable *choice*, indicating whether that option was chosen. We then further split this sample into three sub-samples: (1) observations on Option A when *fish_sav* = 95%, (2) observations on Option A when *fish_sav* = 50%, and (3) observations on Option A when *fish_sav* =5%. Because of the near orthogonal nature of the experimental design, all other attribute levels should be approximately equal across each of these three sub-samples. Given this split sample, we would expect to observe the greatest proportion of respondents choosing Option A in sub-sample (1), followed by sub-sample (2) and then (3). This order would establish external sensitivity to scope. We then repeat the same test for Option B.

Results of the test are presented below in Table 13, which illustrates means and standard deviations for *choice* and attributes over each observation of Option A and Option B. The values of other choice attributes (*com_fish*, *fish_pop*, *aquatic*, and *cost*) are approximately equal over the split samples as one

[10] http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/

would expect, given the experimental design. The proportion of respondents choosing Option A (*choice*) declines from 0.45 to 0.42 to 0.25 as the percentage of fish saved (*fish_sav*) declines from 95% to 50% to 5%. Option B exhibits a similar decline in *choice* with *fish_sav*. This external scope tests for split samples of both Options A and B demonstrate scope sensitivity, as indicated by economic theory.

Table 13—Results of the Split-Sample External Validity Test for the Northeast Survey Data

Variable	Option A		Option B	
	Mean	Std. Dev.	Mean	Std. Dev.
Fish Saved = 95%				
CHOICE	**0.4538**	0.4986	**0.4854**	0.5005
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	45.3866	2.0736	45.3077	2.0187
FISH_POP	28.0560	1.1647	28.5199	1.2591
FISH_SAV	**95.0000**	0.0000	**95.0000**	0.0000
AQUATIC	52.3305	1.2441	52.2334	1.2500
COST	42.3866	20.8902	44.1804	21.7200
Fish Saved = 50%				
CHOICE	**0.4212**	0.4945	**0.4313**	0.4960
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	45.0630	1.9802	45.4469	2.0762
FISH_POP	28.2493	1.2169	28.4187	1.2742
FISH_SAV	**50.0000**	0.0000	**50.0000**	0.0000
AQUATIC	52.2808	1.2323	52.2906	1.2569
COST	41.8109	20.4754	41.6250	20.6614
Fish Saved = 5%				
CHOICE	**0.2514**	0.4344	**0.2452**	0.4308
CONSTANT	0.0000	0.0000	0.0000	0.0000
COM_FISH	45.2938	2.1432	45.3333	2.1172
FISH_POP	28.4379	1.3350	28.3278	1.2054
FISH_SAV	**5.0000**	0.0000	**5.0000**	0.0000
AQUATIC	52.4407	1.2474	52.3636	1.2077
COST	40.0678	19.6789	38.9752	19.8014

7 Estimation of Implicit Prices and WTP

EPA used the preliminary results of the random utility models described in Section 6.1to estimate the marginal annual WTP (or implicit price) for a one percentage point change in each of the four environmental attributes within each survey region. This represents WTP per household, per year, for a one percentage point change in the corresponding choice model attribute. For example, one could calculate the marginal WTP for each additional percentage increase in fish saved, holding all else constant. If utility is modeled as a linear function of attributes, implicit prices may be calculated as $IP_a = {}^{\beta_a}/_{\beta_n}$, where β_a is the estimated coefficient on a non-monetary attribute (e.g., change in fish saved), and β_n is the coefficient on program cost.

Assuming a linear preference function as estimated above, compensating surplus (or household WTP) for any given policy option may be calculated as:[11]

$$CS = \sum_{a=1}^{A} IP_a * (\Delta Attribute_a),$$

where *a=1…A* represents the number of distinct non-price attributes in the model, and $\Delta Attribute_a$ is the change in attribute *a* resulting from the policy. Relevant attributes are *com_fish*, *fish_pop*, *fish_sav* and *aquatic* (see Table 21 for variable definitions). Compensating surplus for any non-status quo policy option is calculated as:

$$CS = (IP_{com\_fish} * \Delta com\_fish) + (IP_{fish\_pop} * \Delta fish\_pop) + (IP_{fish\_sav} * \Delta fish\_sav) + (IP_{aquatic} * \Delta aquatic)$$

where the delta (Δ) represents a change in the attribute in question. That is, total WTP for a policy change is calculated as the sum of the product of implicit prices and corresponding attribute changes. The implicit price for the ASC (*constant*) was excluded when calculating compensating surplus because it was found to be insignificant during model estimation. See Section 6.1 for additional discussion of the ASC and its interpretation.

EPA notes that ecological systems are typically characterized by correlation among many processes and outcomes. In the context of impingement and entrainment losses, for example, a reduction in A1E losses (*fish_sav*) maybe correlated with changes in fish populations (*fish_pop*), aquatic ecosystem condition (*aquatic*), and commercial fish populations (*com_fish*). Were the stated preference survey scenarios to incorporate the same correlations, it would be difficult to determine which attribute(s) caused respondents to choose one scenario over another. For example, if large reductions in I&E losses always accompany large positive effects on fish populations and large positive effects on ecosystem condition within survey scenarios (and vice versa), it would be difficult to estimate the relative influence of each effect on respondents' choices.

The experimental design used in the stated preference survey breaks this correlation, allowing different survey attributes to vary independently. This enables different respondents to view many different possible policy outcomes, each with different combinations of *fish_sav*, *fish_pop*, *aquatic* and *com_fish*. While some of the resulting scenarios might be unlikely in actual aquatic systems, they are not ecologically impossible. For example, the experimental design allows respondents to consider scenarios in which large reductions in fish losses accompany small changes in fish populations and aquatic condition (positive changes in *fish_sav* in some questions are also paired with no change in the population or aquatic condition metrics). Because attributes vary independently across the 72 different choice questions presented to respondents in each survey region, it is possible to estimate the unique effects of each attribute on individuals' choices and therefore, values. By breaking the correlation between these attributes present in ecosystems, the choice experiment design allows estimation of the independent effect of each attribute on choices and willingness to pay.

These attributes have almost zero correlation in the resulting experimental design. It is thus possible to obtain precise (i.e., efficient) estimates of each effect, without concerns that these estimates are confounded by correlations among the ecological outcomes in the survey. This allows WTP for each ecological effect to be estimated, independent from all other effects.

[11] EPA excluded the ASC when estimating the benefits of regulatory options. The sign of the mean implicit price for the ASC varies across the survey regions. It is negative for Northeast, Inland, and National versions and positive for the Southeast and Pacific versions.

Because the mixed logit model includes random coefficients, EPA estimates implicit prices using the welfare simulation approach of Johnston and Duke (2007; 2009) following the framework outlined by Hensher and Greene (2003).[12] The procedure begins with a parameter simulation following the parametric bootstrap of Krinsky and Robb (1986), with R=1000 draws taken from the mean parameter vector and associated covariance matrix. For each draw, the resulting parameters are used to characterize asymptotically normal empirical densities for fixed and random coefficients. For each of these R draws, a coefficient simulation is then conducted for each random coefficient, with S=1000 draws taken from simulated empirical densities. Here, all coefficient simulations draw from a normal distribution except for that on *cost*, which is fixed. WTP measures are calculated for each draw, resulting in a combined empirical distribution of $R \times S$ observations from which summary statistics are derived. All implicit prices are modeled as the WTP for a one percentage point change in the ecological attribute all else being constant. The resulting empirical distributions accommodate both the sampling variance of parameter estimates and the estimated distribution of random parameters. We follow Hu et al. (2005) and simulate welfare estimates as the mean over the parameter simulation of mean WTP calculated over the coefficient simulation (i.e., mean of mean WTP).

As shown in Table 14, the estimated implicit prices are uniformly larger for commercial fish populations, fish populations (all fish), and aquatic ecosystem condition than fish saved. In the Northeast, for example, households value a one percentage point increase in commercial fish populations or aquatic ecosystem condition about seven times more than a one percentage point increase in fish saved. Although the discussion in this section refers to WTP for a percentage point increase in fish saved, it is important to note that this variable represents a one percentage point reduction relative to the baseline mortality (e.g., the Northeast survey booklet indicated a baseline loss of 1.1 billion fish). This relationship between the percentage point reduction and cardinal fish losses was specified clearly in survey questions, and the same relationship was maintained throughout each survey version. Again, using the Northeast survey as an example, EPA is presenting the WTP for a percentage point reduction of mortality which is associated with a specific absolute quantity of fish out of 1.1 billion fish, rather than a general, relative reduction of one percent from an unspecified level of I&E mortality. The regional and national surveys have different baseline fish losses. EPA expected survey responses to vary across the regions, both because residents might have different values, and because baseline losses differ. The implicit prices reflect this expected variation. EPA plans to explore whether respondents are more sensitive to the representation of fish saved in percentage terms, or in absolute numbers.

[12] This is the same approach applied by Johnston et al. (2011a; 2012).

