NOTICE OF OFFICE OF MANAGEMENT AND BUDGET ACTION

Date 06/22/2018

Department of Commerce
National Oceanic and Atmospheric Administration

FOR CERTIFYING OFFICIAL: Rod Turk
FOR CLEARANCE OFFICER: Jennifer Jessup

In accordance with the Paperwork Reduction Act, OMB has taken action on your request received 06/06/2018

ACTION REQUESTED: Revision of a currently approved collection
TYPE OF REVIEW REQUESTED: Regular
ICR REFERENCE NUMBER: 201806-0648-003
AGENCY ICR TRACKING NUMBER:
TITLE: Preliminary Case Study Assessing Economic Benefits of Marine Debris Reduction
LIST OF INFORMATION COLLECTIONS: See next page

OMB ACTION: Approved with change
OMB CONTROL NUMBER: 0648-0756
The agency is required to display the OMB Control Number and inform respondents of its legal significance in accordance with 5 CFR 1320.5(b).

EXPIRATION DATE: 08/31/2020 DISCONTINUE DATE:

BURDEN:	RESPONSES	HOURS	COSTS
Previous	726	56	0
New	3,832	219	0
Difference			
Change due to New Statute	0	0	0
Change due to Agency Discretion	3,106	163	0
Change due to Agency Adjustment	0	0	0
Change due to PRA Violation	0	0	0

TERMS OF CLEARANCE: OMB notes that 30 days have transpired since the agency published public notice for this information collection request in the Federal Register. OMB reminds the agency to submit the information collection request package to OMB in ROCIS concurrent with publication of the 30-day Federal Register notice, as per 5 CFR Part 1320.10.

OMB Authorizing Official: Dominic J. Mancini
Deputy and Acting Administrator,
Office Of Information And Regulatory Affairs

List of ICs			
IC Title	Form No.	Form Name	CFR Citation
On-site interview	NA	On-site interview	
Mail survey	NA	Mail survey	

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PAPERWORK REDUCTION ACT SUBMISSION

Please read the instructions before completing this form. For additional forms or assistance in completing this form, contact your agency's Paperwork Clearance Officer. Send two copies of this form, the collection instrument to be reviewed, the supporting statement, and any additional documentation to: Office of Information and Regulatory Affairs, Office of Management and Budget, Docket Library, Room 10102, 725 17th Street NW, Washington, DC 20503.

1. Agency/Subagency originating request
DOC/NOAA/NOS

2. OMB control number
a. 0648 -_____ b. [ ] None

3. Type of information collection (*check one*)
a. [ ] New Collection
b. [✔] Revision of a currently approved collection
c. [ ] Extension of a currently approved collection
d. [ ] Reinstatement, without change, of a previously approved collection for which approval has expired
e. [ ] Reinstatement, with change, of a previously approved collection for which approval has expired
f. [ ] Existing collection in use without an OMB control number
For b-f, note Item A2 of Supporting Statement instructions

4. Type of review requested (*check one*)
a. [✔] Regular submission
b. [ ] Emergency - Approval requested by ____/____/____
c. [ ] Delegated

5. Small entities
Will this information collection have a significant economic impact on a substantial number of small entities? [ ] Yes [✔] No

6. Requested expiration date
a. [ ] Three years from approval date b. [✔] Other Specify: 08/31/2020

7. Title
Preliminary Case Study Assessing Economic Benefits of Marine Debris Reduction - Regional Pilot Study

8. Agency form number(s) (*if applicable*)

9. Keywords

10. Abstract

The National Oceanic and Atmospheric Administration (NOAA) is requesting approval for a revised information collection to conduct a mail survey of households visiting beaches in four coastal locations as part of a Preliminary Case Study Assessing Economic Benefits of Marine Debris Reduction (hereafter referred to as the "Regional Pilot Study"). The four locations include Orange County, CA; Erie and Ottawa counties, OH; Kent and Sussex counties, DE; and Baldwin County, AL. The survey instrument for the Regional Pilot Study will combine a selection of questions from a previous study funded by NOAA titled "Assessing the Economic Benefits of Reductions in Marine Debris: A Pilot Study of Beach Recreation in Orange County, California" with new contingent behavior questions developed specifically for this study. to estimate the economic impacts of marine debris on tourism-dependent communities. The economic impacts to be evaluated include changes in the number of trips, the value of beach recreation to those who visit the beach, and changes in tourism spending (also called regional economic impacts) associated with an increase or decrease in the number of recreational trips.

11. Affected public (*Mark primary with "P" and all others that apply with "x"*)
a. P Individuals or households d. ___ Farms
b. ___ Business or other for-profit e. ___ Federal Government
c. ___ Not-for-profit institutions f. ___ State, Local or Tribal Government

12. Obligation to respond (*check one*)
a. [✔] Voluntary
b. [ ] Required to obtain or retain benefits
c. [ ] Mandatory

13. Annual recordkeeping and reporting burden
a. Number of respondents 1,733
b. Total annual responses 1,933
1. Percentage of these responses collected electronically 10 %
c. Total annual hours requested 110
d. Current OMB inventory 0
e. Difference
f. Explanation of difference
1. Program change
2. Adjustment

14. Annual reporting and recordkeeping cost burden (*in thousands of dollars*)
a. Total annualized capital/startup costs 0
b. Total annual costs (O&M) 0
c. Total annualized cost requested 0
d. Current OMB inventory 0
e. Difference
f. Explanation of difference
1. Program change
2. Adjustment

15. Purpose of information collection (*Mark primary with "P" and all others that apply with "X"*)
a. ___ Application for benefits e. P Program planning or management
b. ___ Program evaluation f. ___ Research
c. ___ General purpose statistics g. ___ Regulatory or compliance
d. ___ Audit

16. Frequency of recordkeeping or reporting (*check all that apply*)
a. [ ] Recordkeeping b. [ ] Third party disclosure
c. [✔] Reporting
1. [ ] On occasion 2. [ ] Weekly 3. [ ] Monthly
4. [ ] Quarterly 5. [ ] Semi-annually 6. [ ] Annually
7. [ ] Biennially 8. [✔] Other (describe) One time

17. Statistical methods
Does this information collection employ statistical methods
[✔] Yes [ ] No

18. Agency Contact (person who can best answer questions regarding the content of this submission)
Name: Amy Uhrin
Phone: 240-533-9426

19. Certification for Paperwork Reduction Act Submissions

On behalf of this Federal Agency, I certify that the collection of information encompassed by this request complies with 5 CFR 1320.9

NOTE: The text of 5 CFR 1320.9, and the related provisions of 5 CFR 1320.8(b)(3), appear at the end of the instructions. *The certification is to be made with reference to those regulatory provisions as set forth in the instructions.*

The following is a summary of the topics, regarding the proposed collection of information, that the certification covers:

(a) It is necessary for the proper performance of agency functions;

(b) It avoids unnecessary duplication;

(c) It reduces burden on small entities;

(d) It used plain, coherent, and unambiguous terminology that is understandable to respondents;

(e) Its implementation will be consistent and compatible with current reporting and recordkeeping practices;

(f) It indicates the retention period for recordkeeping requirements;

(g) It informs respondents of the information called for under 5 CFR 1320.8(b)(3):

- (i) Why the information is being collected;
- (ii) Use of information;
- (iii) Burden estimate;
- (iv) Nature of response (voluntary, required for a benefit, mandatory);
- (v) Nature and extent of confidentiality; and
- (vi) Need to display currently valid OMB control number;

(h) It was developed by an office that has planned and allocated resources for the efficient and effective management and use of the information to be collected (see note in Item 19 of instructions);

(i) It uses effective and efficient statistical survey methodology; and

(j) It makes appropriate use of information technology.

If you are unable to certify compliance with any of the provisions, identify the item below and explain the reason in Item 18 of the Supporting Statement.

Signature of Senior Official or designee	Date

Agency Certification (signature of Assistant Administrator, Deputy Assistant Administrator, Line Office Chief Information Officer, head of MB staff for L.O.s, or of the Director of a Program or StaffOffice)	
Signature for Hugh Johnson	Date 4/11/2017
Signature of NOAA Clearance Officer	
Signature BRABSON.SARAH.1365710488 Digitally signed by BRABSON.SARAH.1365710488 Date: 2018.06.29 16:41:00 -04'00'	Date

SUPPORTING STATEMENT
Preliminary Case Study Assessing Economic Benefits of Marine Debris Reduction
Regional Pilot Study
OMB CONTROL NO. 0648-0756

A. JUSTIFICATION

1. Explain the circumstances that make the collection of information necessary.

The National Oceanic and Atmospheric Administration (NOAA) is requesting approval for a revised information collection to conduct a mail survey of households visiting beaches in four coastal locations as part of a Preliminary Case Study Assessing Economic Benefits of Marine Debris Reduction (hereafter referred to as the "Regional Pilot Study"). The four locations include Orange County, CA; Erie and Ottawa counties, OH; Kent and Sussex counties, DE; and Baldwin County, AL. The survey instrument for the Regional Pilot Study will combine a selection of questions from a previous study funded by NOAA titled "Assessing the Economic Benefits of Reductions in Marine Debris: A Pilot Study of Beach Recreation in Orange County, California" (hereafter referred to as the "Orange County Pilot Study"; IEc, 2014, Leggett et al., 2018) with new contingent behavior questions developed specifically for this study. The data from the current survey instrument will be combined with a national model of coastal recreation, which relies on data collected for the *Deepwater Horizon* oil spill assessment (English and McConnell, 2015; English et al., In review), to estimate the economic impacts of marine debris on tourism-dependent communities. The economic impacts to be evaluated include changes in the number of trips, the value of beach recreation to those who visit the beach, and changes in tourism spending (also called regional economic impacts) associated with an increase or decrease in the number of recreational trips.

The Marine Debris Research, Prevention, and Reduction Act of 2006 (hereafter referred to as "the Act"; 33 U.S.C. §§ 1951 et seq.), together with the Marine Debris Act Amendments of 2012, established NOAA's Marine Debris Program (hereafter referred to as "the Program") to "identify, determine sources of, assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, the marine environment, and navigation safety." Marine debris is defined as "any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes." The Act directs the Program to "undertake outreach and education activities for the public and other stakeholders on sources of marine debris…and its adverse impacts on the United States economy…." The Act also directs the Program to "estimate the potential impacts of a severe marine debris event, including economic impacts on…tourism." The Program also works closely with NOAA's Damage Assessment Remediation and Restoration Program (DARRP), which requires information on the value of restoration projects related to marine debris removal in the context of natural resource damage assessments under the Oil Pollution Act (33 U.S.C. §§ 2701 et seq.).

The Program requires information on the impact of marine debris on beach visitors to adequately address the requirements of the Act that are related to the economy and tourism, and to assess the

benefit of restoration projects related to marine debris removal within the context of natural resource damage assessments. In past discussions with state and local governments and organizations, the economic impacts of marine debris and benefits of its removal for communities has been a salient topic but has not been informed by sufficient quantitative research. The need for studies to estimate the economic effects of marine debris has been identified as a priority by both the Program and the communities with which it works. The Program's assistance to NOAA's DARRP would also be enhanced by more specific knowledge about the economic benefits of restoration projects that reduce marine debris on beaches.

