SUPPORTING STATEMENT

SOCIOECONOMICS OF WHALE WATCHING IN THE CHANNEL ISLANDS REGION: SURVEY OF WHALE WATCHING PASSENGERS

OMB CONTROL No. 0648-0729

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.

Potential Respondent Universe

The population that will be surveyed is individuals who participate in whale watching boat tours in the Channel Islands region. There are two main whale-watching seasons: Grey Whales (December – April) and Big Whales (May – October). Based on a 2017 an operator survey, we estimate the population of whale watchers to be about 7,800.[1]

The unit of analysis for passengers is a person-trip. We estimate numbers of days and expenditures of whale watching per person-trip and can then extrapolate from sample to population based on estimates of total person-trips for whale watching. For non-market economic value, the unit of analysis is passenger household annual willingness to pay.

Survey Forms

The proposed collection has two components: 1) on-site survey and 2) mail back survey. The on-site survey will be used to get information about the respondent's socio-demographic characteristics, non-market economic value of whales and other marine animals, environmental attitudes, and preferences for marine mammals. The on-site survey will employ an intercept method. The mail back survey will be used to get information about the respondent's expenditures and their importance-satisfaction ratings for 17 natural resource attributes, facilities and services. The mail back survey will be provided to respondents intercepted who agree to further participate in the study.

[1] Socioeconomics of Commercial Whale Watching and Other Marine Wildlife Observation Operations in the Channel Islands National Marine Sanctuary, OMB CONTROL No. 0648-0717.

Sample Size and Response Rate

From the pre-test and previous collections[2], we expect a 90% net response rate for the intercept survey. Because the on-site survey is limited to 15-20 minutes on average, the follow-up mail back survey is required to answer more detailed data needs.

For the mail backs, experience has achieved 40-45% response rates for the expenditure questions and 50-60% for the importance/satisfaction questions when passengers are given both[3]. We are using the lower estimates to be conservative. To calculate expected net response rates, we multiply the estimates by 0.9 to account for the 10% expected refusal rates from the on-site survey.

Full Survey – Grey Whale Season

Intercept Survey	
1) Number of participants (completes)	600
2) Expected response rate (%)	90.00
Mail backs – Number of participants	600
Expenditure	
1) Number of participants (completes)	270
2) Expected response rate (%)	45.00
Importance/Satisfaction	
3) Number of participants (completes)	270
4) Expected response rate (%)	45.00

Full Survey – Big Whale Season

Intercept Survey	
1) Number of participants (completes)	600
2) Expected response rate (%)	90.00
Mail backs – Number of participants	600
Expenditure	
3) Number of participants (completes)	270
4) Expected response rate (%)	45.00
Importance/Satisfaction	
5) Number of participants (completes)	270
6) Expected response rate (%)	45.00

[2] Leeworthy, Vernon R. 1996. Technical Appendix: Sampling Methodologies and Estimation Methods Applied to the Florida Keys/Key West Visitor Surveys. Silver Spring, MD: National Oceanic and Atmospheric Administration. Available at: http://sanctuaries.noaa.gov/science/socioeconomic/floridakeys/pdfs/vistechappen9596.pdf

[3] Ibid

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.

Stratification and Sample Selection

On-site surveys will be conducted on boat docks in the Channel Islands region after whale watching boats return to port following viewing trips. There are three counties (Santa Barbara, Ventura, and Los Angeles) within the Channel Islands region and surveys will be clustered proportionally by county. Once we have collected the information on passenger counts for each operation and month[4], we will be able to estimate the proportion of passengers within each county, operation, and season. We will then divide our sample size proportionally across each county and/or operation for each season. Passengers will be randomly selected as they disembark the vessel. Respondents who complete the on-site survey and agree to participate further in the study will be provided a mail back survey. The purpose of the mail back survey is to collect information from respondents regarding expenditures during their trip to the Channel Islands region, as well as the their assessment about the importance versus satisfaction related to various natural resource attributes and services offered in the region.