Table 14— Estimated Implicit Prices for a One Percentage Point Change in Each Attribute , WTP per household, per Year (2011$)

Region/Attribute	Implicit Price [a]	Standard Deviation	90% Confidence Interval 5th	95th
Northeast				
ASC (*CONSTANT*)	-$2.42	$13.39	-$22.52	$19.88
Commercial Fish Populations (*COM_FISH*)	$7.35	$2.15	$4.14	$11.14
Fish Populations (all fish) (*FISH_POP*)	$2.66	$3.13	-$2.32	$7.71
Fish Saved (*FISH_SAV*)	$1.12	$0.22	$0.76	$1.50
Aquatic Ecosystem condition (*AQUATIC*)	$7.66	$3.40	$2.35	$13.45
Southeast				
ASC (*CONSTANT*)	$2.47	$10.02	-$13.51	$18.97
Commercial Fish Populations (*COM_FISH*)	$3.49	$1.42	$1.30	$5.89
Fish Populations (all fish) (*FISH_POP*)	$3.57	$2.08	$0.27	$6.98
Fish Saved (*FISH_SAV*)	$0.75	$0.18	$0.46	$1.04
Aquatic Ecosystem condition (*AQUATIC*)	$6.61	$2.12	$3.00	$10.00
Pacific				
ASC (*CONSTANT*)	$11.72	$26.76	-$28.73	$54.17
Commercial Fish Populations (*COM_FISH*)	$4.67	$5.26	-$3.16	$13.35
Fish Populations (all fish) (*FISH_POP*)	$6.43	$7.32	-$5.12	$17.61
Fish Saved (*FISH_SAV*)	$2.52	$0.80	$1.39	$3.90
Aquatic Ecosystem condition (*AQUATIC*)	$9.50	$7.67	-$3.03	$22.38
Inland				
ASC (*CONSTANT*)	-$7.82	$11.37	-$26.28	$10.93
Commercial Fish Populations (*COM_FISH*)	$3.10	$1.07	$1.43	$4.83
Fish Populations (all fish) (*FISH_POP*)	$3.48	$1.72	$0.75	$6.30
Fish Saved (*FISH_SAV*)	$0.78	$0.14	$0.55	$1.01
Aquatic Ecosystem condition (*AQUATIC*)	$2.70	$2.11	-$0.84	$6.16
National				
ASC (*CONSTANT*)	-$2.09	$17.57	-$30.91	$25.01
Commercial Fish Populations (*COM_FISH*)	$4.93	$2.03	$1.84	$8.34
Fish Populations (all fish) (*FISH_POP*)	$7.04	$3.56	$1.35	$12.78
Fish Saved (*FISH_SAV*)	$1.13	$0.32	$0.59	$1.68
Aquatic Ecosystem condition (*AQUATIC*)	$3.94	$4.00	-$2.72	10.56

[a] The implicit prices are per percentage point increase from the specified baseline (reference) levels. They are not directly transferable to scenarios with alternative baseline levels.

8 Method for Estimating Regional and National Benefits

The implicit prices presented in Table 14 could be used to estimate annual monetized benefits for the survey regions and total U.S. households under regulatory options. Annual WTP per household for a regulatory option can be calculated by multiplying changes in environmental attributes due to the regulation (fish saved, commercial fish populations, fish populations (all fish), and aquatic ecosystem condition) by their respective implicit prices, or WTP per percentage point change. The models use a linear approximation for utility, so the implicit price of each attribute is constant.

The annual household WTP under each regulatory option could be estimated solely based on changes in fish saved (*fish_sav*) by multiplying its implicit price by the percentage change in fish saved. EPA has calculated the marginal change in fish saved (%) under each regulatory option based on the percentage reduction in A1E losses relative to baseline A1E losses within the survey region.[13] The resulting estimates of A1E reductions and percentage fish saved for each survey region and the United States are presented in Table 15. Confidence intervals for annual household WTP would be calculated based on the 5th and 95th percentile from the empirical distribution of the implicit price for fish saved (see Table 14). Changes in commercial fish populations, fish populations (all fish), and aquatic ecosystem condition could also factor into the calculation of household WTP; however, EPA has not modeled changes in these drivers of WTP. Within the context of the model, using only changes in fish saved would result in conservative estimates of benefits, in that it assumes zero impacts on all other choice model attributes. EPA notes that while monetized benefits based solely on fish saved would be conservative within the framework of the survey results and model, there are other reasons why the WTP estimates might be biased, as discussed previously.

As described previously, the regions for the stated preference survey differ from the benefits regions used for the analysis of the proposed rule.[14] EPA estimated the A1E reductions in Table 15 by applying state-level data for facility actual intake flow (AIF) to regional A1E reductions from the proposed rule. EPA believes that the use of flow to extrapolate A1E reductions is appropriate for this regional and national level analysis. It is important to note that the generalized relationship between flow and A1E described, as well as any resulting estimates of WTP for percent of fish saved, which are based on specific regional levels of baseline losses, may not hold at specific sites around the country.

[13] For its 316(b) analyses, EPA standardized all I&E mortality losses into equivalent numbers of 1-year-old fish, or A1E. This conversion allows losses to be compared among species, years, facilities, and regions. Refer to Section 3 of the Environmental and Economic Benefits Analysis (EEBA) of the proposed rule (USEPA 2011a) for additional detail on EPA's assessment of baseline A1E losses and reductions in A1E losses under regulatory options.

[14] See Table 3 for the list of states included in each survey region.

Table 15—Reduction in A1E Losses and Fish Saved (%) by Survey Version and Regulatory Option

Survey Version and Regulatory Option	Reduction in A1E Losses	Fish Saved (%)
Northeast		
Eliminating Baseline I&E Mortality Losses [a]	964.87	100.00
Option 1	78.31	8.12
Option 2	880.70	91.28
Option 3	893.73	92.63
Option 4	77.29	8.01
Southeast		
Eliminating Baseline I&E Mortality Losses	722.97	100.00
Option 1	271.41	37.54
Option 2	642.28	88.84
Option 3	651.70	90.14
Option 4	265.86	36.77
Pacific [b]		
Eliminating Baseline I&E Mortality Losses	385.99	100.00
Option 1	1.78	0.46
Option 2	33.28	8.62
Option 3	34.74	9.00
Option 4	1.73	0.45
Inland		
Eliminating Baseline I&E Mortality Losses	462.29	100.00
Option 1	263.48	56.99
Option 2	425.29	92.00
Option 3	433.38	93.75
Option 4	257.54	55.71
National Version		
Eliminating Baseline I&E Mortality Losses	2536.13	100.00
Option 1	614.97	24.25
Option 2	1981.55	78.13
Option 3	2013.55	79.39
Option 4	602.42	23.75

[a] This hypothetical scenario reflects the benefits that would be achieved if all I&E mortality losses were eliminated. EPA includes it to allow comparison of regulatory option benefits to total baseline I&E mortality losses. This scenario was listed as "Baseline I&E Losses" in the EEBA for the proposed rule.

[b] The calculation of Fish Saved (%) for the Pacific survey region includes reductions in A1E losses at Hawaii facilities. This approach is consistent with the EEBA which included Hawaii facilities in the California region. EPA did not apply household WTP to Hawaii households when estimating regulatory benefits because Hawaii households were not included in the mail survey sample.

Regulatory Scenarios: Option 1 = IM limitations based on modified traveling screens for all facilities with flow greater than 2 million gallons per day (MGD); Option 2 = Intake flow commensurate with closed-cycle cooling for facilities that have a design intake flow of greater than 125 MGD and IM limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; Option 3 = Intake flow commensurate with closed-cycle cooling for all facilities and IM limitations based on modified traveling screens for all facilities with flow greater than 2 MGD; Option 4 = IM limitations based on modified traveling screens for all facilities with flow greater than 50 million gallons per day (MGD).

If the results of the stated preference survey are to be used for the final rule, EPA would calculate the total annual WTP within each survey regions under each regulatory option by multiplying the annual household WTP by the number of households in the survey region. See Table 3 for the number of households in each survey region. Annual WTP for each survey region would then be discounted based on the regulatory compliance schedule. The compliance schedule is a time profile that reflects when benefits from each facility will be realized. It is based on the anticipated timeline of rule implementation and biological considerations. EPA estimated a separate compliance schedule for each 316(b) region for the proposed rule. The compliance schedule for each survey region would be calculated by weighting each 316(b) regional schedule based on its contribution to total regional A1E reductions under regulatory options. Refer to Appendix D of the EEBA for the proposed rule (USEPA 2011a) for additional description of the compliance schedule. Since the compliance schedule moves the reductions in A1E into the future, this step will reduce the present value of the total benefits accrued to households decreasing annualized benefits estimates.

Annualized national benefits could be calculated as the sum of regional benefits or based on the national survey version. If the results are to be used for the final rule, EPA would conduct additional analysis to compare the results and evaluate the validity of these two approaches for estimating benefits to U.S. households.[15] As described previously, the model estimates a constant marginal WTP (or implicit price) per percentage point reduction in baseline mortality, regardless of how much progress has already been made in reducing I&E mortality. EPA notes that this simplification, while common in many types of benefit analysis, does not allow one to quantify or test theoretically-expected effects such as diminishing marginal WTP, i.e., that the more of a good an individual has, the less she is willing to pay for an additional unit. Relative to a diminishing marginal utility form, the linear functional form likely produces lower estimates of WTP at low percentages of fish saved, and higher estimates of WTP at high percentages of fish saved. This fact could affect the relative attractiveness of regulatory options from a cost-benefit viewpoint; therefore, EPA will also investigate alternative non-linear functional forms that relax the assumption of constant utility. As noted earlier, EPA has not yet completed fielding the non-response studies and analyzing the non-response data for the Southeast, Pacific, Inland, and National versions. The implicit prices presented in Table 14 do not include any adjustments or weighting based on the non-response studies. EPA expects to improve the accuracy of preliminary implicit prices by incorporating the results of the non-response studies for all survey versions. EPA will post these results on the Agency's website[16] once they become available. EPA will also make adjustments to the estimation methodology that may be necessary to address issues of representativeness that arise as a result of the Agency's continuing efforts at scope and validity testing, public comment that results from the NODA, and comments from the planned external peer review. As already noted, EPA will carefully consider those comments and results before determining what role quantified benefits based on this stated preference survey should play in the benefits analysis for the final rule. The Northeast non-response study has been completed and a weighted model and implicit prices based on its results are discussed in Section 9.3.