The Orange County Pilot Study was a first step toward a more thorough, research-based understanding of the economic effects of marine debris on coastal communities. However, it was limited in several ways, including a single location, a focus on one-day recreation trips, and a focus on the value for recreators without addressing regional economic impacts. The proposed Regional Pilot Study expands the research by evaluating locations on the Atlantic Coast, the Pacific Coast, the Gulf Coast, and the Great Lakes; incorporating multiple-day recreation trips in the study; and estimating both recreation value and regional tourism impacts.

The proposed Regional Pilot Study will allow the Program to communicate more effectively with local communities about how economic questions can be addressed and further, findings from this study have potential implications for local policymakers and resource managers. On the basis of the economic estimates from this study, we will be able to provide data to these tourism-dependent communities to make more informed choices about the utility of more extensive research for any given location or policy decision.

2. Explain how, by whom, how frequently, and for what purpose the information will be used. If the information collected will be disseminated to the public or used to support information that will be disseminated to the public, then explain how the collection complies with all applicable Information Quality Guidelines.

Overview

Currently, very little is known about the effects of marine debris on recreational participation and attitudes toward beach recreation in coastal communities that are facing problems with marine debris. This limits the Program's ability to assess the full economic and social impacts of marine debris on tourism-dependent coastal communities. There is also little known about how people's perceptions of marine debris relate to the frequency and value of recreational trips. The survey instrument will allow the collection of data on public attitudes toward marine debris and anticipated changes in recreational behavior due to marine debris presence.

The survey data will be used by the Program to estimate the economic impacts of marine debris in the four study locations. Data on survey respondents' attitudes toward marine debris and the effect of marine debris on their choice of where and how often they go to the beach will be combined with a national model of recreation choice originally developed for the *Deepwater Horizon* oil spill assessment. NOAA's Marine Debris Monitoring and Assessment Project (MDMAP) of onsite measurements of debris at selected beaches will be used to help characterize current debris levels (Herring, 2018; included in supporting materials). In addition, the survey

data will be used to characterize debris levels as perceived by beach users, and characterize public concern associated with debris presence. The study will estimate the change in the number of visits to the beach and the resulting economic impacts from a variety of potential changes in marine debris on local beaches.

Information quality (objectivity and integrity)

NOAA's Information Quality Guidelines (NOAA, 2014) encompass the utility, objectivity, and integrity of information that is disseminated to the public. The utility of the information was described in the first section.

The objectivity of information relates to its accuracy and reliability, whether the data collection and interpretation relied on established methods, whether materials released to the public have been appropriately reviewed, and whether the results are presented in the appropriate context.

The data from the Regional Pilot Study will include the number of recreation trips taken to beaches in a given community, the value of recreation trips, and the change in the value and number of trips as a result of different marine-debris scenarios. It is important that these results are reliable and accurate. The total number of trips and the value of trips will be estimated using a nationwide model developed for the *Deepwater Horizon* oil spill assessment. The data collection and analysis for the *Deepwater Horizon* model were developed in preparation for litigation by a team of experts in economics, statistics, and survey design. The data collection and analysis plans were also reviewed by outside experts not directly involved in the study design. The data were subject to extensive quality controls, and the model was developed based on a thorough evaluation of the best available methods.

The change in the value and number of trips will be estimated using data collected in the marine debris survey. Specifically, the survey asks people how many more or fewer trips they would take given changes in the amount of marine debris on beaches. The survey also asks people to estimate the current level of debris at beaches with which they are familiar, using a 1-to-5 rating developed using onsite measurements of debris conducted by NOAA at selected beaches in each location (Herring, 2018).

In economic surveys and analyses, one of the best ways to evaluate the accuracy and reliability of results is to perform a cross-validation based on a comparison with alternative methods. We were able to do this by comparing results from an OMB-approved pretest for the Regional Pilot Study conducted in Orange County[1] to results of the previous Orange County Pilot Study (IEc, 2014, Leggett et al., 2018). The pretest survey used "stated preference" methods to ask recreators how they would respond to a change in marine debris. The Orange County Pilot Study used "revealed preference" methods to infer how recreators respond to marine debris by analyzing which beaches they choose to go to and whether the presence of marine debris influences their

1. Details of the pretest are described in a memorandum to Amy Uhrin and Carlie Herring, National Oceanic and Atmospheric Administration, titled "Draft Pretest Results: Economic Impacts of Marine Debris on Tourism-Dependent Communities," dated March 21, 2018.

choices. In the Orange County Pilot Study (revealed-preference), the results indicated that people would respond to a 50% increase in debris levels by reducing the total number of trips they take by 6.1% (IEc, 2014; Leggett et al., 2018). The pretest results for the Regional Pilot Study (stated-preference), when combined with the *Deepwater Horizon* recreation model, indicate that the same scenario would result in a 7.2% decrease in trips. Other scenarios could also be analyzed, and the two models would again produce similar results. This consistency between results for stated-preference and revealed-preference studies is a good indication that both methods are obtaining reliable and accurate information.

The Regional Pilot Study also asks people to estimate the amount of debris on beaches. The analysis will not directly rely on the results of this information. For example, an accurate estimate of the loss from a doubling of debris does not require estimates of the initial level of debris, and beachgoers who avoid beaches with debris are usually responding to their perceptions rather than to any specific knowledge of debris levels. However, to put economic values in context, it is helpful to quantify people's perceptions of debris and to evaluate how well their perceptions reflect actual debris amounts.

The previous Orange County Pilot Study provides valuable corroborating evidence that beachgoers are able to recall and report debris levels at beaches sufficiently well to inform marine debris research. The study asked people to rate marine debris at beaches using a 1-to-5 scale. These ratings were then included as a characteristic of beaches in the study's revealed-preference model. The model's estimate of the effect of a respondent's recollection of marine debris levels on the value of a recreation trip in Orange County was a decline in value of $6.26 per trip (IEc, 2014; Leggett et al., 2018).

The Orange County Pilot Study also calculated the effect of marine debris levels using measured marine debris levels rather than a respondent's recollection of marine debris levels. The corresponding decline in per-trip value was $5.45 (IEc, 2014; Leggett et al., 2018). The results of the impacts of marine debris using recalled and measured marine debris levels are qualitatively and statistically similar, indicating that people's perceptions of debris provide reliable information about relative debris levels at different beaches.[2]

The debris ratings in the current Regional Pilot Study use the same 1-to-5 rating scale that was used in the Orange County Pilot Study, but now include pictures of debris on beaches to assist respondents when applying ratings to beaches. The Orange County Pilot Study found a 0.34 correlation between the debris ratings and the onsite measurements (IEc, 2014; Leggett et al., 2018). In the OMB-approved pretest for the Regional Pilot Study, we found a 0.47 correlation between ratings from respondents and the onsite measurements from the Orange County Pilot Study. This preliminary evidence suggests that the pictures may improve respondents' abilities to provide accurate ratings for beaches with which they are familiar. Using

2. Dollar amounts were calculated by dividing the coefficients for debris measures 1 and 5 (IEc, 2014, page 36) by the coefficient on travel cost for model 2 (IEc, 2014, page 35), and multiplying by the average level of debris measure 1 (IEc, 2014, page 16) and the average level of debris measure 2 (Chris Leggett, RSG Inc., personal communication, 4/27/2018).

the pictures in the Regional Pilot Study to convert respondent ratings to actual measurements of the quantity of debris per square meter, we find that the ratings imply debris amounts about half as large as the onsite measurements. As noted, we do not intend to interpret the ratings as quantitative estimates of debris levels, but as a way of characterizing how current debris levels are perceived by beachgoers. In the Regional Pilot Study, we have onsite measurements of debris for selected beaches in each of the proposed study areas (Herring, 2018). These measurements will assist in interpreting the debris ratings in the appropriate context.

Additional evidence from the Regional Pilot Study pretest suggests that respondents found the survey questions to be clear. According to probing questions included in the pretest, 71.4% of respondents indicated the pictures of debris were a good or somewhat good representation of the types of debris they have seen on Orange County beaches. The most important factor for estimating quantities of debris is the amount of debris found in a given area. Results showed that 89.8% of respondents indicated that the description of the area used to estimate debris levels was clear or somewhat clear, and 83.7% of respondents thought the amount of debris shown in the pictures was accurate or somewhat accurate for the beaches with which they are familiar.

Regarding the effect of debris on recreation trips, 89.8% of respondents were either confident or somewhat confident about reporting any change in the number of trips they would take if there were almost no debris, and 81.6% of respondents were either confident or somewhat confident about any change in the number of trips they would take if there were twice as much debris. It is possible that questions about the effect of debris are most difficult for those reporting a change in their trips, as opposed to answering that their trips would stay the same. Among the cases where respondents reported a change, 75% of respondents were confident or somewhat confident in their answer.

An internal scope test was performed using data from the Regional Pilot Study pretest. The scope test indicates that people have a lower value for a smaller change in levels of marine debris. The average debris rating was 2.0, which is equivalent to 2 pieces of debris per 500 square feet (or 0.04 pieces per square meter). The two contingent behavior scenarios involve a reduction to almost no debris, defined as 1 piece of debris per 500 square feet; and a doubling of debris, leading to an average of 4 pieces of debris per 500 square feet. The hypothetical reduction in debris is therefore half as great as the hypothetical increase in debris. Consistent with these scenarios, the increase in trips of 4.0% from a decline in debris is smaller than the decrease in trips of 14.0% from an increase in debris. The confidence intervals are 3.4% to 5.5% and 13.4% to 16.4%, respectively.

The change in the number of trips people take, and the initial number of trips under current conditions, are elicited from respondents for a full-year reporting period. Some studies have found that recall periods of greater than three months may lead respondents to overstate the total number of trips they take (Chu et al., 1992). We note that for the Regional Pilot Study, the total number of trips will come from the *Deepwater Horizon* model, which used aerial photography and other onsite measurements to calculate the number of trips (Tourangeau et al., 2017). The evidence above suggests that people are accurately reporting their change in trips when calculated as a percentage, the key result from the Regional Pilot Study pretest (the study design

does not allow us to calculate total trips in this study). The advantage of using a full-year reporting period is that the type of trips people take could differ at different times of the year. For example, local residents who jog at the beach throughout the year may be less concerned about marine debris than people who take vacations at the beach for swimming and sunbathing. This means that data covering the full year are likely to be more accurate for estimating economic effects. However, we can limit the survey to the three-month period of June through August if that is preferred.

We will use a logit travel-cost model and a regional economic impacts model to analyze the data. Both of these models represent the most commonly accepted methods for estimating changes in economic value and impacts from environmental factors affecting recreation. The travel-cost model was originally developed for the *Deepwater Horizon* natural resource damage assessment and relied on the best available methods as determined by the team of economists working on that case (English et al., In review). The regional economic model relies on Regional Input-Output Modeling System (RIMS II) multipliers, which are widely used for regional economic analyses (Bess and Ambargis, 2011).

All data from the Regional Pilot Study survey will be subject to double data entry for quality control purposes. The report for the Regional Pilot Study and any publications in the academic literature will describe the methods in sufficient detail to be reproduced by other researchers. Assumptions will be thoroughly described so researchers can evaluate results in the appropriate context. There will be an internal review by economists and scientists at NOAA of all methods and any documents to be released to the public. Dr. George Parsons at the University of Delaware has been involved throughout the study serving as an external reviewer for most aspects of the study.

