

**SUPPORTING STATEMENT**  
**U.S. Department of Commerce**  
**National Oceanic & Atmospheric Administration**  
**Economic Analysis of Shoreline Treatment Options for Coastal New Hampshire**  
**OMB Control No. 0648-xxxx**

**B. COLLECTIONS OF INFORMATION EMPLOYING STATISTICAL METHODS**

**1. Describe (including a numerical estimate) the potential respondent universe and any sampling or other respondent selection method to be used. Data on the number of entities (e.g. establishments, State and local governmental units, households, or persons) in the universe and the corresponding sample are to be provided in tabular form. The tabulation must also include expected response rates for the collection as a whole. If the collection has been conducted before, provide the actual response rate achieved.**

*i. Potential Respondent Universe and Response Rate*

The potential respondent universe for this study includes residents aged 18 and over living in Census Block Groups located 1) in the two coastal counties in New Hampshire, 2) in Massachusetts within Census Block Groups bordering the Hampton-Seabrook Estuary, and 3) in Maine within Census Block Groups bordering the Piscataqua River. The sample will be stratified by households living in block groups bordering three water bodies of interest (Great Bay Estuary, Hampton-Seabrook Estuary, and Piscataqua River), as well as by residents of the 17 communities located in the coastal zone to enable subgroup analyses of interest.

The estimated total number of occupied households in the study region is 610,855 (US Census Bureau/American FactFinder, 2015a) and the estimated total population 18 years and over is 1,242,040 (US Census Bureau/American FactFinder, 2015b).

In terms of response rate, as a part of the 2010 decennial census, the U.S. Census Bureau reported mail back participation rates ranging from 51% to 78% for New Hampshire counties (US Census Bureau, 2010). Recent studies conducted in the region on similar topics being investigated in the present study were examined to determine a reasonable response rate. Johnston, Feurt, and Holland (2015) reported a response rate of 32.4% on their mail back contingent choice survey of Maine watershed residents; Myers et al. (2010) and Edwards et al. (2011) reported a 65% response rate from an intercept survey in the Delaware Bay to estimate the economic value of birdwatching; and ERG (2016) reported a 51% response rate from an online survey of New York households to understand preferences and values for shoreline armoring versus living shorelines and a 54% response rate from an online survey of New Jersey households to understand values of salt marsh restoration at Forsyth National Wildlife Refuge.

To better understand the social context of the issue in the region of interest, researchers talked with key partners to gather anecdotal information on the level of public knowledge,

interest, and awareness of shoreline treatment options. Additionally, researchers attended a public workshop for local property owners interested in learning how to protect their property from coastal flooding.

Based on the anecdotal information gathered, researchers anticipate heightened resident awareness and interest in the issue within the region, which may improve survey response rates. Given the response rates reported from mail back surveys in the study region achieved by Census, along with rates from topically comparable surveys in other similar areas, researchers plan for a response rate of approximately 25% plus an additional 10% from the incentive for a total response rate of 35%.