EPA notes that benefits estimated based on the stated preference survey should not be viewed as additive to those benefit values estimated at proposal. Values estimated using the stated preference survey would represent both use and non-use willingness-to-pay. As a result, if EPA includes the quantified benefits derived from the stated preference survey in the final benefits analysis, those benefits will supplant the previous benefit estimates.

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[15] EPA notes that the preliminary benefit estimates generated using the implicit prices presented in Table 14 should not be viewed as additive to those benefit values estimated at proposal. As a result, if EPA includes quantified benefits derived from the stated preference survey in the final benefits analysis, those benefits will supplant the previous benefit estimates.

[16] http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/

9 Non-Response Study and Preliminary Results Using a Weighted Model for the Northeast Region

9.1 Non-Response Study

EPA is also conducting a follow-up study of households that did not return a completed mail survey to identify whether survey non-respondents are fundamentally different than survey respondents by asking them a few demographic and attitudinal questions. Their responses are compared statistically to the main mail survey sample to indicate whether there is any evidence of significant non-response bias in the completed mail survey sample. The follow-up study includes a set of key attitudinal and socio-demographic variables that are thought to be associated with WTP for reducing fish mortality from cooling water intake systems (CWIS). EPA anticipates that respondents will need approximately five minutes to complete the short questionnaire.

EPA's target sample across all regions for the non-response study is 600 completed questionnaires. This sample size will permit EPA to reject the hypothesis of no difference in population percentages between respondents and non-respondents in characteristics of interest (yes/no type) with 80 percent power when a two-sided statistical test shows a difference of 12 percentage points. The subsample of non-respondents is being contacted using a combination of Priority Mail and telephone. In total, EPA planned to achieve 400 completed surveys in the Priority Mail subsample and 200 completed questionnaires in the telephone subsample. EPA allocated the target non-response completed surveys to each survey region in proportion to the mail survey sample size of each region (see Table 3). The resulting non-response targets are presented in Table 16.

As described previously, EPA implemented the Northeast mail survey and non-response study in advance of other regions. EPA has not yet completed the non-response studies for the Southeast, Pacific, Inland and the national survey versions. For 109 total non-response contacts in the Northeast region, the initial target sample sizes were 73 and 36 for the Priority Mail and telephone subsample, respectively. EPA implemented the Priority Mail component in advance of the telephone component. Questionnaires were sent to 146 non-responding households based on an anticipated 50% response rate (73/0.5). The anticipated response rate was based on prior studies that administered surveys via Priority Mail. The selected households were sent a preview letter one week in advance of the questionnaire, which included a $2 incentive. EPA actually received 48 completed questionnaires from the Priority Mail subsample, for a 33% response rate (48/146). Because the Priority Mail response was lower than expected, the target number of telephone completed surveys was increased to obtain the desired number of responses.

EPA randomly selected 331 households for the telephone survey from the subset of households with matched telephone numbers that did not complete the main mail survey or Priority Mail questionnaire. Fifty-one of the households had been previously sent a completed Priority Mail questionnaire but did not return it. The other 280 households (330-51) were sent a preview letter including a $2 incentive one week before the first telephone contact attempt. EPA made up to 12 attempts to achieve telephone contacts with the selected households. EPA stopped telephone calls after reaching 63 completed questionnaires within the 331 selected households, for a response rate of 19%.

Responses to the Northeast non-response questionnaires were compared statistically to the responses of the main mail survey to determine whether weighting or statistical adjustment was necessary to minimize non-response bias in the main mail survey sample. See Section 9.2 for additional detail on the non-response analysis. Refer to the ICR (EPA ICR# 2402.01) for additional details regarding the non-response study and sampling design.

Table 16—Target Sample Sizes for the Non-Response Study			
	Completed Questionnaires Target		
Survey Region	**Priority Mail Subsample**	**Telephone Subsample**	**Total**
Northeast	73	36	109
Southeast	98	49	147
Inland	128	64	192
Pacific	51	25	76
Total for Regional Surveys Versions	350	175	524
National Survey Version	50	25	76

9.2 Results of the Northeast Non-Response Study

EPA received 111 completed responses to the short questionnaire administered to sampled households in the Northeast survey region that did not respond to the main survey. Descriptive statistics for the non-response study include:

- Number of households contacted: 426 households (280 received only the telephone call , 95 received only the Priority Mail survey, and 51 received both the telephone call and Priority Mail survey).
- Number of complete responses received: 111 households (48 by mail and 63 by telephone).
- Priority Mail response rate: 33% (48 completed surveys out of 146 households).
- Telephone response rate: 19% (63 completed surveys out of 331 households contacted).

Table 17 provides demographic characteristics for participants in the Northeast non-response study. EPA tested for statistical differences between respondents and non-respondents to the main mail survey for a set of eight key demographic characteristics. Table 18 presents the results of hypothesis testing for age, gender, education, employment, the importance of aquatic ecosystems, Hispanic or Latino origin, race, and income. T-testing was used for age, the only cardinal variable in this group, and the Mann Whitney U Test and χ^2 Test of Proportions were used for categorical and ordinal variables. Gender and education were found to be statistically different across the respondent and non-respondent populations. For other variables, we do not reject the null hypothesis of equal means across populations.

The non-response survey included two attitudinal questions asking participants to rank the importance of protecting aquatic ecosystems and to rank how involved government should be in environmental regulation. Responses to these two questions are summarized in Figure 3. The question regarding the importance of protecting aquatic ecosystems was included in both the main mail survey and the non-response survey. As shown in Table 18, hypothesis testing indicated that rankings for the importance of protecting aquatic ecosystems were not statistically different for respondent and non-respondent samples. The question about how involved government should be in environmental protection was worded differently between the main and non-response survey so we did not compare those questions in this document.

Table 17—Demographic Characteristics of the Main and Non-Response Samples for the Northeast Survey Region

Statistic	Value/Percent of Sample[a]	
	Main Mail Sample[b]	Non-Response Sample
Average age of respondents	54.6	53.7
Percent of respondents under 65[c]	74.6%	73.9%
Percent male respondents[d]	63.9%	44.5%
Percent currently employed	63.6%	62.7%
Percent employed under age 65	76.9%	79.3%
Highest Level of Education		
Less than High School	4.2%	4.5%
High School or Equivalent	15.7%	27.3%
High School +Technical School	10.2%	4.5%
One or More Years of College	23.9%	17.3%
Bachelor's Degree	22.7%	27.3%
Graduate Degree	23.2%	19.1%
Hispanic or Latino Origin	5.1%	5.6%
Racial Category[e]		
American Indian or Alaskan Native	3.1%	2.9%
Black or African American	7.5%	11.4%
Native Hawaiian or Other Pacific Islander	1.3%	0.0%
Asian	5.7%	2.9%
White	86.6%	85.7%
Average Household Size	2.5	2.6
Number of household members 16 or older	2.0	2.1
Total Household Income [f]		
Average	$88,880	$81,480
Standard Deviation	$69,309	$68,486
Consume commercially caught fish or seafood	91.9%	84.7%
Consume recreationally caught fish or seafood	46.4%	47.7%

Notes:
[a] Respondents did not answer a given demographic question were excluded when calculating percentages.
[b] The demographic statistics presented here for the main mail sample are based on all 421 observations. Note all EPA received a total of 421 completed mail surveys for the Northeast region. The demographic statistics presented here in this table are based on all 421 observations. Not all of these observations were data entered at the time respondent and non-respondent characteristics were statistically compared for this memorandum due to time constraints. The statistical comparisons and the preliminary Northeast model were estimated based on 394 observations. The additional survey responses will be included in the analysis for the final rule.
[c] Compares to 79% for 18+ population based on Census 2010
[d] The population is 48.6% male averaging across Northeast states, based on the American Community Survey 2005-2009.
[e] Racial percentages sum to more than 100% due to some individuals checking more than one racial category box. The survey did not have a box specifically indicating two or more races.
[f] The survey asked respondents to select one of eight categories for annual household income. The average and standard deviation reported here were calculated using the midpoint of each range. $250,000 was used for the highest income category included in the survey ("$250,000 or more").

Table 18—Results from Comparison of Demographic Characteristics of Survey Respondents and Non-Respondents for the Northeast Region[a]

Variable	T-test	Mann Whitney U Test	χ^2 Test of Proportions
	P-value	Two-sided Pr >|Z|	Probability
Age	0.5404	-	-
Gender	**-**	**0.0001**	**0.0001**
Education	**-**	**0.2532**	**0.0360**
Employment	-	0.9841	0.9837
Importance of Aquatic Ecosystems	-	0.6205	0.9010
Hispanic/Latino	-	0.6825	0.6814
Race	-	0.7004	0.5335
Income	-	0.3993	0.9781

Notes:
[a] Hypothesis testing was used to compare the respondent and non-respondent samples and identify statistical differences. T-testing was used for age, the sole cardinal demographic variable assessed. The Mann Whitney U Test (or Wilcoxon rank-sum test) and χ^2 Test of Proportions are preferred for comparing samples of categorical and ordinal variables. The null hypothesis for all three tests is equality of means across respondents and non-respondents.