The integrity of the information relates to computer security and assurances that the data are not compromised in any way. Following NOAA's Information Quality Guidelines, the data will be safeguarded from improper access, modification, or destruction. Specifically, the data will be safeguarded in the same way as the Regional Pilot Study pretest data: the onsite survey data will be collected on secure tablets provided by NOAA's Information Technology (IT) department and comply with all security standards. To provide additional controls for private data, respondents' names and addresses will be removed from the original dataset (with a unique identification linking them to the original record). Specifically, names and addresses will be uploaded from the tablets directly onto a secure laptop computer provided by NOAA's IT department, and will comply with all security standards. As an additional security measure, the laptop computer will have its internet connectivity disabled. The names and addresses will be printed directly from the secure laptop computer to hard copy letters, envelopes, and postcards; the laptop will be connected to the printer with a physical cord. The names and addresses will be deleted once the mailing is complete.

Once personally identifiable information has been removed, the remaining data will be uploaded and stored on Abt Associates' (Abt's) secure network environment. Abt complies with the Privacy Act of 1974, the Health Insurance Portability and Accountability Act of 1996 (HIPAA), and the E-Government Act of 2002, including Title III: Federal Information Security Management Act (FISMA). Abt has also successfully complied with client requirements for a

System of Records Notice (SORN) and a Privacy Impact Assessment (PIA).The mail survey data will be sent to Market Strategies International, a research and consulting partner. Market Strategies undergoes annual SOC2 Type II auditing, third-party external penetration testing, Health Information Trust Alliance (HITRUST) certification, and International Standards Organization (ISO) 20252 certification. Documentation of these audits and certifications are available to our clients upon request.

Background

Marine debris is widely acknowledged to be a persistent problem in many coastal areas of the United States. There are a variety of potential economic losses associated with marine debris, including costs incurred by local governments and volunteer organizations to remove and dispose of marine debris, impacts on the tourism industry due to changes in the number of visitors, effects on waterfront property values due to diminished aesthetic appeal, impacts on the value of recreation to beach visitors, and potential effects on recreational and commercial fisheries.

Existing studies suggest that beach litter detracts from tourists' beach enjoyment and, as a result, reduces the recreational value of coastal beaches (Ofiara and Brown, 1999; Brouwer et al., 2017; Krelling et al., 2017). Marine debris potentially also creates significant economic costs by reducing the probability of returning to the same location, particularly among first-time visitors (Ballance et al., 2000; Schuhmann, 2012). Beach visitors are likely to be concerned about marine debris both because it poses potential physical harm due to cuts or bacterial infections and because it may detract from the perceived natural beauty of an area. In contrast to debris or litter along the roadside or in parks, there is a high potential for dermal contact with marine debris on beaches as visitors frequently go barefoot, lie directly on the sand, and dig in the sand. The existence of numerous volunteer efforts to remove debris from beaches, the willingness of visitors to participate in beach clean-up, and the fact that many municipalities regularly rake beaches to remove debris are probable indications that beach visitors prefer cleaner beaches (Brouwer et al., 2017).

Details and purpose of information collection

The Regional Pilot Study will provide an important contribution to the literature on the economic value of changes in marine debris on U.S. beaches. Building on the Orange County Pilot Study (IEc, 2014; Leggett et al., 2018), the study of debris impacts at four locations nationwide (Table 1) will be the first attempt to link beach trip choices with estimates of marine debris at beaches. While Parsons et al. (2009) included indicators of beach cleaning activities in an economic model for Texas Gulf Coast beaches, they did not base their analysis on the amount of debris at beaches. Other recent beach recreation models have addressed a variety of beach attributes but did not include marine debris, such as the Southern California beach model (Hanemann et al., 2004); a model of visits to New Jersey, Delaware, and Maryland beaches (Parsons and Massey, 2003); and a model focused on visits to San Diego County beaches (Lew and Larson, 2005). Some studies have addressed other timely and important issues for beach communities, such as the development of offshore wind turbines in North Carolina (Landry et al., 2012) or the potential impact of climate change in Southern California (Pendleton et al.,

2011). We are aware of one study that investigated the value of debris removal, but it presented only hypothetical debris levels and was not applied to specific beaches and actual debris levels (Smith et al., 1997). Thus, while the literature has demonstrated the importance of beach characteristics and amenities on the economic value of beach recreation, the economic impact of changes in debris at U.S. beaches has not been investigated. The results of the Regional Pilot Study will be used to evaluate the significance of economic impacts associated with marine debris, and the need for potential further research in selected communities or regions, or nationwide.

Table 1. Study areas and included counties

Study area	Counties in study area
Great Lakes	Erie and Ottawa counties, OH
East Coast	Kent and Sussex counties, DE
Gulf of Mexico	Baldwin County, AL
West Coast	Orange County, CA

The primary research goal of the Regional Pilot Study is to use contingent behavior questions to estimate the impact of marine debris on the number of trips people take to beaches in each study area. These contingent behavior questions will ask respondents to estimate how changes in marine debris levels would affect the number of trips they take to beaches in a given area. The impact on trips will be used as input to a nationwide model of beach visitation developed for the *Deepwater Horizon* oil spill assessment, conducted by NOAA and other State and Federal agencies. The model is important because it incorporates data on recreation trips from throughout the United States to derive the value of recreation trips and to estimate the degree to which people substitute one location to another when beach quality in a particular area changes. The results of the study will be compared to the Orange County Pilot Study to evaluate the consistency of the contingent behavior results with results of an important alternative method (the "revealed preference" method) for evaluating impacts to recreation and the value from changes in beach quality.

The Regional Pilot Study will also expand results from the Orange County Pilot Study to communities nationwide by addressing a variety of qualitative issues, including:

- What specific types of marine debris have the greatest impact on beach choices (e.g., plastic, metal, glass)?
- What do beachgoers know about the sources of marine debris on beaches?
- Does the impact of marine debris on beach choice vary in a systematic way across respondents (e.g., if visitors with children are more sensitive to marine debris levels)?
- What is the relationship between respondents' perceptions of marine debris and actual marine debris levels?
- How important is marine debris relative to other beach attributes about which people care?

The current data collection effort will consist of two steps: a short onsite intercept survey of beachgoers and a primary mail survey.

The onsite intercept survey will ensure that the sample includes only respondents who visit beaches in the study location. The onsite sampling will involve intercepting people at multiple beaches in each study location. The beaches will be selected to represent the various types of beach experiences available, including more- and less-developed beaches. The target responding sample size is 100 completed household surveys in each study location. We assume a response rate of 35% to the mail portion of the survey, which is the typical response rate for onsite surveys with mail follow-up (Millar and Dillman, 2011; Lynn, 2013; Dillman et al., 2014). This means that an initial sample of 286 respondent addresses must be obtained onsite to reach the target of 100 completed surveys.

The onsite survey will involve approaching people at each sampled beach and asking them to participate in the survey. Onsite interviewers will be assigned to multiple beaches within each study location. Interviewers will administer intercept surveys on two separate days during the high-volume beach season (approximately June to August 2018). The two days will consist of both a weekend day and a weekday to create a sample frame that will consist of a variety of beachgoers (day-trippers and vacationers). Onsite staff will start on one side of the target beach and work their way to the opposite side, approaching each party to request participation in the intercept survey by one member of the party. Interviewers will be provided with informational material to share with respondents to provide background information and credibility for the study. The goal of the intercept survey is to recruit participants for a follow-up mail survey and gather information about respondents for use in a mail-survey nonresponse adjustment.

For those willing to take the mail survey, a brief onsite interview will ask the respondent's name and mailing address; several demographic questions such as age and education; and several attitudinal questions about beach characteristics, including marine debris. Those who do not agree to participate in the mail survey will not be asked their name or address, but will be asked their ZIP code and all the other questions in the onsite survey. Appendix A provides a copy of the onsite interview form.

Data collected during onsite interviews will be used to evaluate nonresponse bias. A nonresponse study will compare demographic variables and attitudinal questions for three sampling groups, including those who refuse to participate in the mail survey but are willing to answer the several questions onsite (including demographic questions), those who initially agree to the mail survey but later fail to return it, and those who complete the mail survey. Those who refuse the onsite survey will be asked their age, and their gender will be recorded, so that this group can also be compared to the other groups with respect to age and gender.

The primary survey will be implemented by mail (Millar and Dillman, 2011; Lynn, 2013; Dillman et al., 2014). The target date for mailing the surveys is September 2018. The primary mail survey will include questions that focus on the number of day and overnight trips to beaches in each target region, respondents' attitudes toward marine debris, the presence of marine debris at beaches, and demographic characteristics (see below for a description of each survey

question). The respondent will be asked to indicate the specific beach(es) that he or she visited in the previous 12 months (from September 1, 2017 to August 31, 2018), and the number of day and overnight trips taken. The respondent will also be asked whether and how changes in marine debris levels would affect her or his visitation of the local beaches.

The implementation sequence for the mail survey will be as follows:

- **Day 1**: The primary mail survey will be mailed to all sampled households via first-class mail. The survey instrument will include an introductory letter informing respondents about the survey and encouraging their participation by a specific date. The initial packet will also include a questionnaire and a self-addressed, postage-paid return envelope.

- **Day 7**: A thank you/reminder postcard will be mailed to all sampled households thanking them for responding and encouraging them to complete the survey if they have not already.

- **Day 14**: Another thank you/reminder email will be sent to all sampled households who have not yet responded to encourage their survey completion, and provide them with information to request another copy of the survey if it has been lost or misplaced.

- **Day 21**: A replacement survey instrument will be sent to all sampled households who have not yet responded via first class mail. The replacement survey will include a letter with a final reminder to complete the survey, a second questionnaire, and a postage-paid return envelope.

The content and specific purpose of each question is described below.

Primary mail survey

The survey questions, and the purpose of each question, are described below.

- **Familiarity with local beaches.** Question 1 will ask respondents to review a map and list of local beaches and indicate the beaches with which they are familiar. This will remind respondents of local area beaches and make respondents aware of the beaches we will be asking about in subsequent questions about trips and debris levels.

- **Number of trips.** Questions 2 and 3 will ask respondents about the total number of their single- and multiple-day trips during the previous year to all beaches in the study area. Respondents' total number of trips throughout the year will be used as the baseline to which changes in trips, estimated in later questions, are compared. Single- and multiple-day trips involve different expenditures, and the breakout into these two categories will be used in the analysis that estimates benefits to the regional economy.

- **Importance of beach attributes.** Question 4 will ask respondents about the importance of 13 attributes when choosing which beaches to visit. This will support the interpretation of contingent behavior results by allowing a comparison of the importance respondents place on marine debris to their reported behavioral responses to changes in marine debris. The

question may also encourage respondents to think carefully about how they respond to marine debris relative to other beach characteristics when answering the contingent behavior questions.

- **Marine debris levels.** Question 5 will ask respondents to report which beaches they visited over the last beach season and to rate the level of marine debris they encountered at each beach by comparing the debris they encountered to photographs of debris provided in the survey. The debris ratings will be used to supplement onsite marine debris measurements (Herring, 2018) and develop a more complete evaluation of the level of debris at beaches throughout each coastal community. To specify the size of the beach area respondents are asked to evaluate, the survey includes an oblique-angle photograph that represents the perspective from which beachgoers would view a beach during their visit. This is preferable to a plan-view aerial image, which is a perspective few beachgoers have seen. In one-on-one interviews, respondents indicated they understood the size of the area depicted in the photograph. Similarly, in the mail-survey pretest, 90% of respondents said the description of the area – which included the pictures – was clear. The debris photographs that were included in the survey are representative of common items found on beaches in the United States, based on a NOAA database of volunteer monitoring (Herring, 2018).