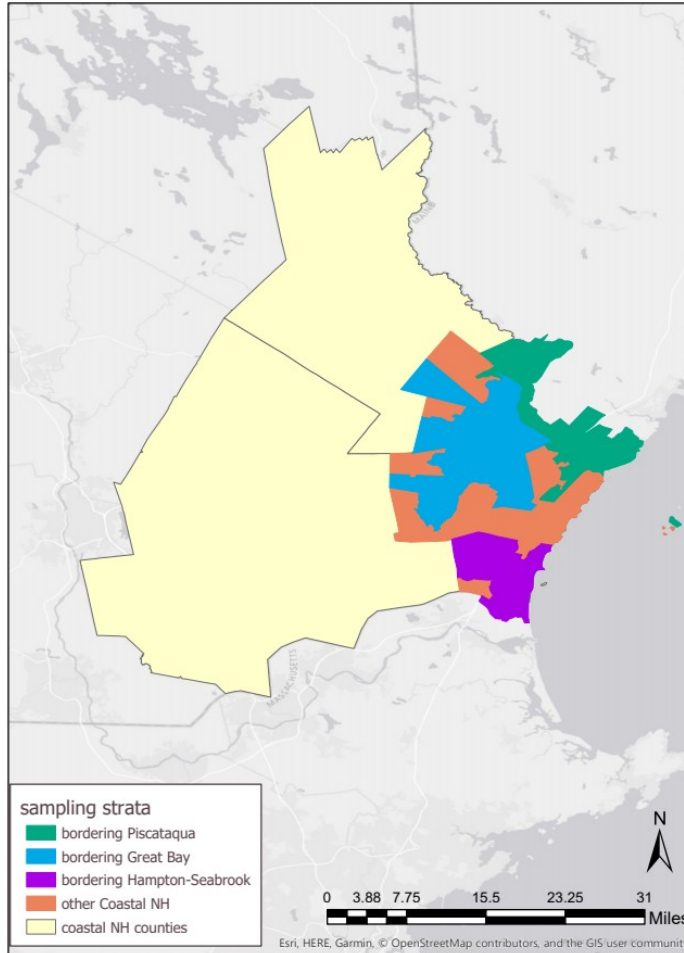
*ii. Sampling and Respondent Selection Method*

A pretest will be conducted on 450 individuals. We propose use of address-based sampling to select residential households randomly within each of the strata. The vendor that is contracted to supply data will secure the address-based frame.

Data will be collected using a two-stage stratified sampling design. The study region will be stratified geographically. Details of the strata are explained below. Within each stratum, we will be selecting households at random, and within each selected household, the individual with the next upcoming birthday who is aged 18 or older will be selected. Therefore, the primary sampling unit (PSU) is the household, and the secondary sampling unit (SSU) consists of individuals selected within each household. The proposed strata will allow the researchers to examine the influence of geographic proximity on respondent opinions and values.

The strata are comprised of the following (Figure 1):

1. Block groups bordering the Great Bay Estuary (bordering Great Bay)
2. Block groups bordering the Hampton-Seabrook Estuary (bordering Hampton-Seabrook)
3. Block groups bordering the Piscataqua River (bordering Piscataqua)
4. Block groups within the 17 coastal zone communities (other Coastal NH)
5. Block groups within the two coastal counties (coastal NH counties)



*Figure 1: Sampling geography by strata*

Table 1 provides a breakdown of the tentative estimated number of completed surveys desired for each stratum, along with the sample size per stratum, assuming a 35% response rate and 10% non-deliverable rate. The “coastal NH counties” strata is further stratified by county to help ensure geographic coverage.

As we are interested in comparing differences between strata, an equal allocation is used to minimize the sampling variance. However, the sample size for the “coastal NH counties” is doubled and proportionately allocated between the two counties to reduce the variance in sampling weights. See Section 2.v. below for more details.

The final sample size (completes and adjusted) for the final collection will be calculated with the assistance of the vendor selected to conduct the data collection, based on their expertise conducting similar surveys in the region of interest. Additionally, the final sample size for the final collection may be adjusted based on information gained after a pretest of the survey.

To approximate random selection of one respondent within the household, instruction will be given in the informational letter accompanying the survey package asking that the

survey be completed by the person in the household age of 18 or older who has the next upcoming birthday.

*Table 1: total households, pretest sample, final collection estimated completes needed, and final collection adjusted sample size by strata*

Strata	Sub-strata	Estimated Population 18 and over	Estimated Occupied Households	Pretest Sample	Completes Needed	Adjusted (35% Response Rate)	Adjusted (10% Non-Deliverable Rate)
Great Bay	--	30,037	12,237	90	384	1,098	1,221
Hampton-Seabrook	--	18,725	10,169	90	384	1,098	1,221
Piscataqua	--	30,638	16,891	90	384	1,098	1,221
other Coastal NH	--	63,165	28,511	90	384	1,098	1,221
coastal NH counties	Rockingham	160,393	77,121	129	552	1,578	1,752
	Strafford	59,036	30,091	51	216	618	687
TOTAL		361,994	175,020	540	2,304	6,588	7,323