Degree of Accuracy Needed for the Purpose Described in the Justification

The general sampling methodology and estimation of the on-site survey and mail back survey have been tested several times in the Florida Keys (1995-96 and 2007-08). Sample sizes have been selected for application in the Channel Islands region to ensure statistical accuracy at the 95% confidence level or plus or minus 5 percent at a minimum with many data elements expected to be estimated with less potential error since sample sizes exceed those necessary to achieve 95% confidence.

Documentation of the non-market economic value of whales and other marine animals, and how that value changes with changes in conditions of whale and other marine animal populations, is the general purpose of this collection. The goal is to be able to estimate the marginal value of changes in whale populations, which will be used in a decision-support tool for assessing shipping management strategies in the Channel Islands region. These values could also be used in damage assessments.

[4] Socioeconomics of Commercial Whale Watching and Other Marine Wildlife Observation Operations in the Channel Islands National Marine Sanctuary, OMB CONTROL No. 0648-0717. This data collection will be executed from August through September 2015.

The method chosen is commonly referred to as a stated-preference conjoint analysis (Louviere, Hensher and Swait, 2009). For economic valuation of attributes, the method is also referred to as multi-attribute utility theory (Adamowicz, Louviere, and Swait, 1998). With five attributes with four levels (low, medium, medium high and high condition) each, the possible combination of attributes to form options (bundles of attributes) is equal to four to the fifth power, or 1,024. In most of the literature, price or the dollar bid amounts for each bundle of attributes is also treated as another attribute when selecting a random sample of all possible combinations. We have chosen to use six levels to the dollar bid amounts resulting in 6,144 possible combinations. Because this is impossible to implement, we propose use of a fractional factorial design (Louviere, Hensher, and Swait, 2009).

We will use SAS program code provided by Johnson et al. (2007) to generate an optimal design and test the efficiency of the design. There are then two decisions we have to make: 1) the number of choices any one respondent has to make and 2) the number of different versions of the survey.

We have decided to limit the number of choices any one respondent has to make to three choices with each choice including the Status Quo option (A) plus two other options (B and C). In each choice set, the Status Quo (A) is always included and cost the household $0, but results in all attributes in their low condition. Other options are mixes of low, medium, medium high, and high conditions. The Status Quo option is often referred to in the literature as the “opt-out option” and provides the basis on which other options are evaluated.

Initial runs of the programs indicated that an optimal design would require at least 48 alternatives/options to achieve an orthogonal (attributes are uncorrelated) design. An optimal design ensures we can estimate the marginal effects or marginal values of each attribute for the main effects. We decided our design would use three choice questions per respondent blocked into 16 versions. Each choice contains the Status Quo option plus a B and C option with different bundles of attributes at different levels. We ran the SAS program several times with different numbers of attributes and found that we could get an optimal design with 5 attributes (4 levels each) plus price (6 levels).

One concern of the randomization in fractional factorial design is the match-ups in the choices (B and C options). One has to review the match-ups of B and C options to ensure they make sense. That is, that an option with higher levels of attributes has a higher price than an option with lower levels of attributes. All of the choices in our design meet this criterion.

Finally, the choice sets have to be checked for dominant options/alternatives. These are options for which all respondents would choose them or not choose them. Such options provide no information in comparative choices (Louviere, 2000). We don't think our design currently contains any dominant options, but the pre-test will be used to check for this.

The choice questions for the full survey are included in with the clearance package. Prices are assigned based on the optimal design and currently include the level of the price (1 to 6). The following prices will be tested in the pre-test ($20, $40, $80, $175, $350 and $700). These prices are based on findings from existing scholarship and were recently used successfully in a similar type of valuation for the Outer Coast of the State of Washington in their Marine Spatial Planning effort in a project implemented by Point97/Surfrider Foundation.[5] We believe this will give us a good starting point to test the bid amounts.

Determination of the Minimum Sample Size

In Orme (1998), the following formula is found for determining the minimum sample size for a given design:

N = 500 * NLEV/(NALT*NREP)

where,

N = minimum sample size required

NLEV = the largest number of levels in any attribute (here 6 for number of prices)

NALT = number of alternatives (options) per choice set (not including the Status Quo), (here 2)

NREP = number of choice sets per respondent (here 3)

So in our design, the minimum sample size required for statistical efficiency is equal to 500. Our planned sample size is 600 for each season, so our sample sizes are sufficient to not only meet minimum requirements, but provide added safety for margin of error.