- **Contingent behavior questions.** Contingent behavior is a "stated preference" method in which respondents indicate how their recreation choices would change given hypothetical changes in recreation options. Questions 6 and 7 will ask whether respondents would change the number of trips they would take to the study area under two hypothetical scenarios: (1) "If there had been almost no garbage or manmade debris at beaches" and (2) "If there had been twice as much garbage or manmade debris at beaches." These questions will allow us to estimate changes in the number of beach trips associated with increases or decreases in marine debris in different target communities.

- **Public attitude toward marine debris.** Questions 8 through 12 will ask whether respondents are concerned about the presence of various types of garbage or manmade debris on the sand or in the surf while visiting a beach, the types of debris they have actually seen on beaches, their understanding of the sources of debris found on beaches, and whether they have participated in beach cleanup efforts. These questions were part of the Orange County Pilot Study and will continue to be helpful as context for evaluating marine debris policies in coordination with coastal communities.

- **Demographic characteristics.** Questions 13 through 19 will ask respondents to report the number of adults and children in their household; and their gender, age, ethnicity, race, education level, and income. These questions will be used in the nonresponse analysis and may also be used to investigate the relationship between the response to changes in marine debris levels and demographic characteristics.

The Program will retain control over the information and safeguard it from improper access, modification, and destruction, consistent with NOAA standards for confidentiality, privacy, and electronic information. See the response to Question 10 of this Supporting Statement for more

information on confidentiality and privacy. The information collection is designed to yield data that meet all applicable information quality guidelines.

3. Describe whether, and to what extent, the collection of information involves the use of automated, electronic, mechanical, or other technological techniques or other forms of information technology.

Data for the onsite intercept survey will be collected via secured computerized tablets. The tablets will electronically collect the participant contact data and transmit information to our study contact database. Interviewers will administer the survey questions to respondents and enter data directly into the tablet interface. Data entered into the tablet will be securely stored in our contact database. Only authorized study personnel will have access to the secure tablets and information will not be shared or disclosed for any reason.

Data will be collected via a mail survey using mailing addresses collected via an onsite intercept survey. The data collection effort will not use automated, electronic, mechanical, or other technological techniques or other forms of IT.

4. Describe efforts to identify duplication.

A review of the literature did not identify any existing research on the economic impact of marine debris on beach visitors and local economies in the United States. While Parsons et al. (2009) included "manual cleaning" and "machine cleaning" variables in an economic model focused on Texas Gulf Coast beaches, they did not evaluate the amount of debris at beaches. The study also focused on day trips by Texas residents only, which limits its application to the estimation of economic impacts on other tourism-dependent communities. Other beach recreation models do not include any measure of marine debris at all, including the Southern California beach model (Hanemann et al., 2004), a model focused on visits to New Jersey, Delaware, and Maryland beaches (Parsons and Massey, 2003); and a model focused on visits to San Diego County beaches (Lew and Larson, 2005). Although the Pilot Study of Beach Recreation in Orange County (IEc, 2014) allows the estimation of welfare effects to beachgoers from changes in marine debris levels, the study focused on single-day trips only.

5. If the collection of information involves small businesses or other small entities, describe the methods used to minimize burden.

The proposed information collection will focus on households and will not affect small businesses or other small entities.

6. Describe the consequences to the Federal program or policy activities if the collection is not conducted or is conducted less frequently.

If the information collection is not conducted, the Program will have difficulty moving forward with a research program aimed at advancing our knowledge concerning the economic impacts of marine debris on the U.S. economy. The study is a necessary step toward this goal as it allows

the Program to extend the results of the prior Orange County Pilot Study (IEc, 2014; Leggett et al., 2018).

7. Explain any special circumstances that require the collection to be conducted in a manner inconsistent with OMB guidelines.

The proposed information collection will be conducted in a manner that is consistent with the Office of Management and Budget (OMB) guidelines.

8. Provide information on the PRA Federal Register Notice that solicited public comments on the information collection prior to this submission. Summarize the public comments received in response to that notice and describe the actions taken by the agency in response to those comments. Describe the efforts to consult with persons outside the agency to obtain their views on the availability of data, frequency of collection, the clarity of instructions and recordkeeping, disclosure, or reporting format (if any), and on the data elements to be recorded, disclosed, or reported.

A Federal Register Notice published on February 22, 2017 (FR Doc. 2017-03433) solicited public comment. Only two comments were received by the Program. Because these were outside the scope of study for this work, no response was required.

9. Explain any decisions to provide payments or gifts to respondents, other than remuneration of contractors or grantees.

No monetary incentives will be offered to survey respondents.

10. Describe any assurance of confidentiality provided to respondents and the basis for assurance in statute, regulation, or agency policy.

NOAA will not collect any identifying information about survey respondents other than name and household address. Only ZIP code and state will be included in the data; names and street addresses will be used only during the mail administration of the survey and will not be included in the survey data.

The survey materials will include a statement that the respondent's name and street address will be removed from NOAA's database after NOAA receives the completed questionnaire, or after two months. In addition, the survey materials will state that all information provided "will remain confidential to the extent permitted by law." No other confidentiality assurances will be provided to the respondent.

11. Provide additional justification for any questions of a sensitive nature, such as sexual behavior and attitudes, religious beliefs, and other matters that are commonly considered private.

No questions of a sensitive nature will be asked.

12. Provide an estimate in hours of the burden of the collection of information.

The proposed collection involves two one-time surveys, an onsite intercept survey and the primary mail survey, plus a non-response follow-up study.

- **Onsite intercept survey**: We will intercept potential respondents at beaches in each study area and ask them to complete a short onsite survey. The onsite intercept survey will include demographic questions, attitudinal questions about marine debris, and questions about participation in single or multiple-day trips. The last question will ask respondents if they would be willing to participate in a future mail survey. For those who agree to participate in the mail survey, we will ask for their name and mailing address. For those who do not agree to participate in the mail survey, we will record their ZIP code instead of their name and mailing address. To achieve a target sample of 400 completed mail surveys (100 in each of 4 study areas), we will need to approach 3,432 potential respondents to obtain 1,144 addresses for the mail survey. This estimate is based on a 33% participation rate among those approached for the onsite survey and a 35% response rate for the mail survey. We also assume that 33% of those approached for the onsite survey complete the onsite portion but refuse the mail portion.

- **Primary mail survey**: We will mail the primary survey to the 1,144 onsite intercept survey respondents who agree to participate in the mail survey. Assuming a 35% response rate to the mail survey, we expect to receive 400 completed surveys. For the remaining 744 nonrespondents, we will have some demographic and beach visitation data from the onsite survey.

- **Non-respondent follow-up study**: We will use information collected during onsite interviews (including people who did not wish to participate in the survey and those who agreed initially but did not return the mail survey) to conduct a nonresponse study.

Based on pre-tests, we assume that each respondent will spend 4 minutes completing the onsite survey if they provide their full mailing and email address and 3 minutes completing the onsite intercept survey if they decline participating in the mail survey. We also conservatively include 1 minute of survey time for onsite nonrespondents, who will be briefly asked to provide their age if they are willing. The primary mail survey will require approximately 10 minutes to complete. Thus, we estimate the total burden of this collection to be 219 hours (Table 2). This is a one-time data collection effort, so there will be no additional costs expected for respondents.

Table 2. Total estimated burden

Survey	Responses	Completion time	Burden hours
Single question (age) for onsite refusals	1,144	1 minute	19
Onsite intercept survey (decline mail survey)	1,144	3 minutes	57
Onsite intercept survey (agree to mail survey)	1,144	4 minutes	76
Primary mail survey	400	10 minutes	67
		Total	219

Table 3 reports mean hourly wages for each of the four study areas (BLS, 2017). Multiplying the burden hours for each region by the mean hourly wage yields a total labor cost of $4,599.

Table 3. Total estimated labor cost for completing the onsite intercept survey and the primary mail survey

Study area	Expected number of onsite survey refusals	Expected number of onsite survey respondents without address	Expected number of onsite survey respondents with address (and survey mailings)[a]	Expected number of mail-survey completes	Total burden hours[b]	Dollar value per burden hour	Total labor cost[c]
Great Lakes	286	286	286	100	55	$19.31	$1,057
East Coast	286	286	286	100	55	$20.09	$1,100
Gulf of Mexico	286	286	286	100	55	$17.36	$951
West Coast	286	286	286	100	55	$27.22	$1,491
Total	1,144	1,144	1,144	400	220		$4,599

a. Surveys will be mailed to those who complete the onsite intercept survey and agree to participate in the mail survey (provided mailing addresses).
b. Based on 1 minute per onsite refusal, 3 minutes per onsite interview without address, 4 minutes per onsite interview with address, and 10 minutes per completed mail survey.
c. Totals may not sum due to rounding.

13. <u>Provide an estimate of the total annual cost burden to the respondents or record-keepers resulting from the collection (excluding the value of the burden hours in Question 12 above).</u>

There will be no recordkeeping or reporting costs resulting from the data collection effort. The mail survey packages will include postage-paid envelopes.

14. <u>Provide estimates of annualized cost to the Federal government.</u>

The total annualized cost to the Federal Government is $342,087.40. This total cost is comprised of two components:

1. **Operational expenses**: All operational costs will be incurred by the contractor, Abt. The contract with Abt is for $335,105, which includes the survey design and testing, survey implementation, data analysis (including estimating economic impacts on local communities), and reporting.

2. **Labor costs for staff**: The estimated time required for Program staff to oversee the information collection is 80 hours at a Series and Grade of Environmental Scientist, ZP-0401-04, and an hourly rate of $87.28 (including benefits), resulting in total labor costs for staff of $6,982.40.

Total: $342, 087.40.

15. Explain the reasons for any program changes or adjustments.

This is a revision, replacing the initial pretest with a survey in 4 locations.

16. For collections whose results will be published, outline the plans for tabulation and publication.

Statistical summaries of responses to all survey questions will be developed, including the mean, minimum, maximum, and standard deviation for questions with numerical responses; and response frequencies for questions with categorical response options. In addition, responses related to changes in beach visits will be analyzed within the context of an economic model. This will include an estimate of changes in the value of recreation and impacts to the regional economies for the four communities, as described in detail in Part B of this supporting statement.

The overall schedule for the study is as follows:

- Conduct intercept surveys — June–August 2018
- Print and coordinate survey materials — September 2018
- Implement mail survey — September–October 2018
- Analyze results and develop report — October–December 2018

The project report will be posted online on the Program website (http://marinedebris/noaa.gov) in pdf format.

17. If seeking approval to not display the expiration date for OMB approval of the information collection, explain the reasons why display would be inappropriate.

The expiration date for OMB approval will be displayed on all surveys associated with this information collection.

18. Explain each exception to the certification statement.

There are no exceptions to the certification statement.

SUPPORTING STATEMENT
Preliminary Case Study Assessing Economic Benefits of Marine Debris Reduction
Regional Pilot Study
OMB CONTROL NO. 0648-0756

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.