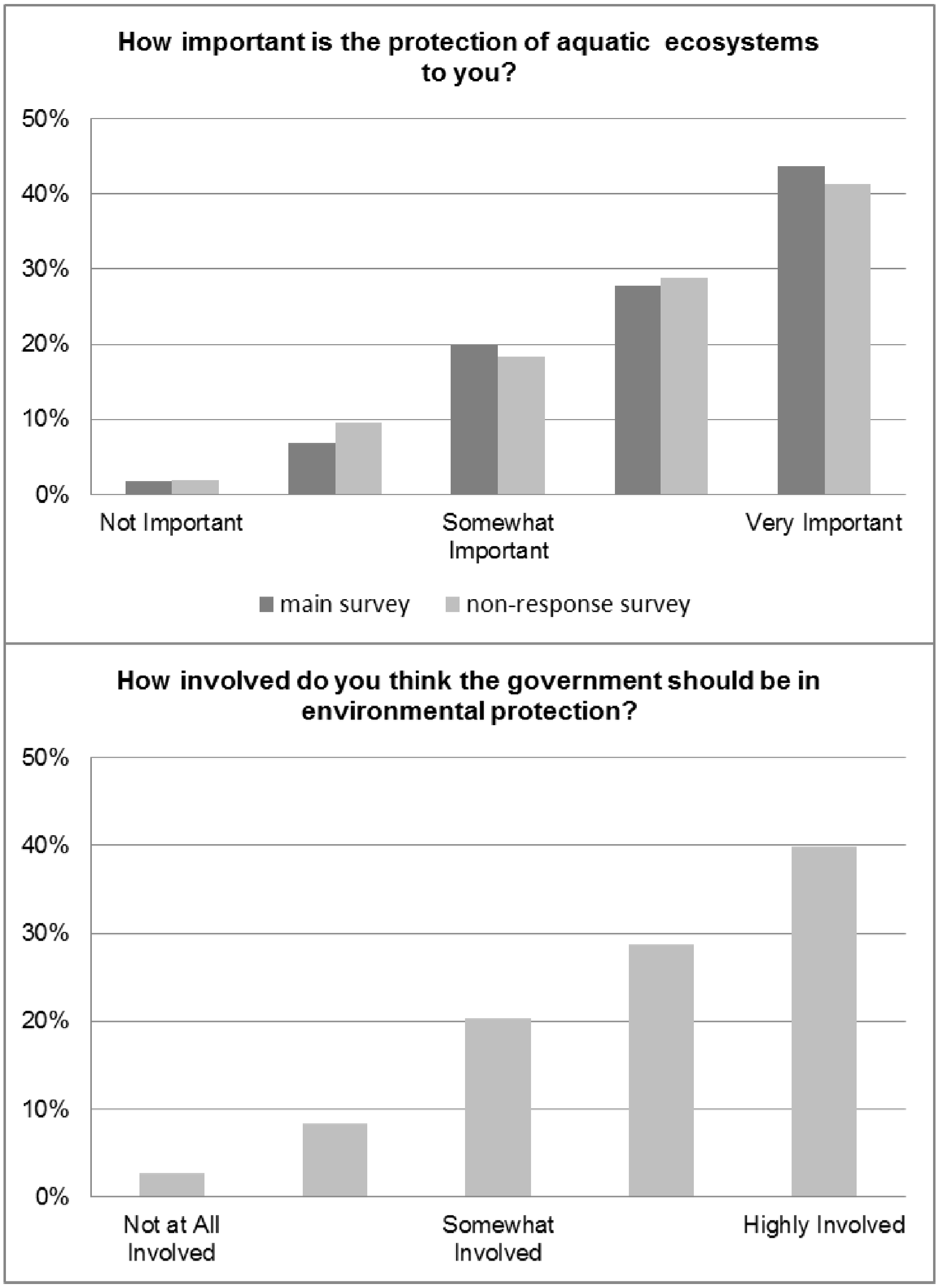

Figure 3 – Summary of Responses to Attitudinal Questions Included in the Non-Response Survey for the Northeast Region

EPA conducted additional analysis with the unweighted Northeast model to evaluate the need to include weights to account for differences in gender and education. EPA did this by re-estimating the unweighted random utility model with interactions for two dummy variables: (1) college, which identifies college education respondents, and (2) female, which identifies female respondents. This random utility model with interactions is presented in Table 19. Results from the unweighted model with interactions are inconclusive overall. Mixed logit model statistics indicate a statistical fit that is comparable to the model without interactions, with a model χ^2 of 510.93 (d.f. = 33, p<0.0001) and a pseudo R^2 of 0.22. The interaction variables *college*com_fish*, *college*fish_sav*, and *female*fish_sav* are individually statistically significant. However, taken as a group the set of interactive terms does not improve the model and we fail to reject the null hypothesis of zero joint influence. The result of the joint test of significance indicate that a weighted model may not be needed, but individual significance of some of the interacted education and gender variables point to the possible need to develop a weighted model.

Table 19—Results for the Preliminary Unweighted Model for the Northeast Survey Region Including Interactions for Education (*college*) and Gender (*female*)

Variable	Coefficient	Standard Error	Coefficient/St. Error	P-value P[|Z| > z]
Random parameters in utility functions				
CONSTANT	-0.11591	0.44143	-0.263	0.7929
COM_FISH	0.18027	0.06949	2.594	0.0095
FISH_POP	0.07348	0.10314	0.712	0.4762
FISH_SAV	0.02767	0.00857	3.228	0.0012
AQUATIC	0.17045	0.11677	1.460	0.1444
Nonrandom parameters in utility functions				
COST	-0.02720	0.00560	-4.854	0.0000
COLLEGE*CONSTANT	0.21781	0.56578	0.385	0.7003
COLLEGE*COM_FISH	0.13960	0.07728	1.806	0.0708
COLLEGE*FISH_POP	0.01544	0.12576	0.123	0.9023
COLLEGE*FISH_SAV	0.04490	0.00830	5.410	0.0000
COLLEGE*AQUATIC	0.13699	0.12766	1.073	0.2832
COLLEGE*COST	-0.00679	0.00692	-0.981	0.3268
FEMALE *CONSTANT	-0.23947	0.53138	-0.451	0.6522
FEMALE *COM_FISH	0.01361	0.07840	0.174	0.8622
FEMALE *FISH_POP	0.07421	0.12132	0.612	0.5407
FEMALE *FISH_SAV	0.01836	0.00791	2.320	0.0203
FEMALE *AQUATIC	0.05411	0.12544	0.431	0.6662
FEMALE*COST	-0.00317	0.00746	-0.424	0.6714
Derived standard deviations for parameter distributions				
sdCONSTANT	0.03890	0.65397	0.059	0.9526
sdCOM_FISH	0.13270	0.09846	1.348	0.1777
sdFISH_POP	0.13294	0.21716	0.612	0.5404
sdFISH_SAV	0.08309	0.01321	6.289	0.0000
sdAQUATIC	0.28535	0.31368	0.910	0.3630

EPA decided to estimate a Northeast model with weights for gender and education based on the results of hypothesis testing described in this section and the individual significance of some of the interacted education and gender variables presented in Table 10. The estimated WTP values for reducing I&E

presented in Section 8 are based on this weighted model. Weighting to reduce non-response biases adjusts the weight given to individual observations in a statistical analysis. This adjustment is implemented so that the weight given to a particular subgroup of individuals within the analyzed sample matches the weight for the same subgroup in the desired population (Yansaneh 2003). Subgroups in this case are defined using demographic data on income and education, although they may be defined using any observable variable. The weighting process is as follows:

- Non-response adjustment weight for the i^{th} subgroup is given by $w_i = w_{1i} * w_{2i}$, where w_i is the final adjusted weight for the observation, w_{1i} is the initial (unadjusted) weight, and w_{2i} is the non-response adjustment factor.
- The default initial weight on each observation, w_{1i}, is equal to either 1 or $1/N$, where N is the number of observations.
- The representation (or proportion) of subgroup i in the target population is known, and is given by R_i. The representation (or proportion) of that subgroup in the sample is given by S_i.
- The adjustment factor w_{2i} is then calculated as R_i/S_i. The final weight given to each observation is then given by $w_i = w_{1i} \times R_i/S_i$.
- Subgroups are defined as individuals characterized by a particular combination of demographic or other attributes. The number of subgroups is generally equal to $\prod_r D_r$, where D_r is the number of possible outcomes (levels) for the r^{th} attribute. For example, non-response weighting according to gender (male vs. female) and education (no bachelor's degree vs. bachelor's degree or higher), has four subgroups (male without a bachelor's degree, male with a bachelor's degree, female without a bachelor's degree, and female with a bachelor's degree).

Table 20 summarizes the four subgroups included in the model and presents the proportion of respondents which fall in each subgroup. The proportions for the overall Northeast population were calculated using data from the 2010 American Community Survey. The preliminary results from the weighted model are presented in Table 21 below. EPA will continue to explore potential non-response bias and weighting as the results of the other regions and national survey results become available.

Table 20—Subgroups Included within the Weighted Model			
Subgroup	**Definition**	**Sample Proportion[a]**	**Population Proportion[b]**
M1	Male, age 18+, without a bachelor's degree	0.35	0.33
M2	Male, age 18+, with bachelor's degree of higher	0.30	0.14
F1	Female, age 18+, without a bachelor's degree	0.19	0.37
F2	Female, age 18+, with bachelor's degree of higher	0.16	0.16

Notes:
[a] The proportion of the sample in each subgroup was calculated based on respondents that provided both educational attainment and gender information.
[b] The proportion of the 18+ population within in each subgroup was calculated using 5-yr estimates of educational attainment within Northeast states from the 2010 American Community Survey.