In addition to the above, as a general rule, six observations are needed for each attribute in a bundle of attributes to identify statistically significant effects (Bunch and Batsell, 1989 and Louviere et al, 2000). Since we have 5 attributes plus price, we have 6 attributes so we need

[5] Leeworthy, V,R. and P.C. Wiley. 2003. "Socioeconomic Impact Analysis of Marine Reserve Alternatives for the Channel Islands National Marine Sanctuary" Silver Spring, MD, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Special Projects. 118pp.; Loomis, J.B. and D.M. Larson. 1994. "Total Economic Values of Increasing Gray Whale Populations: Results from a Contingent Valuation Method." Marine Resources Economics. 9:275-286; Point97/Surfrider Foundation 2015. "Non-market Economic Values of Natural Resource Attributes for Recreation on Washington's Outer Coast. Preliminary Results.

36 observations per version. Our design includes 16 versions, so we need a sample size of 576 at a minimum. We plan for 600 completes, so we will have 37 observations per version in each sample, which again is above the requirements to achieve statistical efficiency.

Analysis of Choice Questions

Analysis of the choice sets for estimating the non-market economic use values and how those values change with changes in reef attribute conditions and socioeconomic factors will start out using a standard multinomial model based in random utility theory, as described by Ben-Akiva and Lerman (1985). To summarize their exposition, let *U* = utility of household (well-being). Consider *U* to be a function of a vector zin of attributes for alternative *i*, as perceived by household respondent n. The variation of preferences between individuals is partially explained by a vector Sn of socio-demographic characteristics for person *n*.

$U_{in} = V(z_{in}, S_n) + \varepsilon(z_{in}, S_n) = V_{in} + \varepsilon_{in}$

The "*V*" term is known as indirect utility and "ε" is an error term treated as a random variable (McFadden 1974), making utility itself a random variable. An individual is assumed to choose the option that maximizes their utility. The choice probability of any particular option (Status Quo Option A, Option B, or Option C) is the probability that the utility of that option is greatest across the choice set Cn:

$P\ (i \mid C_n) = Pr[V_{in} + \varepsilon_{in} \geq V_{jn} + \varepsilon_{jn}\ ,\ for\ all\ j \in C_n,\ j\ not\ equal\ to\ i]$

If error terms are assumed to be independently and identically distributed, and if this distribution can be assumed to be Gumbel, the above can be expressed in terms of the logistic distribution:

$P_n(i) = e^{\mu Vin} / \sum e^{\mu Vjn}$

The summation occurs over all options in a choice set. The assumption of independent and identically distributed error terms implies independence of irrelevant attributes, meaning the ratio of choice probabilities for any two alternatives is unchanged by addition or removal of other unchosen alternatives (Blamey et al., 2000). The "μ" term is a scale parameter, a convenient value for which may be chosen without affecting valuation results if the marginal utility of income is assumed to be linear. The analyst must specify the deterministic portion of the utility equation ''*V*,'' with sub-vectors *z* and *S*. The vector *z* comes from choice experiment attributes, and the vector *S* comes from attitudinal, recreational, and socio-demographic questions in the survey. Econometrics software will be used to estimate the regression coefficients for *z* and *S*, with a linear-in-parameters model

specification. These coefficients are used in estimating average household value for a change in one level to another level of a particular attribute for welfare estimation. Welfare of a change is given by (Holmes & Adamowicz, 2003):

$\$ Welfare = (1/\beta_c)[V^0 - V^1]$

where β_c is the coefficient on cost, V^0 is an initial scenario, and V^1 is a change scenario.

The standard multinomial logit model treats the multiple observations (choice experiment replications) from each household as independent. An alternative is to model these as correlated with a random parameters (mixed) logit model. Thus a random parameters logit model will also be tested using techniques described by Greene (2007).