The potential respondent universe consists of visitors to each coastal study location who are 18 years of age or older. Onsite intercept surveys at local beaches will be used to find respondents for the primary mail survey. The onsite intercept survey includes demographic questions, attitudinal questions about marine debris, and questions about participation in single or multiple-day trips. The last question asks respondents if they would be willing to participate in a future mail survey. For those who decline to participate in the onsite interview entirely, we will ask their age, and record their gender and the reason they did not participate. For those who participate in the onsite intercept survey and agree to participate in the mail survey, we will record their name and mailing address. For those who complete the intercept survey but do not agree to participate in the mail survey, we will record their ZIP code in lieu of their name and mailing address.

We anticipate that 67% of those approached will agree to participate in the onsite survey and 33% will agree to receive a mail survey. We will thus need to approach 3,432 potential respondents to obtain the desired 1,144 addresses to administer the mail survey. Assuming a 35% response rate for the mail survey, we expect to receive 400 completed surveys (Table 4).

Table 4. Expected number of intercept and mail surveys for each study area

Sample area	Number of onsite intercept surveys	Expected number of survey mailings[a]	Expected number of completed surveys
Great Lakes	572	286	100
East Coast	572	286	100
Gulf of Mexico	572	286	100
West Coast	572	286	100
Total	2,288	1,144	400

a. Surveys will be mailed to those who complete the onsite intercept survey and agree to participate in the mail survey.

An OMB-approved pretest was conducted in Orange County, CA, from September 2017 through January 2018. The response rates for each stage of the pretest survey are shown in Table 5. We used the American Association for Public Opinion Research (AAPOR) RR1 definition for calculating response rates. The response rate for the onsite survey was 36.2% and the response rate for the mail survey was 17.4%. The cumulative response rate for the two stages was 6.3%.

Table 5. Onsite, mail, and cumulative response rates for the pretest

Stage of survey	Number	Percent
Onsite survey		
Sampled beachgoers	777	100.0%
At least two mail-survey demographics known	743	95.6%
Five mail-survey demographics known	504	64.9%
Valid addresses obtained	281	36.2%
Mail survey		
Valid addresses	281	100.0%
Returned surveys	49	17.4%
Cumulative response rate		6.3%

The necessity of obtaining and analyzing pretest results in time to begin the full survey in the summer of 2018 led us to conduct the pretest mail survey on a schedule that overlapped with the holiday season, which may have affected response rates for the mail survey. If we conduct the full mail survey in September 2018, we expect the final response for the mail stage of the survey to be 35%, based on previous experience. Using our assumption of a 33% response rate for the onsite survey (slightly lower than in the pretest), this would result in a cumulative response rate of 11.6%.

A two-stage onsite and mail survey has the disadvantage that respondents drop out at both stages, leading to a low cumulative response rate. This two-stage sampling approach was essential given the need to contact a sample of all people who visit the beach, which includes people taking overnight trips from throughout the county. A nationwide mail survey to identify beachgoers from the general population would be prohibitively expensive.

The two-stage survey also has advantages with regard to nonresponse that may offset the potential effects of low response rates. Specifically, the first stage allows us to capture some information about the great majority of people in the sample. Specifically, we will have the ability to reweight the mail survey respondents to match nearly the entire sample with respect to both gender and age, since both of these variables will be recorded for 96% of the onsite sample. We will also have the ability to match on five demographic variables for 65% of the sample, namely, those who complete the onsite survey. This will allow us to reduce any bias that may result from nonresponse in a way that specifically focuses on the population of interest, namely, people who go to the beach. This kind of adjustment would not be possible in a one-stage mail survey since characteristics of beachgoers are not available from any outside control source, such as U.S. Census data.

To further adjust for nonresponse, we have revised the onsite survey to include four attitudinal questions from the mail survey. This will allow us to reweight the mail survey observations so that responses to the attitudinal questions, along with the five demographic variables, can be matched to the 65% of the sample that responded to the onsite survey. The specific questions will include asking respondents the importance of three beach characteristics: free parking, no crowds, and no garbage or manmade debris. The onsite survey will also include the question of whether respondents feel garbage or manmade debris is a problem on local beaches.

The pretest yielded estimates with reasonable precision for Orange County beachgoers. The estimated change in trips from doubling debris loads was a 14.0% decrease in trips, with a

confidence interval of 13.4% to 16.4%. The change in trips from a decrease in debris to "almost none" was an increase of trips by 4.0%, with a confidence interval of 3.4% to 5.5%. Confidence intervals were estimated using a jackknife variance procedure. The targeted number of 100 completed surveys in a given study area should yield greater precision than the 49 observations obtained in the pretest.

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.

Statistical methodology for stratification and sample selection

As described in Part A, we will begin sampling procedures by selecting multiple beaches in each of the four study locations. The beaches selected will represent various types of beach experiences available, including more- and less-developed beaches. Because this approach relies on judgment to achieve representativeness rather than probability-based sampling, there is some uncertainty involved. The degree of accuracy needed is discussed below.

When sampling at the selected beaches, we wish to ensure that approximately 50% of respondents take multiple-day (or overnight) trips. The reason for this target is that a sufficient number of respondents taking multiple-day trips is important for characterizing switching by beachgoers between regions, which is a critical aspect of the *Deepwater Horizon* model (English et al., In review). It is also important for estimating the number of overnight hotel stays, which is necessary for the regional economic analysis. Conversely, targeting a sufficient number of local beachgoers who are likely to take more trips and visit more beaches in their region, is important for characterizing garbage and marine debris at as many beaches in each region as possible. If, during this initial onsite sampling, it appears that the proportion of those taking overnight trips is significantly less than or greater than 50%, we will adjust the sampling rates accordingly. When evaluating whether an adjustment is needed, we will assume that anyone engaged in a day trip at the time of the onsite survey takes only day trips to the area being sampled. When evaluating the adjustment we will also account for the effects of choice-based sampling, described below. To illustrate the type of adjustment that could be made, consider the case where only 25% of respondents take overnight trips during the initial sampling of a given region. This would mean there are three times as many people taking day trips as there are taking overnight trips. To reach the target of an even split, we would adjust the sampling fraction to one-third for those taking day trips.

Onsite sampling is a form of choice-based sampling, where the choices of selected respondents affect their probability of entering the sample. In this study there are three components of choice-based sampling. The first is the length of time a respondent spends at the beach on a given day. The second is the number of days the respondent spends at the beach during a given trip, which is one for day trips but could be more for overnight trips. The third is the number of trips the respondent takes to the given sampling area during the year. Data on the length of time at the beach and the number of days spent at the beach for a given trip will be collected during the onsite interviews. These questions will be asked with respect to the trip taking place at the time of the interview, and the responses will be viewed as a random draw from all trips the respondent

takes. Data on the number of trips a respondent takes to the relevant sampling area during the course of the year (September 2017–August 2018) will be collected in the mail survey.

Estimation procedure

As discussed in Part A, the primary research goal is to quantify the relationship between marine debris and the number of trips to beaches in the study areas. Any change in beach visits caused by potential changes in marine debris, expressed as a percentage, will be used as input to economic models. The models will estimate the impacts of marine debris on the value of recreation and the regional economy. A secondary goal is to compile response statistics on questions in the survey that do not involve a change in trips, such as what types of garbage and debris respondents typically see on the beach, respondents' demographic characteristics, and other questions.

For all survey results, the statistical estimation procedure will use a weighted average of a respondent's answers, where weights account for the sample selection factors described above. For example, a respondent who spent three days at the beach on his or her overnight trip, took two trips during the year, and spent four hours at the beach on the day he or she was intercepted, will have a sampling weight that is the product of one-third, one-half, and one-fourth. If the sampling rate for those taking day or overnight trips is adjusted, the weights used in the estimation will also include a factor that is the inverse of the sampling rate at the time of the onsite interview. The sampling weights will be used to compile respondent statistics at the study areas only. The Program does not intend to extrapolate its study results to the national level.

The model estimation procedure relies on a nationwide travel cost model of coastal recreation. The model was developed by experts for NOAA and other Federal and State trustees in the *Deepwater Horizon* oil spill assessment (English et al., In review). A travel cost model involves a system of demand functions, where price is the cost to individuals of traveling to a given site and quantity is the number of trips individuals take to the site. In the *Deepwater Horizon* model, travel cost is calculated using an average of airfares and driving costs, depending on the distance traveled and the proportion of people traveling by air or car for any given distance. Travel cost also includes the value of time spent traveling. The structure of the model is nested logit, with coastal beaches grouped into 76 model sites covering all coastal areas of the continental United States, including the Great Lakes. In response to an environmental change, the model accounts for the change in the value of trips to a given site, the switching of trips between a given site and alternative sites, and changes in the total number of trips to all sites. The recreation data used in the model come from a sample of 41,716 respondents living throughout the continental United States. Additional details about the *Deepwater Horizon* model and data can be found in English and McConnell (2015), Herriges (2015), and Leggett (2015). While the final *Deepwater Horizon* model focused on sites in the southeast United States, data were collected for trips to all beaches throughout the country and this more comprehensive data will be used for the marine debris model.

Since the *Deepwater Horizon* model already estimates the total number of trips to each site, we will not rely on the Regional Pilot Study survey to estimate the total number of trips in the selected coastal locations. Instead, we have defined the coastal locations so that they match sites in the *Deepwater Horizon* model. A percentage change in trips due to changes in garbage or marine debris, estimated using the contingent behavior questions from the Regional Pilot Study

survey will be applied to total trips at the relevant model sites. The resulting change in total trips is the information the model requires to estimate the change in value.

Degree of accuracy needed

The survey for the Regional Pilot Study will be used to calculate average statistics rather than totals. For example, the average percent change in the number of trips is the key result for the analysis of economic value. Statistics for the total change in the number of trips are not required because the *Deepwater Horizon* model (English et al., In review) that will be used to calculate economic value already includes estimates of the total number of trips. A percent change from the Regional Pilot Study survey will be applied to the *Deepwater Horizon* totals, which simplifies the weighting procedures. Specifically, we will not calculate weights to extrapolate from trips at the several sites sampled to total beach trips in the region. We also will not calculate weights that extrapolate from the times when onsite sampling is conducted to all times when beach recreation occurs. These weights, which would be required to estimate statistics reflecting totals, are not required for the average statistics to be used in this study.

The largest source of potential inaccuracy is the sampling of a small number of beaches at one point in time during the recreation season. To achieve more accurate representativeness, probability-based sampling would require a random selection of a large number of beaches and a large number of sampling times throughout the recreation season. The cost of such an effort was determined to not be warranted given that we require only average statistics characterizing respondent choices rather than statistics quantifying the total number of trips.

Specialized sampling procedures

We will not employ any specialized sampling procedures, other than the onsite sampling methods described above.

Periodic data collection

The data collection effort will gather information for a full year of recreation activity in one survey effort. There will be no periodic data collection.

3. <u>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.</u>

A number of measures will be implemented to maximize the response rate, including:

- A short beach intercept survey (~ 4 minutes) will identify individuals willing to participate in a mail survey.
    - Onsite interviewers will recruit potential participants from multiple beaches within the study area. Interviewers will have background information to share with respondents about the study to provide potential participants context and credibility for the research.

- The intercept survey will be administered via computerized tablets to minimize respondent burden and transmit data in real-time.

- The initial mail-survey packet will contain an introductory letter informing respondents about the survey and encouraging their participation by a specific date. All letters will include the NOAA logo and will be signed by the Chief Scientist of the NOAA Marine Debris Program.

- The survey will be sent via first-class mail and will include a self-addressed, postage-paid return envelope to facilitate response.