Mixed logit model statistics for the weighted model suggest good statistical fit, with a model χ^2 of 478.67 (d.f. = 21, $p<0.0001$) and a pseudo $R^2$of 0.22. These statistics compare favorably to similar models in the published literature. The mixed logit model also shows significant improvements in fit over the comparable conditional logit model. See Section 6.1 for a discussion of the statistical fit across different choice experiments in the literature.

Results for the preliminary Northeast model with weights for education and gender are presented in Table 21 (refer to Table 7 for the definitions of variables included in the weighted model). Signs of all statistically significant variables are as expected. All model variables except for *fish_pop* (changes in fish populations) and *constant* (the alternative specific constant (ASC) for the status quo) are statistically significant. This implies that statistically significant and positive WTP is associated with increases in fish saved (*fish_sav*), commercial fish populations (*com_fish*), and aquatic ecological condition (*aquatic*). Stated another way, EPA can statistically reject the premise that the fish saved have no value, or that their value is zero. However, EPA did not find statistically significant WTP for increases in "all fish populations," *ceteris paribus*, at least within the range presented in survey scenarios. These patterns are robust across a wide range of model specifications. As noted above, all variables except cost represent percent progress towards the upper ecological reference condition (100%). Hence, these coefficients may be directly interpreted as the relative marginal utility derived from a one percentage point change in each ecological attribute. In the estimated model, for example, marginal utility is greatest (per percentage point change) for increases in aquatic ecological condition (*aquatic*), with lower (but still statistically significant) impacts associated with changes in commercial fish populations (*fish_pop*) and the number of fish saved (*fish_sav*).

Within the presented weighted model, four out of five primary choice attributes (80%)—fish saved (*fish_sav*), commercial fish populations (*com_fish*), aquatic ecological condition (*aquatic*), and program cost (*cost*)—are statistically significant at $p<0.052$ or better, which suggests positive implicit prices (WTP for changes in the attributes alone). These patterns are robust across a wide range of model specifications. By comparison, six out of seven primary attributes (86%) are statistically significant at the same level in Johnston et al. (2011b). Carlsson et al. (2003) report five out of six coefficients on choice attributes as similarly significant. Do and Bennett (2009) also report four out of five primary choice attributes as statistically significant, and (similar to the present analysis) find the choice attribute associated with broader fish species to be statistically insignificant. Analogous outcomes are common in choice experiments across the literature addressing aquatic ecological improvements, with the substantial majority of choice attributes found to have statistically significant impacts. Similarly, mixed findings with regard to the statistical significance of diagonal and below diagonal values in the Cholesky matrix are common—both statistically significant and insignificant effects are common.[17]

EPA notes that these weighted model results are preliminary. At the time of this memorandum, EPA has finished fielding the Northeast version of the mail survey, the first of five such versions (four regional and one national). EPA implemented the Northeast version in advance of the other versions as a pilot study to inform potential changes to other survey versions. EPA intends to apply a number of validity tests to examine the robustness and theoretical consistency of estimated WTP equations after other survey versions have completed fielding.

Table 21— Preliminary Results for the Northeast Model Weighted For Education and Gender [a,b]

Variable	Coefficient [c]	Standard Error	Coefficient/St. Error	P-value P[|Z| > z]
Random parameters in utility functions				
CONSTANT	-0.19167	0.34295	-0.559	0.5762
COM_FISH	0.14850	0.04921	3.018	0.0025
FISH_POP	0.09356	0.07931	1.180	0.2381
FISH_SAV	0.02712	0.00548	4.947	0.0000
AQUATIC	0.18299	0.09398	1.947	0.0515
Nonrandom parameters in utility functions				
COST	-0.02017	0.00393	-5.137	0.0000
Derived standard deviations for parameter distributions				
sdCONSTANT	0.03763	0.93582	0.040	0.9679
sdCOM_FISH	0.17587	0.14002	1.256	0.2091
sdFISH_POP	0.18098	0.21738	0.833	0.4051
sdFISH_SAV	0.05255	0.01532	3.430	0.0006
sdAQUATIC	0.24411	0.43106	0.566	0.5712

[a] The mixed logit results have a χ^2 of 478.67 (d.f. = 21, p<0.0001) and a pseudo R^2 of 0.22.

[b] EPA received a total of 421 completed surveys for the Northeast region. Not all of these observations were data entered at the time of model estimation for this memorandum due to time constraints. The preliminary Northeast model was estimated based on 394 observations. The additional survey responses will be included in the analysis for the final rule.

[c] For random parameters in utility functions, coefficients represent the estimated means of random parameter distributions.

[17] Within mixed logit estimation, the estimated Cholesky matrix characterizes the correlated distributions of random parameters; it may be used to calculate implied standard deviations random parameter distributions, as well as correlations among different random parameters. As described by Hensher and Greene (2003, p. 162), the Cholesky matrix "decompose[s] the standard deviation parameters into their attribute-specific … and attribute-interaction … standard deviations."

9.3 Implicit Prices and Annualized Benefits for the Northeast Region using the Weighted Model

EPA used the results of the weighted Northeast model to estimate the marginal annual WTP (or implicit price) for a one percentage change in each of the four environmental attributes within the Northeast U.S. The resulting implicit prices are presented in Table 22. For the Northeast region, the implicit prices are higher when using the weighted results. This increase is the net result of increases and decreases from weighting to decrease the impact of overrepresented groups and increase the impact of underrepresented groups. Based on the survey results, women and the college educated tend to express greater WTP for improvements in the environmental attributes. Weighting based on population proportions for gender and education (see Table 20) decreases the impact of the college educated thereby reducing WTP, and increases the importance of female respondents thereby raising WTP. Overall, these changes resulted in a net increase in estimated implicit prices. EPA will analyze the non-response data for Southeast, Pacific, Inland, and national surveys using an approach consistent with that of the Northeast non-response data. See Section 7 for a description of how EPA would use estimated implicit prices to estimate benefits under regulatory options.

Table 22— Estimated Implicit Prices for a One Percentage Point Change in Each Attribute in the Northeast, WTP per household, per Year based on the Weighted Model (2011$)

Attribute	Implicit Price [a]	Standard Deviation	90% Confidence Interval	
			5th	95th
ASC (*CONSTANT*)	-$8.61	$17.70	-$34.53	$20.23
Commercial Fish Populations (*COM_FISH*)	$7.55	$3.01	$3.37	$12.76
Fish Populations (all fish) (*FISH_POP*)	$4.75	$4.32	-$1.84	$11.62
Fish Saved (*FISH_SAV*)	$1.40	$0.38	$0.85	$2.08
Aquatic Ecosystem condition (*AQUATIC*)	$9.34	$5.03	$1.35	$18.14

[a] The implicit prices are per percentage point increase from the specified baseline (reference) levels. They are not directly transferable to scenarios with alternative baseline levels.

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Appendix A: Experimental Design for the Survey Regions

Table A-1—Experimental Design for the Northeast Survey Region

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
1	1	45%	30%	5%	52%	$48	48%	27%	5%	54%	$48
1	2	48%	28%	50%	51%	$60	48%	30%	95%	52%	$72
1	3	48%	27%	50%	52%	$72	45%	27%	50%	51%	$12
2	1	48%	30%	5%	52%	$48	43%	28%	50%	52%	$12
2	2	45%	28%	50%	54%	$24	48%	27%	50%	51%	$36
2	3	43%	27%	5%	54%	$36	45%	27%	95%	51%	$24
3	1	48%	30%	5%	51%	$48	48%	27%	5%	54%	$72
3	2	45%	28%	95%	54%	$60	45%	28%	95%	52%	$12
3	3	43%	28%	5%	54%	$12	43%	30%	50%	54%	$24
4	1	45%	28%	95%	54%	$72	43%	30%	5%	51%	$72
4	2	48%	30%	95%	52%	$36	45%	28%	50%	54%	$36
4	3	45%	27%	50%	51%	$60	43%	27%	95%	52%	$48
5	1	48%	27%	50%	52%	$24	45%	30%	50%	54%	$48
5	2	45%	27%	5%	51%	$36	43%	28%	5%	51%	$36
5	3	43%	30%	50%	54%	$12	45%	28%	5%	51%	$60
6	1	43%	28%	95%	52%	$36	43%	30%	5%	54%	$72
6	2	48%	27%	95%	54%	$60	48%	28%	95%	52%	$36
6	3	43%	28%	50%	51%	$48	45%	27%	50%	51%	$24
7	1	43%	30%	50%	54%	$48	43%	30%	95%	51%	$12
7	2	48%	28%	95%	51%	$24	45%	27%	5%	54%	$60
7	3	45%	27%	5%	51%	$36	48%	28%	50%	52%	$72
8	1	45%	30%	5%	51%	$36	45%	30%	95%	54%	$72
8	2	43%	28%	95%	51%	$60	48%	28%	50%	51%	$72
8	3	45%	28%	50%	52%	$60	43%	28%	5%	52%	$24
9	1	48%	27%	5%	54%	$72	48%	28%	50%	51%	$48
9	2	43%	30%	50%	51%	$24	45%	30%	95%	52%	$72
9	3	43%	28%	95%	52%	$12	43%	27%	95%	54%	$48
10	1	48%	30%	50%	51%	$60	43%	30%	50%	51%	$24
10	2	45%	28%	95%	54%	$48	45%	30%	95%	52%	$48
10	3	43%	28%	50%	52%	$36	48%	28%	95%	54%	$72
11	1	45%	28%	5%	51%	$12	48%	30%	95%	52%	$60
11	2	48%	30%	95%	54%	$60	43%	27%	5%	54%	$24
11	3	43%	30%	50%	52%	$36	45%	28%	5%	51%	$12
12	1	48%	28%	95%	51%	$36	48%	30%	50%	51%	$48
12	2	43%	27%	5%	54%	$60	45%	27%	95%	52%	$60
12	3	43%	30%	50%	52%	$72	43%	27%	50%	54%	$72
13	1	48%	27%	95%	54%	$24	48%	30%	5%	52%	$24