Econometric Specification

A main effects utility function is hypothesized, and following common practice a linear-in-parameters model will be sought. A generic format of the indirect utility function to be modeled is:

$V = \beta_o + \beta_1$(Large Baleen Whales Individuals Change) + β_2(Other Baleen Whales Population Change) + β_3 (Smaller Whales and Dolphins & Porpoises Population Change) + β_4(Seals and Sea Lions Population Change) + β_5(Shorebirds and Seabirds Population Change) + β_6(Cost)

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.

The duration of on-site surveys is anticipated to be a maximum of 20 minutes. The surveys will be conducted in person, thereby maximizing the response rate. We expect net expected response rates from this portion of the survey of 90%, thus minimizing the probability of non-response bias.[6]

The mail back surveys involve lower expected net response rates and thus increase the potential for non-response bias. We will be able to test for differences between those who completed the intercept survey and those who completed the mail back survey. Should significant differences be detected and, therefore, the existence of potential non-response bias, then sample-weighting will be conducted to correct for the potential biases.

[6] Ibid.

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.

To develop the willingness to pay choice sets, researchers worked with scientists and resource managers from CINMS to identify proposed management issues/objectives important to management and passengers, as well as to determine the status quo for natural resource attributes to be included in the willingness to pay scenarios.

As stated previously, bid amounts for the choice sets in the current on-site survey, submitted herein, were based on previous research[7]. However, researchers must avoid the statistical problem of "fat tails" or everyone choosing the highest price for a given option (i.e., bundle of attributes) or everyone choosing the lowest price for a given option. Additionally, researchers want to ensure bid amounts are designed such that a higher price for a given option is not preferred over a lower price for a given option (i.e., it does not make economic sense to pay a higher price if you can get the good or service at a lower price). The range of bids used is critical for estimating the non-market economic use value and how that value changes with changes in whale and other marine animal population conditions (i.e., marginal value of attributes).

Pre-test

Under 0648-0729, a pre-test was conducted in the summer of 2017 by the University of California Santa Barbara (UCSB) Bren School. The objective was to determine the bid amounts for the contingent choice questions used to estimate the non-market value of different attributes of whale watching, primarily the value of avoiding a whale death.

A total of 360 on-site surveys were completed with a cooperation rate of 93%. Four versions of the survey were implemented with each version containing three choices. One choice was always the Status Quo or no change in future management or policy and the expected impacts on different attributes. The "Status Quo" would cost the respondent $0 per household per year (see original supporting statement for 0648-0729).

The pre-test results were tested for the responses to different dollar amounts for the bids in the choice questions. At the lower limit of $20, not everyone said "Yes" thus avoiding the "fat tails" problem, which would mean no information was learned. At the top dollar bid of $700, not everyone said "No", again avoiding the "fat tails" problem. Generally, as the bids

[7] Leeworthy, V,R. and P.C. Wiley. 2003. "Socioeconomic Impact Analysis of Marine Reserve Alternatives for the Channel Islands National Marine Sanctuary" Silver Spring, MD, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Special Projects. 118pp.; Loomis, J.B. and D.M. Larson. 1994. "Total Economic Values of Increasing Gray Whale Populations: Results from a Contingent Valuation Method." Marine Resources Economics. 9:275-286; Point97/Surfrider Foundation 2015. "Non-market Economic Values of Natural Resource Attributes for Recreation on Washington's Outer Coast. Preliminary Results.

increased, the percent of "yeses" declined controlling for quantity/quality of attributes. The dollar values tested included $20, $40, $80, $175, $350 and $700. These dollar amounts are used in the final design for the full survey specified in this application.

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.

NOAA Project Leads

Dr. Bob Leeworthy was the primary advisor on the statistical aspects of the study design. Dr. Leeworthy is Chief Economist with the Office of National Marine Sanctuaries. He is an expert in this area of research and application. Generally, the NOAA Project Leads will provide guidance, mentorship and oversight to the Bren Student Research Team, who will be responsible for implementation of the pre-test, in terms of data collection and analysis. Researchers for the National Ocean Service will be responsible for implementation of the full data collection.

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