- One week after sending the initial survey, a thank you/reminder postcard will be mailed to all sampled households thanking them for responding and encouraging them to complete the survey if they have not already.

- One week after sending the first thank you/reminder postcards, another thank you/reminder postcard will be sent to all sampled households who have not yet responded to encourage their survey completion, and provide them with information to request another copy of the survey if it has been lost or misplaced.

- Three weeks after sending the initial survey, a replacement survey will be mailed to all sampled households who have not yet responded via first class mail. The replacement survey will include a letter with a final reminder to complete the survey, a second questionnaire, and a self-addressed, postage-paid return envelope to facilitate response.

- All survey materials were carefully crafted to provide a pleasing appearance that encourages response. Questions are kept short and the total number of questions was minimized, given the research needs. An attractive, color map of local beaches is included with each survey instrument.

A potential alternative to a mixed-mode data collection effort includes a web-based survey and an in-person survey. However, existing probability-based web panels (e.g., GfK Knowledge Networks) would have inadequate sample sizes at the county level, and the cost associated with completing an in-person survey at a study location would be much higher compared to a mixed mode survey. While it would be possible to provide a Web URL that allows mail survey respondents to complete the survey over the internet, recent research has found that providing an internet option in a mail survey does not improve response rates relative to a mail-only approach (Messer and Dillman, 2011; Medway and Fulton, 2012; Dillman et al., 2014). The potential for nonresponse bias will be assessed by comparing the demographic characteristics and responses to attitudinal questions of those who did not agree to take the mail survey during onsite intercepts, those who agreed to but did not return the survey, and those who completed the survey. If substantial differences are observed, sampling weights will be developed through sequential post-stratification (e.g., raking), so that the weighted demographic totals for the survey data align with corresponding totals for the surveyed region (Battaglia et al., 2004).

Table 6 presents information from the Regional Pilot Study pretest that relates to both a nonresponse analysis and the potential for a nonresponse adjustment. The table shows four demographic variables that are available for most people in the target sample, namely, for the 504 people who did not refuse our onsite survey out of a total of 777 people intercepted on

the beach. The four variables are the respondent's age, household size, level of education, and whether the respondent's household has children. In the final version of the survey, gender will also be available, for a total of five variables that can be used to analyze and control for nonresponse (gender was not recorded for many respondents in the pretest due to an omission in the onsite intercept survey form). Additionally, both age and gender will be available for all but a very small number of people, since even those who refused the onsite survey were asked to give their age, which most did (88.0% of the 273 refusals provided their age).

Table 6. Nonresponse analysis and variables available for nonresponse adjustment

Variable	Mail data N = 49	Onsite with address N = 345	Onsite no address N = 159	Onsite refusals N = 273	Onsite total N = 777	Onsite total without refusals N = 504
Age ≤ 45	36.2%	54.5%	58.4%	60.3%	57.3%	55.7%
Age > 45	63.8%	45.5%	41.6%	39.7%	42.7%	44.3%
Household size	2.7	3	2.8	N/A	N/A	2.9
Household has children	31.9%	39.7%	36.5%	N/A	N/A	38.7%
Less than high school	0.0%	0.9%	1.3%	N/A	N/A	1.0%
High school or General Education Diploma	10.4%	22.9%	17.3%	N/A	N/A	21.1%
Some higher education	33.3%	42.0%	32.7%	N/A	N/A	39.1%
Bachelor degree	31.3%	29.6%	33.3%	N/A	N/A	30.8%
Graduate degree	25.0%	4.6%	15.4%	N/A	N/A	8.0%

Respondents to the mail survey differ from the target sample primarily with respect to age and education (Table 6). Those returning the mail survey were on average older and more educated than those intercepted on the beach. Of those returning the mail survey, 63.8% were older than 45, compared to 42.7% in the target sample. The proportion of mail respondents with a bachelor degree or higher was 56.3%. This compares to 38.8% of the onsite survey respondents. The distributions of the variables analyzed change primarily at the mail stage of the study, indicating that nonresponse at other stages of the study may have less effect on representativeness.

We believe the best approach to adjust for nonresponse in this study – when the first contact is through an intercept survey – is to reweight the mail survey observations so the weighted distributions of key demographic variables match the variable distributions for respondents intercepted onsite. This would potentially be done for all five demographic variables and would allow us to match to about 65% of the target sample (504 / 777 = 0.65). This approach could also be applied using age and gender to match to about 96% of the target sample [(88% x 273 + 504) / 777 = 0.96). As noted earlier, the final onsite survey has been revised to include four attitudinal variables about the importance of certain beach characteristics to respondents, including the presence of garbage or marine debris, and whether they think garbage or marine debris is a problem on beaches in their local area. These variables will allow for a more thorough nonresponse adjustment than just demographic variables alone. We can also perform a nonresponse follow-up study if that approach is preferred.

4. <u>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.</u>

Comments on the survey materials were solicited from the following persons outside the agency:

1. Dr. George Parsons, Professor, Department of Economics, University of Delaware.

2. Dr. Eric English, Economist, Bear Peak Economics.

3. Dr. Jason H. Murray, Economist, I. M. Systems Group, Inc.

A pretest was conducted with the approval of OMB from September 2017 through January 2018. During the pretest, we conducted onsite surveys at eight beaches in Orange County on Wednesday, September 27, 2017 and on the following Saturday, September 30, 2017. The onsite surveys asked several brief questions about each respondent's recreation and also elicited the respondent's address for completion of a follow-up mail survey. We intercepted 777 recreators and obtained onsite interviews with 504 of them. We obtained addresses for the follow-up mail survey from 345 onsite respondents.

On December 6, 2017, we mailed 345 surveys and sent reminder postcards one week later. For any valid addresses from which we had not obtained a completed survey, we sent a follow-up survey on December 20, 2017, and a second reminder postcard on January 18, 2018. By the end of January we had received 49 completed surveys. The U.S. Postal Service returned a total of 64 surveys as undeliverable due to invalid addresses.

Details of the pretest are described in a memorandum to Amy Uhrin and Carlie Herring of the National Oceanic and Atmospheric Administration, titled "Draft Pretest Results: Economic Impacts of Marine Debris on Tourism-Dependent Communities," dated March 21, 2018 (included as a supporting document). The main findings and resulting revisions were:

- The two-stage sampling procedure resulted in a low cumulative response rate. We believe this was partly due to the scheduling of the pretest mail survey during the holiday season, which will not be a factor in the final study. The potential effects of nonresponse may be offset by reweighting mail-survey observations so that the distribution of key characteristics match with the onsite survey. To improve the nonresponse adjustment, attitudinal questions from the mail survey were also added to the revised onsite survey.

- There was a high rate of item nonresponse for questions about how many more or fewer trips respondents would take in response to changes in marine debris. We concluded that the format of the original question, requiring respondents to fill out a table, was likely to be confusing to many respondents. The question was revised to take the form of direct questions with a single answer to each question.

- The estimated aggregated responses to changes in debris were statistically significant (e.g., a 14% decrease in trips with a confidence interval of 13.4% to 16.4%). Given that the pretest obtained only 49 completed surveys, and given that the questions about the effects of debris will be revised to reduce item nonresponse, it was determined that the original plan to obtain

200 surveys per region could be revised. The revised study plan reduces the target number of completed surveys per region to 100.

Previous pretesting included one-on-one discussions that were held with beachgoers in the Boston and Los Angeles areas in December 2016 and January 2017. The tests involved seven respondents, in addition to internal testing with Abt employees. The participants filled out a draft version of the survey instrument and discussed the survey and their responses with Dr. Eric English, a research team member. The interviews were designed to evaluate the clarity of the survey questions and the ability of survey respondents to accurately answer the survey questions.

The following summarizes the issues, revisions, and conclusions of the one-on-one discussions:

- The map of the study region was important in helping respondents remember the area of interest when answering questions throughout the survey.

- Respondents were best able to understand the concept of debris density when the idea was described as the respondent picking up all the debris in a specified area and seeing what they find.

- Most respondents said that they were aware of debris levels at the beaches, that they recalled which beaches had more debris and which had less, and were able to make a reasonable estimate of how much debris was present at the beaches.

- For the survey page that explains marine debris and includes any questions, it was important to include text that directed the respondent to the next page for questions about marine debris.

- When estimating any changes in the number of trips because of changes in debris, most respondents described their thought process in ways that indicated that they understood the questions and gave them careful consideration. Examples include respondents thinking about their children playing in the sand, respondents indicating that beaches were already clean enough so that reductions in debris would not matter to them, respondents saying they would choose closer beaches they had previously avoided if there were less debris, and respondents who would change their behaviors consistently by choosing to take more trips if there were less debris and fewer trips if there were more debris.

- The survey took less than 10 minutes for most respondents.

Two additional methodological tests involve comparing survey results to external measures. First, the survey elicits respondents' estimates of how their recreation choices would change in response to hypothetical changes in marine debris levels. This method is called "stated preference." It is common in the economics literature to compare stated-preference results to what are called "revealed preference" results. Revealed preference involves inferring changes in behavior from actual choices people have made in the past. We will compare the stated-preference results of the Regional Pilot Study to the revealed-preference results of the Orange County Pilot Study. As described in Part A, this comparison has already been done using data available from the pretest, and the results support the reliability of the stated preference

questions. Additional comparisons will be possible using the full dataset from the Regional Pilot Study.

Second, the Regional Pilot Study survey elicits respondents' estimates of the amount of garbage and debris at beaches in each study area. These estimates are useful in characterizing the baseline level of debris to which changes are compared. For some beaches, information about the level of marine debris has already been collected onsite. The estimates by respondents to the survey will be compared with the onsite measurements for validation or potential adjustments.

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.

The following individuals were consulted on the statistical aspects of the design:

1. Dr. George Parsons, Professor, Department of Economics, University of Delaware (phone: 302-831-6891).

2. Dr. Eric English, Bear Peak Economics, Boulder, Colorado (phone: 202-699-6334).

3. Dr. Adam Domanski, ECONorthwest (formerly of NOAA) (phone: 206-387-4364).

Abt will collect and analyze the information for the Program.

References

Ballance, A., P.G. Ryan, and J.K. Turpie. 2000. How much is a clean beach worth? The impact of litter on beach users in the Cape Peninsula, South Africa. *South African Journal of Science* 96(5):210–230.

Battaglia, M.P., D. Izrael, D. Hoaglin, and M.R. Frankel. 2004. Tips and tricks for raking survey data (aka sample balancing). *American Association of Public Opinion Research*.

Bess, R. and Z.O. Ambargis. 2011. Input-Output Models for Impact Analysis: Suggestions for Practitioners Using RIMS II Multipliers. Presented at the 50th Southern Regional Science Association Conference, New Orleans, LA. March 23–27. Available: https://www.bea.gov/papers/pdf/WP_IOMIA_RIMSII_020612.pdf. Accessed 11/8/2016.

BLS. 2017. U.S. Department of Labor, Occupational Employment Statistics. Bureau of Labor Statistics. Available: www.bls.gov/oes/.

Brouwer, R., D. Hadzhiyska, C. Ioakeimidis, and H. Ouderdorp. 2017. The social costs of marine litter along European coasts. *Ocean & Coastal Management* 138:38–49.

Chu, A., D. Eisenhower, M. Hay, D. Morganstein, J. Neter, and J. Waksberg. 1992. Measuring the recall error in self-reported fishing and hunting activities. *Journal of Official Statistics* 8(1):19–39.