Table A-1—Experimental Design for the Northeast Survey Region

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
13	2	45%	27%	50%	51%	$12	43%	28%	95%	54%	$48
13	3	43%	30%	5%	52%	$60	45%	30%	5%	51%	$60
14	1	45%	30%	50%	54%	$36	48%	28%	95%	54%	$24
14	2	48%	28%	5%	52%	$60	45%	27%	95%	52%	$72
14	3	48%	27%	95%	51%	$48	43%	30%	50%	51%	$60
15	1	43%	27%	5%	54%	$36	45%	30%	50%	52%	$12
15	2	45%	27%	50%	52%	$48	48%	27%	5%	52%	$24
15	3	45%	30%	95%	51%	$72	43%	28%	50%	54%	$60
16	1	43%	28%	5%	54%	$48	48%	28%	50%	54%	$60
16	2	48%	30%	50%	54%	$48	45%	28%	5%	51%	$36
16	3	45%	27%	5%	52%	$72	43%	30%	95%	51%	$24
17	1	45%	27%	95%	54%	$48	45%	28%	95%	51%	$72
17	2	45%	27%	95%	52%	$24	45%	30%	50%	54%	$12
17	3	48%	28%	5%	54%	$12	48%	27%	50%	52%	$60
18	1	43%	27%	95%	52%	$48	43%	28%	5%	52%	$36
18	2	45%	27%	50%	54%	$12	48%	30%	5%	54%	$72
18	3	43%	30%	5%	51%	$24	48%	27%	95%	51%	$12
19	1	43%	30%	95%	51%	$12	48%	30%	5%	52%	$36
19	2	45%	27%	95%	52%	$60	43%	27%	95%	51%	$36
19	3	48%	28%	5%	52%	$72	45%	28%	5%	52%	$24
20	1	43%	30%	5%	52%	$60	48%	30%	5%	51%	$48
20	2	45%	30%	95%	51%	$12	45%	28%	50%	52%	$24
20	3	48%	28%	50%	54%	$36	43%	27%	5%	52%	$12
21	1	48%	27%	95%	51%	$72	48%	27%	5%	54%	$12
21	2	45%	30%	5%	54%	$24	43%	27%	50%	52%	$36
21	3	43%	28%	95%	52%	$24	48%	28%	95%	51%	$24
22	1	43%	27%	50%	51%	$60	43%	28%	5%	54%	$12
22	2	43%	30%	95%	54%	$72	45%	27%	50%	52%	$48
22	3	48%	27%	5%	52%	$12	43%	30%	95%	51%	$36
23	1	43%	27%	5%	51%	$24	43%	28%	5%	52%	$48
23	2	48%	27%	95%	52%	$12	48%	30%	95%	51%	$12
23	3	48%	28%	50%	51%	$48	45%	30%	95%	54%	$36
24	1	45%	28%	50%	52%	$12	48%	30%	50%	54%	$60
24	2	43%	27%	50%	54%	$72	45%	27%	5%	51%	$36
24	3	48%	30%	5%	54%	$24	43%	28%	95%	54%	$72

Notes:
"Com.fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.

Table A-2—Experimental Design for the Southeast Survey Region

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
1	1	42%	28%	25%	70%	$48	45%	25%	25%	72%	$48
1	2	45%	26%	55%	69%	$60	45%	28%	90%	70%	$72
1	3	45%	25%	55%	70%	$72	42%	25%	55%	69%	$12
2	1	45%	28%	25%	70%	$48	40%	26%	55%	70%	$12
2	2	42%	26%	55%	72%	$24	45%	25%	55%	69%	$36
2	3	40%	25%	25%	72%	$36	42%	25%	90%	69%	$24
3	1	45%	28%	25%	69%	$48	45%	25%	25%	72%	$72
3	2	42%	26%	90%	72%	$60	42%	26%	90%	70%	$12
3	3	40%	26%	25%	72%	$12	40%	28%	55%	72%	$24
4	1	42%	26%	90%	72%	$72	40%	28%	25%	69%	$72
4	2	45%	28%	90%	70%	$36	42%	26%	55%	72%	$36
4	3	42%	25%	55%	69%	$60	40%	25%	90%	70%	$48
5	1	45%	25%	55%	70%	$24	42%	28%	55%	72%	$48
5	2	42%	25%	25%	69%	$36	40%	26%	25%	69%	$36
5	3	40%	28%	55%	72%	$12	42%	26%	25%	69%	$60
6	1	40%	26%	90%	70%	$36	40%	28%	25%	72%	$72
6	2	45%	25%	90%	72%	$60	45%	26%	90%	70%	$36
6	3	40%	26%	55%	69%	$48	42%	25%	55%	69%	$24
7	1	40%	28%	55%	72%	$48	40%	28%	90%	69%	$12
7	2	45%	26%	90%	69%	$24	42%	25%	25%	72%	$60
7	3	42%	25%	25%	69%	$36	45%	26%	55%	70%	$72
8	1	42%	28%	25%	69%	$36	42%	28%	90%	72%	$72
8	2	40%	26%	90%	69%	$60	45%	26%	55%	69%	$72
8	3	42%	26%	55%	70%	$60	40%	26%	25%	70%	$24
9	1	45%	25%	25%	72%	$72	45%	26%	55%	69%	$48
9	2	40%	28%	55%	69%	$24	42%	28%	90%	70%	$72
9	3	40%	26%	90%	70%	$12	40%	25%	90%	72%	$48
10	1	45%	28%	55%	69%	$60	40%	28%	55%	69%	$24
10	2	42%	26%	90%	72%	$48	42%	28%	90%	70%	$48
10	3	40%	26%	55%	70%	$36	45%	26%	90%	72%	$72
11	1	42%	26%	25%	69%	$12	45%	28%	90%	70%	$60
11	2	45%	28%	90%	72%	$60	40%	25%	25%	72%	$24
11	3	40%	28%	55%	70%	$36	42%	26%	25%	69%	$12
12	1	45%	26%	90%	69%	$36	45%	28%	55%	69%	$48
12	2	40%	25%	25%	72%	$60	42%	25%	90%	70%	$60
12	3	40%	28%	55%	70%	$72	40%	25%	55%	72%	$72
13	1	45%	25%	90%	72%	$24	45%	28%	25%	70%	$24
13	2	42%	25%	55%	69%	$12	40%	26%	90%	72%	$48
13	3	40%	28%	25%	70%	$60	42%	28%	25%	69%	$60
14	1	42%	28%	55%	72%	$36	45%	26%	90%	72%	$24
14	2	45%	26%	25%	70%	$60	42%	25%	90%	70%	$72

Table A-2—Experimental Design for the Southeast Survey Region

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
14	3	45%	25%	90%	69%	$48	40%	28%	55%	69%	$60
15	1	40%	25%	25%	72%	$36	42%	28%	55%	70%	$12
15	2	42%	25%	55%	70%	$48	45%	25%	25%	70%	$24
15	3	42%	28%	90%	69%	$72	40%	26%	55%	72%	$60
16	1	40%	26%	25%	72%	$48	45%	26%	55%	72%	$60
16	2	45%	28%	55%	72%	$48	42%	26%	25%	69%	$36
16	3	42%	25%	25%	70%	$72	40%	28%	90%	69%	$24
17	1	42%	25%	90%	72%	$48	42%	26%	90%	69%	$72
17	2	42%	25%	90%	70%	$24	42%	28%	55%	72%	$12
17	3	45%	26%	25%	72%	$12	45%	25%	55%	70%	$60
18	1	40%	25%	90%	70%	$48	40%	26%	25%	70%	$36
18	2	42%	25%	55%	72%	$12	45%	28%	25%	72%	$72
18	3	40%	28%	25%	69%	$24	45%	25%	90%	69%	$12
19	1	40%	28%	90%	69%	$12	45%	28%	25%	70%	$36
19	2	42%	25%	90%	70%	$60	40%	25%	90%	69%	$36
19	3	45%	26%	25%	70%	$72	42%	26%	25%	70%	$24
20	1	40%	28%	25%	70%	$60	45%	28%	25%	69%	$48
20	2	42%	28%	90%	69%	$12	42%	26%	55%	70%	$24
20	3	45%	26%	55%	72%	$36	40%	25%	25%	70%	$12
21	1	45%	25%	90%	69%	$72	45%	25%	25%	72%	$12
21	2	42%	28%	25%	72%	$24	40%	25%	55%	70%	$36
21	3	40%	26%	90%	70%	$24	45%	26%	90%	69%	$24
22	1	40%	25%	55%	69%	$60	40%	26%	25%	72%	$12
22	2	40%	28%	90%	72%	$72	42%	25%	55%	70%	$48
22	3	45%	25%	25%	70%	$12	40%	28%	90%	69%	$36
23	1	40%	25%	25%	69%	$24	40%	26%	25%	70%	$48
23	2	45%	25%	90%	70%	$12	45%	28%	90%	69%	$12
23	3	45%	26%	55%	69%	$48	42%	28%	90%	72%	$36
24	1	42%	26%	55%	70%	$12	45%	28%	55%	72%	$60
24	2	40%	25%	55%	72%	$72	42%	25%	25%	69%	$36
24	3	45%	28%	25%	72%	$24	40%	26%	90%	72%	$72

Notes:
"Com.fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.