**2. Describe the procedures for the collection, including: the statistical methodology for stratification and sample selection; the estimation procedure; the degree of accuracy needed for the purpose described in the justification; any unusual problems requiring specialized sampling procedures; and any use of periodic (less frequent than annual) data collection cycles to reduce burden.**

*i. Stratification and Sample Selection*

Residential households will be randomly selected from each stratum using an address-based frame procured from the U.S. Postal Service. The desired sample size for each stratum was calculated using Equation 1, provided above.

*ii. Weighting*

For obtaining population-based estimates of various parameters, each responding household will be assigned a sampling weight. The weights will be used to produce estimates that:

- are generalizable to the population from which the sample was selected;
- account for differential probabilities of selection across the sampling strata;
- match the population distributions of selected demographic variables within strata; and
- allow for adjustments to reduce potential non-response bias.

These weights combine:

- a base sampling weight which is the inverse of the probability of selection of the household;
- a within-stratum adjustment for differential non-response across strata; and
- a non-response weight.

Post-stratification adjustments will be made to match the sample to known population values (e.g., from Census data).

There are various models that can be used for non-response weighting. For example, non-response weights can be constructed based on estimated response propensities or on weighting class adjustments. Response propensities are designed to treat non-response as a stochastic process in which there are shared causes of the likelihood of non-response and the value of the survey variable. The weighting class approach assumes that within a weighting class (typically demographically-defined), non-respondents and respondents have the same or very similar distributions on the survey variables. If this model assumption holds, then applying weights to the respondents reduces bias in the estimator that is due to non-response. Several factors, including the difference between the sample and population distributions of demographic characteristics, and the plan for how to use weights in the regression models will determine which approach is most efficient for both estimating population parameters and for the stated-preference modeling.

*i. Experimental Design*

As the complexity of the research question increases (more vignette factors and/or more levels for the vignette factors), so does the number of possible vignette combinations. For the proposed study, the factorial combination of all six factors results in a population of  $3^6=729$  possible vignettes. However, this is neither useful (respondents would get tired of the repetition) nor required because three-way and higher-order interaction effects are rarely of importance. Therefore, the entire vignette population is systematically partitioned into small and mutually exclusive sets such that all main effects and two-way interaction effects remain estimable.

In order to create vignette sets, an optimized design of 18 vignettes was selected from the vignette population using the DoE.base package in R (Groemping, 2029). The “who pays” factor was then used as a blocking factor to form three sets of six vignettes – one set consisting of vignettes describing only residents of coastal New Hampshire paying, another describing all residents of New Hampshire paying, and another describing anyone who resides in or visits coastal New Hampshire paying. A set size of six vignettes was chosen for three reasons. First, six vignettes can be judged by each respondent without getting tired or frustrated over the repetitive task. Second, respondents can compare and assess the six vignettes simultaneously instead of sequentially. This helps to avoid sequence and carry over effects and, thus, increases the reliability of vignette measurements. Third, the systematic confounding according to the RBCF-3<sup>5</sup> design still allows us to estimate all main and two-way interaction effects without any confounding.

Splitting the overall vignette population into three “who pays” subpopulations is referred to

as a confounding factorial design and results in vignette sets that do not vary the “who pays” factor. Consequently, a single respondent will never see different “who pays” vignettes simultaneously, implying that this vignette factor is a *between-subjects* factor while all other vignette factors are *within-subjects* factors. It is essential in a between-subjects experiment that the potential respondents within the different vignette subpopulations are highly similar to each other so that extraneous respondent variables across subpopulations do not become confounding variables. To address this concern, the vignette subpopulations will be distributed evenly and randomly within each strata and respondent characteristics will be controlled for in analysis. Additionally, vignettes will be randomly ordered within sets to reduce ordering effects. The final design can be found in the Vignette supporting document.

ii. *Estimation Procedures*

The first step of analysis is to investigate whether respondents significantly differ between the three “who pay” vignette subpopulations. This is important because this is a between-subjects factor and prone to biases caused by differences between the respondent groups. However, given that the vignette subpopulations will be evenly and randomly distributed within each strata, the risk of bias is low.