Dillman, D., J.D. Smyth, and L.M. Christian. 2014. *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method.* 4th Edition.

English, E. and K. McConnell. 2015. *Overview of Recreation Assessment*. DWH Lost Recreational Use NRDA Technical Working Group Report. Available: https://www.fws.gov/doiddata/dwh-ar-documents/940/DWH-AR0021412.pdf.

English, E., R. von Haefen, J. Herriges, C. Leggett, F. Lupi, K. McConnell, M. Welsh, A. Domanski, and N. Meade. In review. Estimating the value of lost recreation days from the *Deepwater Horizon* oil spill.

Hanemann, M., L. Pendelton, C. Mohn, J. Hilger, K. Kurisawa, D. Layton, C. Bush, and F. Vasquez. 2004. Using Revealed Preference Models to Estimate the Effect of Coastal Water Quality on Beach Choice in Southern California. A Report from the Southern California Beach Valuation Project to the National Oceanic and Atmospheric Administration.

Herriges, J. 2015. *Model Structure*. DWH Lost Recreational Use NRDA Technical Working Group Report. Available: https://www.fws.gov/doiddata/dwh-ar-documents/940/DWH-AR0045972.pdf.

Herring, C. 2018. Supporting Materials for the Study "The Economic Impacts of Marine Debris on Tourism-Dependent Communities": Marine Debris Monitoring and Assessment Project (MDMAP) Overview and Justification of Marine Debris Types and Concentrations.

IEc. 2014. Assessing the Economic Benefits of Reductions in Marine Debris: A Pilot Study of Beach Recreation in Orange County, California. Final Report. June 15, 2014. Industrial Economics, Incorporated. Available: https://marinedebris.noaa.gov/file/2574/download?token=zIPamF9O. Accessed 11/3/2016.

Krelling, A., A. Williams, and A. Turra. 2017. Differences in perception and reaction of tourist groups to beach marine debris that can influence a loss of tourism revenue in coastal areas. *Marine Policy* 85:87–99.

Landry, C.E., T. Allen, T. Cherry, and J.C. Whitehead. 2012. Wind turbines and coastal recreation demand. *Resource and Energy Economics* 34(1):93–111.

Leggett, C. 2015. *Travel Cost Computation*. DWH Lost Recreational Use NRDA Technical Working Group Report. Available: https://www.fws.gov/doiddata/dwh-ar-documents/940/DWH-AR0056724.pdf.

Leggett, C., N. Scherer, T. Haab, R. Bailey, J. Landrum, and A. Domanski. 2018. Assessing the economic benefits of reductions in marine debris at Southern California beaches: A Random Utility Travel Cost Model. *Marine Resource Economics* 33(2):133–153.

Lew, D.K. and D.M. Larson. 2005. Valuing recreation and amenities at San Diego County beaches. *Coastal Management* 33(1):71–86.

Lynn, P. 2013. Alternative sequential mixed-mode designs: Effects on attrition rates, attrition bias, and costs. *Journal of Survey Statistics and Methodology* 1(2):183–205.

Medway, R.L. and J. Fulton. 2012. When more gets you less: A meta-analysis of the effect of concurrent web options on mail survey response rates. *Public Opinion Quarterly* 76(4):733–746.

Messer, B.L. and D.A. Dillman. 2011. Surveying the general public over the Internet using addressed-based sampling and mail contact procedures. *Public Opinion Quarterly* 75(3):429–457.

Millar, M.M. and D.A. Dillman. 2011. Improving response to web and mixed-mode surveys. *Public Opinion Quarterly* 75(2):249–269.

NOAA 2014. National Oceanic and Atmospheric Administration Information Quality Guidelines. Available: http://www.cio.noaa.gov/services_programs/IQ_Guidelines_103014.html. Accessed 5/3/2018.

Ofiara, D., and B. Brown. 1999. Assessment of economic losses to recreational activities from 1988 marine pollution events and assessment of economic losses from long-term contamination of fish within the New York Bight to New Jersey. *Marine Pollution Bulletin* 38 (11):990-1004.

Parsons, G. and D. Massey. 2003. A Random Utility Model of beach recreation. In *The New Economics of Outdoor Recreation*, N. Hanley, W.D. Shaw, and R.E. Wright (eds.). Edward Elgar.

Parsons, G., A. Kang, C. Leggett, and K. Boyle. 2009. Valuing beach closures on the Padre Island National Seashore. *Marine Resource Economics* 24(3):213–235.

Pendleton, L., P. King, C. Mohn, D.G. Webster, R. Vaughn, and P.N. Adams. 2011. Estimating the potential economic impacts of climate change on Southern California beaches. *Climatic Change* 109(1):277–298.

Schuhmann, P.W. 2012. Tourist perceptions of beach cleanliness in Barbados: Implications for return visitation. *Études Caribéennes* (19).

Smith, V.K., X. Zhang, and R.B. Palmquist. 1997. Marine debris, beach quality, and non-market values. *Environmental and Resource Economics* 10(3):223–247.

Tourangeau, R., E. English, K. McConnell, D. Chapman, I. Flores-Cervantes, E. Horsch, N. Meade, A. Domanski, and M. Welsh. 2017. The Gulf Recreation Study: Assessing lost recreational trips from the 2010 Gulf Oil spill. *Journal of Survey Statistics and Methodology* 5(3):281–309.

Onsite Recruitment Sampling Protocols

The goal of the Onsite Recruitment Survey is to recruit volunteers to take part in a short mail survey that will be sent to their home. Each completed recruitment survey will provide a respondent's name and address. Onsite recruitment sampling occurs on two days: one weekday and weekend day. Teams of two field staff will each sample at one of four pairs of beaches. In addition to recruiting mail survey participants, this sampling effort also includes recording an explanation when respondents choose to not to take the survey (refusals) and sampling information.

Your safety is important! If there are any safety concerns (including adverse weather conditions), please contact your supervisor.

General Procedure

1. Sampling at each pair of beaches will begin at 10:00 a.m. and end at 6 p.m. Usually sampling time should be divided approximately equally between beaches. However, there may be no more people to approach for sampling at one of the beaches. In this case begin or resume sampling at the other beach. Keep track of where you left off when leaving a beach, so you can pick up at the same location later if needed. Any areas reasonably accessible from the main entrance to the beach can be considered part of the same beach for sampling purposes.

2. Use the iPad provided to fill in the Onsite Recruitment Surveys. The password for the iPad is <PASSWORD>.

3. The recruitment forms are pre-loaded in the Numbers application, in spreadsheets titled, "Onsite_Recruitment_Form_1_MM.DD.YYYY", "Onsite_Recruitment_Form_2_MM.DD.YYYY", etc. There are four copies of the spreadsheet – one for each beach on each day of sampling. Change the name of the spreadsheet to reflect the sampling date. To do this, double click the spreadsheet icon.

4. Each file contains 5 tabs: a copy of these instructions, a privacy statement, information about the site, the survey form, and a form for refusals. The tabs appear on a ribbon at the top of the spreadsheet. Tap the tab to select.

5. Record responses in green cells only. Do not change other cells.

6. When arriving at a site, enter the sampling information on the tab "Site Info". Enter required information into the green fields in the box labeled, "Sampling information – Complete when arriving at site".

7. Approach each party on the beach and randomly select one adult to speak with. A party could be a group that appears to be together or a single person. Adults include anyone 18 or older. If you are unsure of a person's age you may ask upfront, with a short explanation of the reason. If the selected adult is reluctant to do the survey but another member of the party expresses an interest, conduct the interview with the willing respondent. However, do not canvass the rest of the

party once the selected individual has refused.

8. Record the survey responses in the onsite recruitment form on the tab, "Survey". Survey questions are included in the header rows.

9. When conducting each interview, ask the questions as they appear on the form. Additional instructions are provided on the form in red, bold, italic font. For ease of data entry, you may use all lower-case letters, even for names and places.

10. If a party does not participate, record the time, the reason, his/her gender, the year he/she was born (if willing to provide) and the party size on the sheet titled "Refusals"

11. The goal is to recruit 50% of respondents on day trips (Q1= "No"), and 50% on multiple day trips (Q1= "Yes"). Because there are more people on day trips, skip every 2nd respondent on a day trip. That is, if the previous day-trip respondent was given the full interview, for the next day-trip respondent end the interview at Q1, and vice versa. As always, thank the respondent when ending the interview.

12. After every 20 interviews, save a copy of the spreadsheet.
a. Tap the "Spreadsheets" button in the upper right hand corner to exit the spreadsheet. The spreadsheet will save automatically. Click and hold the spreadsheet icon. Once the spreadsheet is selected (the icon will wiggle), select the + icon in the upper right hand corner. This will automatically create a copy of the spreadsheet, named "Onsite_Recruitment_Form… copy".

b. Reopen the original spreadsheet and continue entering data there. Subsequent copies will automatically be named "Onsite_Recruitment_Form… copy 2", etc. There is a reminder in the Time field at every 20th survey. When entering the time for that field, use the backspace to clear the field first.

13. The goal of this survey is to collect mailing addresses for a follow up survey. If a respondent agrees to participate in the mail survey, it is imperative we have the correct address. Please clarify any questions such as spelling, Road/Street/Ave, etc. If you are unsure of a State's abbreviation, please enter the State's name. Once you have recorded the address, verify it with the respondent. If possible, zoom in and show the respondent your entry. Otherwise, verbally confirm the address.

14. For respondents who agree to do the mail survey, provide information about the mailing as it is presented on the data entry form: "the survey will be mailed to you in early September. It will come in a large envelope from the National Oceanic and Atmospheric Administration. Please complete it and mail it back as soon as you

Privacy Act Statement

Authority: The collection of this information is authorized under 33 U.S.C. 1853 et seq, the Marine Debris Research, Prevention and Reduction Act, which, along with the Marine Debris Amendments of 2012, established the NOAA Marine Debris Program to "identify, determine sources of, assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, the marine environment, and navigation safety."

Purpose: The information will be used to estimate economic impacts associated with marine debris on beaches.

NOAA Routine Uses: The survey data will be combined with a national model of coastal recreation, which relies on data collected for the Deepwater Horizon oil spill assessment, to estimate the economic impacts of marine debris on tourism-dependent communities. Disclosure of this information is permitted under the Privacy Act of 1974 (5 U.S.C. Section 552a) to be shared among NOAA staff for work-related purposes. Disclosure of this information is also subject to all of the published routine uses as identified in the Privacy Act System of Records Notice Commerce/NOAA-11, Contact Information for Members of the Public Requesting or Providing Information Related to NOAA's Mission.

Disclosure: Furnishing this information is voluntary; the only consequence of failure to provide accurate information is that your responses will not contribute to the success of this research.

ONSITE RECRUITMENT SURVEYS - SITE INFORMATION

Red Cells: DO NOT CHANGE
Green cells: ENTER REQUIRED INFORMATION

Sampling information - Complete when arriving at site	
Interviewer Initials	
Date	
Beach	
City	
Number recruited ***(report when complete interviews)***	0

For any selected party that did not give an interview, go to Sheet REFUSALS to record Reason
Gender, Age, and Party Size

Hello my name is _____. I am doing research on beach recreation for th government. I have just a few questions. May I begin?