Table A-3—Experimental Design for the Pacific Survey Region

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
1	1	59%	36%	2%	53%	$48	62%	33%	2%	55%	$48
1	2	62%	34%	50%	52%	$60	62%	36%	95%	53%	$72
1	3	62%	33%	50%	53%	$72	59%	33%	50%	52%	$12
2	1	62%	36%	2%	53%	$48	57%	34%	50%	53%	$12
2	2	59%	34%	50%	55%	$24	62%	33%	50%	52%	$36
2	3	57%	33%	2%	55%	$36	59%	33%	95%	52%	$24
3	1	62%	36%	2%	52%	$48	62%	33%	2%	55%	$72
3	2	59%	34%	95%	55%	$60	59%	34%	95%	53%	$12
3	3	57%	34%	2%	55%	$12	57%	36%	50%	55%	$24
4	1	59%	34%	95%	55%	$72	57%	36%	2%	52%	$72
4	2	62%	36%	95%	53%	$36	59%	34%	50%	55%	$36
4	3	59%	33%	50%	52%	$60	57%	33%	95%	53%	$48
5	1	62%	33%	50%	53%	$24	59%	36%	50%	55%	$48
5	2	59%	33%	2%	52%	$36	57%	34%	2%	52%	$36
5	3	57%	36%	50%	55%	$12	59%	34%	2%	52%	$60
6	1	57%	34%	95%	53%	$36	57%	36%	2%	55%	$72
6	2	62%	33%	95%	55%	$60	62%	34%	95%	53%	$36
6	3	57%	34%	50%	52%	$48	59%	33%	50%	52%	$24
7	1	57%	36%	50%	55%	$48	57%	36%	95%	52%	$12
7	2	62%	34%	95%	52%	$24	59%	33%	2%	55%	$60
7	3	59%	33%	2%	52%	$36	62%	34%	50%	53%	$72
8	1	59%	36%	2%	52%	$36	59%	36%	95%	55%	$72
8	2	57%	34%	95%	52%	$60	62%	34%	50%	52%	$72
8	3	59%	34%	50%	53%	$60	57%	34%	2%	53%	$24
9	1	62%	33%	2%	55%	$72	62%	34%	50%	52%	$48
9	2	57%	36%	50%	52%	$24	59%	36%	95%	53%	$72
9	3	57%	34%	95%	53%	$12	57%	33%	95%	55%	$48
10	1	62%	36%	50%	52%	$60	57%	36%	50%	52%	$24
10	2	59%	34%	95%	55%	$48	59%	36%	95%	53%	$48
10	3	57%	34%	50%	53%	$36	62%	34%	95%	55%	$72
11	1	59%	34%	2%	52%	$12	62%	36%	95%	53%	$60
11	2	62%	36%	95%	55%	$60	57%	33%	2%	55%	$24
11	3	57%	36%	50%	53%	$36	59%	34%	2%	52%	$12
12	1	62%	34%	95%	52%	$36	62%	36%	50%	52%	$48
12	2	57%	33%	2%	55%	$60	59%	33%	95%	53%	$60
12	3	57%	36%	50%	53%	$72	57%	33%	50%	55%	$72
13	1	62%	33%	95%	55%	$24	62%	36%	2%	53%	$24
13	2	59%	33%	50%	52%	$12	57%	34%	95%	55%	$48
13	3	57%	36%	2%	53%	$60	59%	36%	2%	52%	$60
14	1	59%	36%	50%	55%	$36	62%	34%	95%	55%	$24
14	2	62%	34%	2%	53%	$60	59%	33%	95%	53%	$72

Table A-3—Experimental Design for the Pacific Survey Region

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
14	3	62%	33%	95%	52%	$48	57%	36%	50%	52%	$60
15	1	57%	33%	2%	55%	$36	59%	36%	50%	53%	$12
15	2	59%	33%	50%	53%	$48	62%	33%	2%	53%	$24
15	3	59%	36%	95%	52%	$72	57%	34%	50%	55%	$60
16	1	57%	34%	2%	55%	$48	62%	34%	50%	55%	$60
16	2	62%	36%	50%	55%	$48	59%	34%	2%	52%	$36
16	3	59%	33%	2%	53%	$72	57%	36%	95%	52%	$24
17	1	59%	33%	95%	55%	$48	59%	34%	95%	52%	$72
17	2	59%	33%	95%	53%	$24	59%	36%	50%	55%	$12
17	3	62%	34%	2%	55%	$12	62%	33%	50%	53%	$60
18	1	57%	33%	95%	53%	$48	57%	34%	2%	53%	$36
18	2	59%	33%	50%	55%	$12	62%	36%	2%	55%	$72
18	3	57%	36%	2%	52%	$24	62%	33%	95%	52%	$12
19	1	57%	36%	95%	52%	$12	62%	36%	2%	53%	$36
19	2	59%	33%	95%	53%	$60	57%	33%	95%	52%	$36
19	3	62%	34%	2%	53%	$72	59%	34%	2%	53%	$24
20	1	57%	36%	2%	53%	$60	62%	36%	2%	52%	$48
20	2	59%	36%	95%	52%	$12	59%	34%	50%	53%	$24
20	3	62%	34%	50%	55%	$36	57%	33%	2%	53%	$12
21	1	62%	33%	95%	52%	$72	62%	33%	2%	55%	$12
21	2	59%	36%	2%	55%	$24	57%	33%	50%	53%	$36
21	3	57%	34%	95%	53%	$24	62%	34%	95%	52%	$24
22	1	57%	33%	50%	52%	$60	57%	34%	2%	55%	$12
22	2	57%	36%	95%	55%	$72	59%	33%	50%	53%	$48
22	3	62%	33%	2%	53%	$12	57%	36%	95%	52%	$36
23	1	57%	33%	2%	52%	$24	57%	34%	2%	53%	$48
23	2	62%	33%	95%	53%	$12	62%	36%	95%	52%	$12
23	3	62%	34%	50%	52%	$48	59%	36%	95%	55%	$36
24	1	59%	34%	50%	53%	$12	62%	36%	50%	55%	$60
24	2	57%	33%	50%	55%	$72	59%	33%	2%	52%	$36
24	3	62%	36%	2%	55%	$24	57%	34%	95%	55%	$72

Notes:
"Com.fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.

Table A-4—Experimental Design for the Inland Survey Region

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
1	1	42%	37%	55%	44%	$48	45%	34%	55%	46%	$48
1	2	45%	35%	75%	43%	$60	45%	37%	95%	44%	$72
1	3	45%	34%	75%	44%	$72	42%	34%	75%	43%	$12
2	1	45%	37%	55%	44%	$48	40%	35%	75%	44%	$12
2	2	42%	35%	75%	46%	$24	45%	34%	75%	43%	$36
2	3	40%	34%	55%	46%	$36	42%	34%	95%	43%	$24
3	1	45%	37%	55%	43%	$48	45%	34%	55%	46%	$72
3	2	42%	35%	95%	46%	$60	42%	35%	95%	44%	$12
3	3	40%	35%	55%	46%	$12	40%	37%	75%	46%	$24
4	1	42%	35%	95%	46%	$72	40%	37%	55%	43%	$72
4	2	45%	37%	95%	44%	$36	42%	35%	75%	46%	$36
4	3	42%	34%	75%	43%	$60	40%	34%	95%	44%	$48
5	1	45%	34%	75%	44%	$24	42%	37%	75%	46%	$48
5	2	42%	34%	55%	43%	$36	40%	35%	55%	43%	$36
5	3	40%	37%	75%	46%	$12	42%	35%	55%	43%	$60
6	1	40%	35%	95%	44%	$36	40%	37%	55%	46%	$72
6	2	45%	34%	95%	46%	$60	45%	35%	95%	44%	$36
6	3	40%	35%	75%	43%	$48	42%	34%	75%	43%	$24
7	1	40%	37%	75%	46%	$48	40%	37%	95%	43%	$12
7	2	45%	35%	95%	43%	$24	42%	34%	55%	46%	$60
7	3	42%	34%	55%	43%	$36	45%	35%	75%	44%	$72
8	1	42%	37%	55%	43%	$36	42%	37%	95%	46%	$72
8	2	40%	35%	95%	43%	$60	45%	35%	75%	43%	$72
8	3	42%	35%	75%	44%	$60	40%	35%	55%	44%	$24
9	1	45%	34%	55%	46%	$72	45%	35%	75%	43%	$48
9	2	40%	37%	75%	43%	$24	42%	37%	95%	44%	$72
9	3	40%	35%	95%	44%	$12	40%	34%	95%	46%	$48
10	1	45%	37%	75%	43%	$60	40%	37%	75%	43%	$24
10	2	42%	35%	95%	46%	$48	42%	37%	95%	44%	$48
10	3	40%	35%	75%	44%	$36	45%	35%	95%	46%	$72
11	1	42%	35%	55%	43%	$12	45%	37%	95%	44%	$60
11	2	45%	37%	95%	46%	$60	40%	34%	55%	46%	$24
11	3	40%	37%	75%	44%	$36	42%	35%	55%	43%	$12
12	1	45%	35%	95%	43%	$36	45%	37%	75%	43%	$48
12	2	40%	34%	55%	46%	$60	42%	34%	95%	44%	$60
12	3	40%	37%	75%	44%	$72	40%	34%	75%	46%	$72
13	1	45%	34%	95%	46%	$24	45%	37%	55%	44%	$24
13	2	42%	34%	75%	43%	$12	40%	35%	95%	46%	$48
13	3	40%	37%	55%	44%	$60	42%	37%	55%	43%	$60
14	1	42%	37%	75%	46%	$36	45%	35%	95%	46%	$24
14	2	45%	35%	55%	44%	$60	42%	34%	95%	44%	$72