The main component of the analysis is a multilevel model modeling with vignettes as level-one units and respondents as level-two units. The goal is to estimate the effects of the vignette factors and respondent characteristics on support for the proposed policies. The mathematical equation system for a multilevel model is as follows:

Vignette Level (Level 1):  $Y_{ij} = \beta_{0j} + X'_{ij}\beta + r_{ij}$

Respondent Level (Level 2):  $\beta_{0j} = \gamma_{00} + set'_j\gamma_{01} + \gamma_{02} vpay_j + strata'_j\gamma_{03} + resp'_j\gamma_{04} + u_{0j}$

In the level-one equation,  $Y_{ij}$  is the support level for vignette  $i$  judged by respondent  $j$ .  $\beta_{0j}$  is the random intercept for respondent  $j$ .  $X_{ij}$  is the design vector containing the levels of the vignette factors (wetlands, sand dunes, armoring, flooding, and erosion) and selected interaction terms and  $\beta$  is the corresponding coefficient vector. The error term,  $r_{ij}$ , is independent and identically normally distributed with mean zero and variance,  $\sigma_r^2$ .

In the level-two equation,  $\gamma_{00}$  represents the average intercept across respondents,  $set_j$  is the vector of set predictors and  $\gamma_{01}$  is the corresponding coefficient vector. The effect of “who pays” is given by  $\gamma_{02}$  where  $vpay_j$  represents who pays in the vignette. The sampling strata are given by the vector  $strata_j$  and  $\gamma_{03}$  is the corresponding coefficient vector. Alternate specifications for this vector could include a measure of distance from water or whether the respondent lives within a specified distance of specific water bodies of interest. Individual respondent characteristics are given by  $resp_j$  and  $\gamma_{04}$  is the corresponding coefficient vector. The error term,  $u_{0j}$ , is independent and identically normally distributed with mean zero and variance,  $\sigma_u^2$ .

iii. *Degree of Accuracy Needed for the Purpose Described in the Justification*

The following formula can be used to determine the minimum required sample size,  $n$ , for analysis

$$n = \frac{z^2 p(1-p)}{c^2}$$

Where  $z$  is the z-value required for a specified confidence level (here, 95%),  $p$  is the proportion of the population with a characteristic of interest (here,  $p=0.5$  conservatively), and  $c$  is the confidence interval (here, 0.05). Therefore,

$$n = \frac{1.96^2 \cdot 0.5 \cdot 0.5}{0.05^2} \approx 384$$

This means each strata requires a minimum sample size of 384 to be able to test for differences in means at the 95% confidence level with a 5% confidence interval. This will allow a sample size of 128 for each vignette set within each strata. For the pre-test, each strata will have a minimum sample size of 90 which will allow a sample size of 30 for each vignette set within each strata.

A power and sample-size (PSS) analysis will be conducted on the pre-test data to determine if the minimum required sample size needs to be modified. PSS analysis is commonly used to determine the size of the sample needed for the chosen statistical test to have adequate power to detect an effect of a specified magnitude at a pre-specified significance level given fixed values of other study parameters.

**3. Describe the methods used to maximize response rates and to deal with nonresponse. The accuracy and reliability of the information collected must be shown to be adequate for the intended uses. For collections based on sampling, a special justification must be provided if they will not yield "reliable" data that can be generalized to the universe studied.**

#### *Focus Groups*

The first step in achieving a high response rate is to develop a survey that is easy for respondents to complete. Researchers met with nine focus group members to determine 1) if they understood the tasks they were asked to complete, 2) their process for responding, 3) if they considered all outcomes or if any were missing, and 4) if enough information was provided for them to confidently respond.

Overall, the responses from the focus group participants were encouraging. Participants generally understood the instructions and made thoughtful, rational choice selections. They understood the outcomes in the experiment as coastal hazards are an important, relevant issue in coastal New Hampshire, and enough information was provided for them to make their selections.

#### *Implementation Techniques*

The implementation techniques that will be used are consistent with methods that maximize response rates. Researchers propose a mixed-mode system, employing mail contact and recruitment, following the Dillman Tailored Design Method (Dillman et al.,

2014), and online survey administration. To maximize response, potential respondents will be contacted multiple times via postcards and other mailings; this will include a pre-survey notification postcard, a letter of invitation, and follow-up reminders (see “Wave” supporting documents for postcard and letter text). Final survey administration procedures and design of the survey administration tool will be subject to the guidance and expertise of the vendor hired to provide the data with regard to maximizing response rate, based on their experience conducting similar collections in the region of interest.

### *Incentives*

Incentives are consistent with numerous theories about survey participation (Singer and Ye, 2013), such as the theory of reasoned action (Ajzen and Fishbein, 1980), social exchange theory (Dillman et al., 2014), and leverage-salience theory (Groves et al., 2000). Inclusion of an incentive acts as a sign of good will on the part of the study sponsors and encourages reciprocity of that goodwill by the respondent.

Dillman et al. (2014) recommends including incentives to not only increase response rates, but to decrease nonresponse bias. Specifically, an incentive amount between \$1 and \$5 is recommended for surveys of most populations.

Church (1993) conducted a meta-analysis of 38 studies that implemented some form of mail survey incentive to increase response rates and found that providing a prepaid monetary incentive with the initial survey mailing increase response rates by 19.1% on average. Lesser et al. (2001) analyzed the impact of financial incentives in mail surveys and found that including a \$2 bill increased response rates by 11% to 31%. Gajic et al. (2012) administered a stated-preference survey of a general community population using a mixed-mode approach where community members were invited to participate a web-based survey using a traditional mailed letter. A prepaid cash incentive of \$2 was found to increase response rates by 11.6%.

Given these findings, we believe a small, prepaid incentive will boost response rates by at least 10% and would be the most cost effective means to increase response rates. A \$2 bill incentive was chosen due to considerations for the population being targeted and the funding available for the project. As this increase in response rate will require a smaller sample size, the cost per response is only expected to increase by roughly \$1.03.

### *Non-Response Bias Study*

In order to determine if and how respondents and non-respondents differ, a non-response bias study will be conducted in which a short survey will be administered to a random sample of households that receive the main survey but do not complete and return it. The short questionnaire will ask a few awareness, attitudinal and demographic questions that can be used to statistically examine differences, if any, between respondents and non-respondents. It will take respondents about 5 minutes to complete the non-response bias study survey. The samples for the non-response follow up will be allocated proportionately to the number of the original mailings in the geographic division (strata).

A 25% response rate is expected for this follow-up survey and the target sample sizes of 333

and 737 completed non-response surveys for the pre-test and full implementations should provide a margin of error of approximately 5% with a 95% confidence interval. The return envelope will be imprinted with a stamp requesting the recipient to “Please return within 2 weeks.” Table 2 illustrates the target sample size of the non-response survey across survey regions.

*Table 2: Pretest sample, final collection estimated completes needed, and final collection adjusted sample size by strata for non-response bias study*

Strata	Sub-strata	Pretest Expected Completes	Final Collection Expected Completes
Great Bay	--	57	125
Hampton-Seabrook	--	57	125
Piscataqua	--	57	125
other Coastal NH	--	57	125
coastal NH counties	Rockingham	66	140
	Strafford	39	98
TOTAL		333	737

A subset of the questions from the main questionnaire was selected for the non-response bias study survey:

1. *Please indicate how strongly you agree or disagree with the following statements?*
2. *Please indicate whether you think the following will increase or decrease in the next 10 years.*

Questions 1 and 2 are two questions from the main survey that may influence an individual’s response probability. For example, those who do not live in coastal New Hampshire or those who do not believe coastal storms, flooding, or shoreline erosion are major concerns may be less likely to respond.