Table A-4—Experimental Design for the Inland Survey Region

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
14	3	45%	34%	95%	43%	$48	40%	37%	75%	43%	$60
15	1	40%	34%	55%	46%	$36	42%	37%	75%	44%	$12
15	2	42%	34%	75%	44%	$48	45%	34%	55%	44%	$24
15	3	42%	37%	95%	43%	$72	40%	35%	75%	46%	$60
16	1	40%	35%	55%	46%	$48	45%	35%	75%	46%	$60
16	2	45%	37%	75%	46%	$48	42%	35%	55%	43%	$36
16	3	42%	34%	55%	44%	$72	40%	37%	95%	43%	$24
17	1	42%	34%	95%	46%	$48	42%	35%	95%	43%	$72
17	2	42%	34%	95%	44%	$24	42%	37%	75%	46%	$12
17	3	45%	35%	55%	46%	$12	45%	34%	75%	44%	$60
18	1	40%	34%	95%	44%	$48	40%	35%	55%	44%	$36
18	2	42%	34%	75%	46%	$12	45%	37%	55%	46%	$72
18	3	40%	37%	55%	43%	$24	45%	34%	95%	43%	$12
19	1	40%	37%	95%	43%	$12	45%	37%	55%	44%	$36
19	2	42%	34%	95%	44%	$60	40%	34%	95%	43%	$36
19	3	45%	35%	55%	44%	$72	42%	35%	55%	44%	$24
20	1	40%	37%	55%	44%	$60	45%	37%	55%	43%	$48
20	2	42%	37%	95%	43%	$12	42%	35%	75%	44%	$24
20	3	45%	35%	75%	46%	$36	40%	34%	55%	44%	$12
21	1	45%	34%	95%	43%	$72	45%	34%	55%	46%	$12
21	2	42%	37%	55%	46%	$24	40%	34%	75%	44%	$36
21	3	40%	35%	95%	44%	$24	45%	35%	95%	43%	$24
22	1	40%	34%	75%	43%	$60	40%	35%	55%	46%	$12
22	2	40%	37%	95%	46%	$72	42%	34%	75%	44%	$48
22	3	45%	34%	55%	44%	$12	40%	37%	95%	43%	$36
23	1	40%	34%	55%	43%	$24	40%	35%	55%	44%	$48
23	2	45%	34%	95%	44%	$12	45%	37%	95%	43%	$12
23	3	45%	35%	75%	43%	$48	42%	37%	95%	46%	$36
24	1	42%	35%	75%	44%	$12	45%	37%	75%	46%	$60
24	2	40%	34%	75%	46%	$72	42%	34%	55%	43%	$36
24	3	45%	37%	55%	46%	$24	40%	35%	95%	46%	$72

Notes:
"Com.fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.

Table A-5—Experimental Design for the National Survey

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
1	1	54%	34%	25%	55%	$48	57%	31%	25%	57%	$48
1	2	57%	32%	55%	54%	$60	57%	34%	95%	55%	$72
1	3	57%	31%	55%	55%	$72	54%	31%	55%	54%	$12
2	1	57%	34%	25%	55%	$48	52%	32%	55%	55%	$12
2	2	54%	32%	55%	57%	$24	57%	31%	55%	54%	$36
2	3	52%	31%	25%	57%	$36	54%	31%	95%	54%	$24
3	1	57%	34%	25%	54%	$48	57%	31%	25%	57%	$72
3	2	54%	32%	95%	57%	$60	54%	32%	95%	55%	$12
3	3	52%	32%	25%	57%	$12	52%	34%	55%	57%	$24
4	1	54%	32%	95%	57%	$72	52%	34%	25%	54%	$72
4	2	57%	34%	95%	55%	$36	54%	32%	55%	57%	$36
4	3	54%	31%	55%	54%	$60	52%	31%	95%	55%	$48
5	1	57%	31%	55%	55%	$24	54%	34%	55%	57%	$48
5	2	54%	31%	25%	54%	$36	52%	32%	25%	54%	$36
5	3	52%	34%	55%	57%	$12	54%	32%	25%	54%	$60
6	1	52%	32%	95%	55%	$36	52%	34%	25%	57%	$72
6	2	57%	31%	95%	57%	$60	57%	32%	95%	55%	$36
6	3	52%	32%	55%	54%	$48	54%	31%	55%	54%	$24
7	1	52%	34%	55%	57%	$48	52%	34%	95%	54%	$12
7	2	57%	32%	95%	54%	$24	54%	31%	25%	57%	$60
7	3	54%	31%	25%	54%	$36	57%	32%	55%	55%	$72
8	1	54%	34%	25%	54%	$36	54%	34%	95%	57%	$72
8	2	52%	32%	95%	54%	$60	57%	32%	55%	54%	$72
8	3	54%	32%	55%	55%	$60	52%	32%	25%	55%	$24
9	1	57%	31%	25%	57%	$72	57%	32%	55%	54%	$48
9	2	52%	34%	55%	54%	$24	54%	34%	95%	55%	$72
9	3	52%	32%	95%	55%	$12	52%	31%	95%	57%	$48
10	1	57%	34%	55%	54%	$60	52%	34%	55%	54%	$24
10	2	54%	32%	95%	57%	$48	54%	34%	95%	55%	$48
10	3	52%	32%	55%	55%	$36	57%	32%	95%	57%	$72
11	1	54%	32%	25%	54%	$12	57%	34%	95%	55%	$60
11	2	57%	34%	95%	57%	$60	52%	31%	25%	57%	$24
11	3	52%	34%	55%	55%	$36	54%	32%	25%	54%	$12
12	1	57%	32%	95%	54%	$36	57%	34%	55%	54%	$48
12	2	52%	31%	25%	57%	$60	54%	31%	95%	55%	$60
12	3	52%	34%	55%	55%	$72	52%	31%	55%	57%	$72
13	1	57%	31%	95%	57%	$24	57%	34%	25%	55%	$24
13	2	54%	31%	55%	54%	$12	52%	32%	95%	57%	$48
13	3	52%	34%	25%	55%	$60	54%	34%	25%	54%	$60
14	1	54%	34%	55%	57%	$36	57%	32%	95%	57%	$24
14	2	57%	32%	25%	55%	$60	54%	31%	95%	55%	$72

Table A-5—Experimental Design for the National Survey

Survey Version	Choice Question	Option A					Option B				
		Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost	Com. Fish.	Fish. Pop	Fish Saved	Aq. Cond.	Cost
14	3	57%	31%	95%	54%	$48	52%	34%	55%	54%	$60
15	1	52%	31%	25%	57%	$36	54%	34%	55%	55%	$12
15	2	54%	31%	55%	55%	$48	57%	31%	25%	55%	$24
15	3	54%	34%	95%	54%	$72	52%	32%	55%	57%	$60
16	1	52%	32%	25%	57%	$48	57%	32%	55%	57%	$60
16	2	57%	34%	55%	57%	$48	54%	32%	25%	54%	$36
16	3	54%	31%	25%	55%	$72	52%	34%	95%	54%	$24
17	1	54%	31%	95%	57%	$48	54%	32%	95%	54%	$72
17	2	54%	31%	95%	55%	$24	54%	34%	55%	57%	$12
17	3	57%	32%	25%	57%	$12	57%	31%	55%	55%	$60
18	1	52%	31%	95%	55%	$48	52%	32%	25%	55%	$36
18	2	54%	31%	55%	57%	$12	57%	34%	25%	57%	$72
18	3	52%	34%	25%	54%	$24	57%	31%	95%	54%	$12
19	1	52%	34%	95%	54%	$12	57%	34%	25%	55%	$36
19	2	54%	31%	95%	55%	$60	52%	31%	95%	54%	$36
19	3	57%	32%	25%	55%	$72	54%	32%	25%	55%	$24
20	1	52%	34%	25%	55%	$60	57%	34%	25%	54%	$48
20	2	54%	34%	95%	54%	$12	54%	32%	55%	55%	$24
20	3	57%	32%	55%	57%	$36	52%	31%	25%	55%	$12
21	1	57%	31%	95%	54%	$72	57%	31%	25%	57%	$12
21	2	54%	34%	25%	57%	$24	52%	31%	55%	55%	$36
21	3	52%	32%	95%	55%	$24	57%	32%	95%	54%	$24
22	1	52%	31%	55%	54%	$60	52%	32%	25%	57%	$12
22	2	52%	34%	95%	57%	$72	54%	31%	55%	55%	$48
22	3	57%	31%	25%	55%	$12	52%	34%	95%	54%	$36
23	1	52%	31%	25%	54%	$24	52%	32%	25%	55%	$48
23	2	57%	31%	95%	55%	$12	57%	34%	95%	54%	$12
23	3	57%	32%	55%	54%	$48	54%	34%	95%	57%	$36
24	1	54%	32%	55%	55%	$12	57%	34%	55%	57%	$60
24	2	52%	31%	55%	57%	$72	54%	31%	25%	54%	$36
24	3	57%	34%	25%	57%	$24	52%	32%	95%	57%	$72

Notes:
"Com.fish" is an abbreviation for commercial fish populations score.
"Fish Pop." is an abbreviation for the fish populations (all fish) score.
"Aq. Cond." is an abbreviation for the aquatic ecosystem condition score.