3. *Please rate how much you agree or disagree with the following statements.*

The items in question 3 ask about attitudes toward managing estuarine and coastal lands in Coastal New Hampshire, costs to one’s household, and government regulations. Comparing responses to these questions across the main survey study and the non-response bias study will allow researchers to assess whether non-respondents did not complete the main survey for reasons related to the survey topic. In contrast, the last item in question 3 inquires about respondents’ ability or propensity to take surveys in general, comparing responses to this item will help researchers assess whether non-response was related to factors that are likely uncorrelated with the experiment.

4. *What is your sex?*
5. *In what year were you born?*
6. *Do you own or rent property on a shoreline?*
7. *Are you a seasonal or year-round resident of coastal New Hampshire?*
8. *Are you Hispanic or Latino?*
9. *What is your race? (select all that apply)*
10. *What is the highest level of education you have completed?*
11. *What was your annual household income in 2019?*
12. *How many people, including yourself, live in your household?*
13. *How many of these people are at least 18 years old? \_\_\_\_\_*

By including demographic questions in both the survey and non-response follow-up survey, statistical comparisons of household characteristics can be made across the samples of responding and non-responding households. These data can also be compared to household characteristics from the population, which are available from the 2010 Census.

Two-sided statistical tests will be used to compare responses across the sample of respondents to the main survey and those who completed the non-response questionnaire. There are two types of biases that can arise from non-respondents: nonresponse and selection bias (Whitehead, 2006). The statistical comparisons above will allow for the assessment of the presence of nonresponse bias, which is when respondents and non-respondents differ for spurious reasons. If found, a weighting procedure, as discussed in Section B.1.above, can be applied. An inherent assumption in this weighting approach is that, within weight classes, respondents and non-respondents are similar. This assumption may not hold in the presence of selection bias, which is when respondents and non-respondents differ due to unobserved influences associated with the survey topic itself, and perhaps correlated with policy outcome preferences. Researchers will assess the potential for selection bias by comparing responses to the familiarity and attitude questions discussed above. If the results of such comparisons suggest a potential selection bias, the implications towards policy outcome preferences will be examined and discussed.

**4. Describe any tests of procedures or methods to be undertaken. Tests are encouraged as effective means to refine collections, but if ten or more test respondents are involved OMB must give prior approval.**

See response to Part B Question 3 above.

**5. Provide the name and telephone number of individuals consulted on the statistical aspects of the design, and the name of the agency unit, contractor(s), grantee(s), or other person(s) who will actually collect and/or analyze the information for the agency.**

Consultation on the statistical aspects of the study design, including sampling design, survey length, and problematic survey items, was provided by Dr. Robert Johnston (508-751-4619).

Researchers with NOAA's National Centers for Coastal Ocean Science lead this project. Project Principal Investigators are:

Sarah Gonyo, PhD (Lead)  
Economist  
NOAA National Ocean Service  
National Centers for Coastal Ocean Science  
1305 East West Hwy  
Building SSMC4, Rm 9320  
Silver Spring, MD 20910  
Ph: 240-533-0382  
Email: [sarah.gonyo@noaa.gov](mailto:sarah.gonyo@noaa.gov)

Data will be collected and purchased from an external vendor, which has yet to be solicited and selected. Data analysis will be conducted by the project principal investigators along with the following research team member:

Amy Freitag, PhD  
Social Science Analyst  
NOAA National Ocean Service  
National Centers for Coastal Ocean Science  
Cooperative Oxford Laboratory  
904 S Morris St,  
Oxford, MD 21654  
CSS, Inc.  
Ph: 443-258-6066  
Email: [amy.freitag@noaa.gov](mailto:amy.freitag@noaa.gov)

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