			1. Is your visit here today part of a trip away from home lasting more than one day?		
Interview number	Time	AM/PM	No ***Indicate with "x". Skip to Q2 or end interview***	Yes ***Indicate with "x".***	1a. How many days will your trip last in total?
ex1	10:30	AM	x	n/a	n/a
ex2	10:45	AM		x	7
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20	SAVE A COPY				
21					
22					
23					
24					
25					

, Respondent

e federal

1b. How many of those days will you spend time at the beach?	1c. How many nights will you pay for lodging during your trip?	1d. Is going to the beach the main reason for your trip? ***Indicate with "y" or "n"***	2. How many hours in total you will spend at the beach today?	3. What year were you born?
n/a	n/a	n/a	4	36
6	5	y	2	20

4. What is the highest degree or level of school you have completed? ***Indicate with "x", select one***					5. Including yourself, how many adults and children live in your household?		*6. Record Ind*
Less than high school graduate	High school graduate (includes GED)	Some college or Associate's degree	Bachelor's degree	Graduate or professional degree	Adults (18 and older)	Children (Under 18)	Male
				x	2	2	x
	x				1	0	

			8. Would you be willing to take part in a short mail survey		
l respondent gender. licate with "x"		*7. Record number of people in party including respondent*	YES: Could I get your name and address? It will be used only to mail t deleted immediately after. *Record address and confirm verbally, including spelling of cities or s Provide this info:* The survey will be mailed to you in early September. It will come in a the National Oceanic and Atmospheric Administration. Please complet soon as you are able. There are 20 questions, and the survey should ta to complete. We greatly appreciate your participation in thi		
Female	Prefer not to record		First and last name	Street address	City and State
		4	Jane Doe	1881 Ninth St.	Boulder, CO
	x	2	John Smith	20 Main St.	Denver, CO

that we will send to your home?

his survey and will be *streets if necessary.* a large envelope from te it and mail it back as ake around 10 minutes is research!”	NO: Could I get your zip code ***(if refused, type "no")***	9. Lastly, I would like to ask you about beach characteristics. Please tell me how important the following three characteristics are to you when you decide which beaches to visit. On a scale of 1 to 5, where 1 is Not Important and 5 is Very Important: ***(Read each characteristic and enter the response as a number 1 - 5)***		
ZIP code		Parking is free or inexpensive	Not crowded	No garbage or manmade debris on the beach
80302	n/a	3	3	3
80303	n/a	2	5	1

10.Do you think garbage or manmade debris is a problem on Orange County beaches? ***Y or N***
Y
N

		Reason for not completing survey *Indicate with "x"*			Gen *Indicate*
Refusal number	Time	Refusal	Language Barrier	Other (specify)	Male
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					

der ***with "x"***	***Record number of people in party including responden t***	**1) Could you just tell me what year you were born?** ***Ask and record birth year***
Female		

Beach Recreation Survey
ORANGE COUNTY

Your opinions are important to us!

Paperwork Reduction Act Statement

The National Oceanic and Atmospheric Administration (NOAA) is authorized by 33 U.S.C. 1951 et seq. to conduct this survey. The information collected will be used by NOAA to estimate economic impacts associated with marine debris on beaches.

Public reporting burden for this collection of information is estimated to average 10 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other suggestions for reducing this burden to Amy V. Uhrin, NOAA NOS, 1305 East-West Hwy, SSMC4, Room 10240, Silver Spring, MD 20910.

The questionnaire has an identification number for mailing purposes only. Your name and address will be deleted after we receive your completed questionnaire. Notwithstanding any other provisions of the law, no person is required to respond to, nor shall any person be subjected to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.
OMB Control Number 0648-0756 I Current Expiration Date: 08/312020

Privacy Act Statement

Authority: The collection of this information is authorized under 33 U.S.C. 1853 et seq, the Marine Debris Research, Prevention and Reduction Act, which, along with the Marine Debris Amendments of 2012, established the NOAA Marine Debris Program to "identify, determine sources of, assess, prevent, reduce, and remove marine debris and address the adverse impacts of marine debris on the economy of the United States, the marine environment, and navigation safety."

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NOAA Routine Uses: The survey data will be combined with a national model of coastal recreation, which relies on data collected for the Deepwater Horizon oil spill assessment, to estimate the economic impacts of marine debris on tourism-dependent communities. Disclosure of this information is permitted under the Privacy Act of 1974 (5 U.S.C. Section 552a) to be shared among NOAA staff for work-related purposes. Disclosure of this information is also subject to all of the published routine uses as identified in the Privacy Act System of Records Notice Commerce/NOAA-11, Contact Information for Members of the Public Requesting or Providing Information Related to NOAA's Mission.

Disclosure: Furnishing this information is voluntary; the only consequence of failure to provide accurate information is that your responses will not contribute to the success of this research.

Coastal beaches are vital to the area's economy and quality of life. Your answers to this survey will help inform decisions about improving and protecting coastal resources. We want to hear from everyone about things people want to experience when they visit the beach. Your response is important – please complete this **voluntary** survey.

Our questions are about ocean beaches in Orange County, shown in the map below.

1. In the list below, please circle the names of any beaches you went to between September 1, 2016 and August 31, 2017. If you don't know the name of a beach you went to or it is not on the list, please circle the name of a nearby beach.

1. Seal Beach
2. Surfside Beach
3. Sunset Beach
4. Bolsa Chica State Beach
5. Huntington City Beach
6. Huntington State Beach
7. Santa Ana River County Beach
8. Newport Beach
9. Balboa Beach
10. Corona del Mar State Beach
11. Crystal Cove State Park Beach
12. Emerald Bay Beach
13. Laguna Beach
14. Aliso Beach
15. Salt Creek
16. Monarch Beach
17. Dana Point
18. Doheny State Beach
19. Capistrano Beach Park
20. Poche County Beach
21. San Clemente City Beach
22. San Clemente State Beach

Now we would like to ask you about the number of day trips and overnight trips you took to beaches in Orange County. A **day** trip is any time you went to the beach and returned home the same day. An **overnight** trip is when you spent at least one night away from home.

2. Between September 1, 2016 and August 31, 2017, did you take any day trips to beaches in Orange County? Please check ☒ one box.

☐ No ☐ Yes ➔ How many day trips? ☐ day trips

3. Between September 1, 2016 and August 31, 2017, did you take any overnight trips where the main purpose was visiting beaches in Orange County? Please check ☒ one box.

☐ No ☐ Yes ➔ How many overnight trips? ☐ overnight trips

In total, how many nights did you pay for lodging during your overnight trips? ☐ nights

The next question is about beach characteristics.

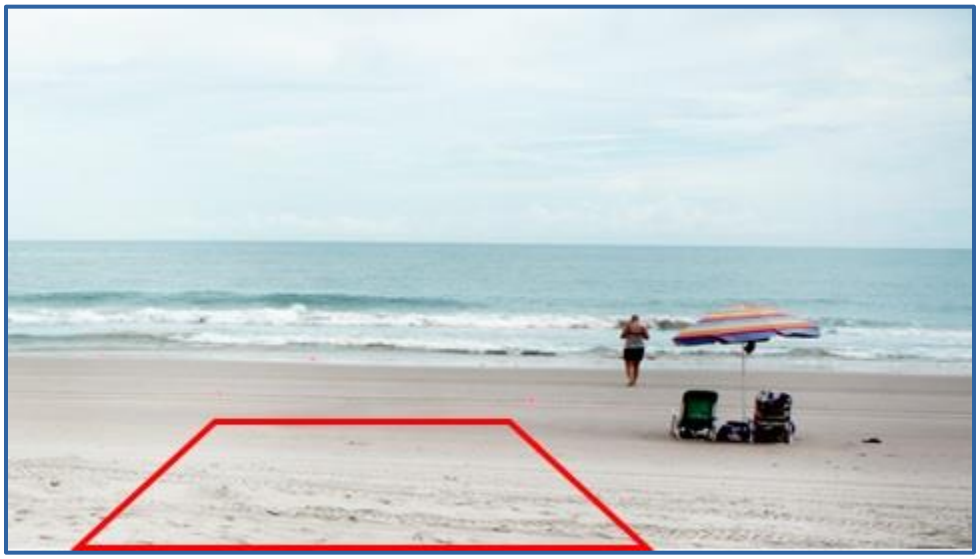
4. Please tell us how important the following characteristics are to you when you decide which beaches to visit. Please check ☒ one box per row.

	Not Important		Somewhat Important		Very Important
	1	2	3	4	5
Scenic beauty or view	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Good water quality	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Close to home	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Parking is convenient	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Parking is free or inexpensive	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Good surfing available	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Sandy (rather than rocky)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Not crowded	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Long enough to go for a walk/run	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Bike path available	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Fishing opportunities available	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
No garbage or manmade debris on the beach	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
No natural debris like kelp or seaweed on the beach	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

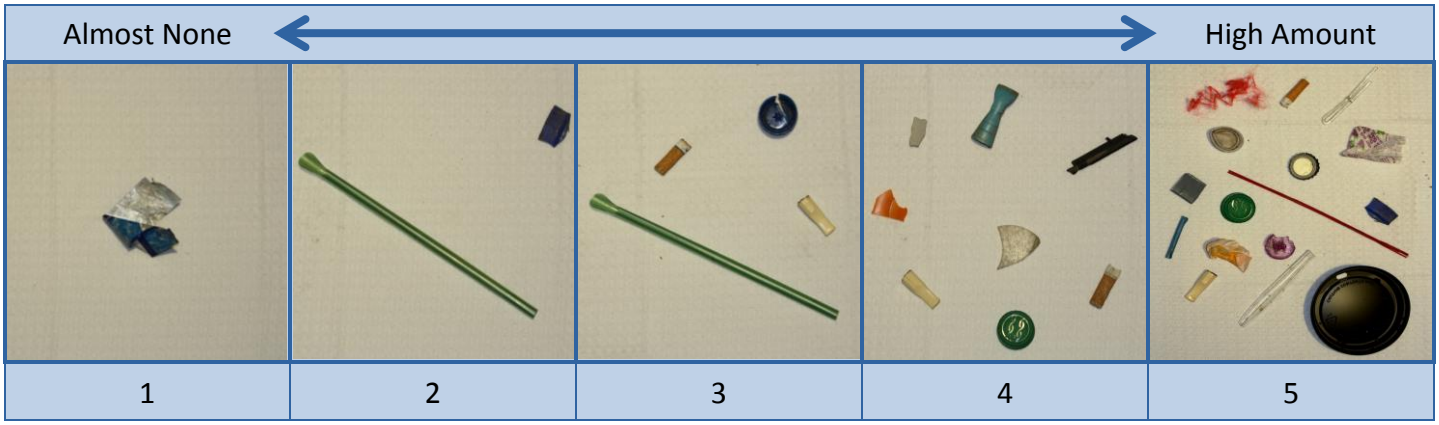
Garbage or Manmade Debris You May See on Beaches

Different beaches can have different amounts of garbage or manmade debris. Garbage or manmade debris refers to items like bottles, wrappers, straws, plastic fragments, or cigarettes. It does not include twigs or seaweed.

The pictures below illustrate the amount of debris commonly found on United States beaches. Imagine you are picking up debris over an area of 500 square feet or approximately the area of three parking spaces, outlined in red below.



If you walked back and forth in this area and picked up all the debris, you might find different amounts ranging from “almost none” to a “high amount.” As the pictures below show, different levels of debris on the beach can be given a score from 1 to 5. Higher scores mean more debris.



On the next page, we will ask you to use the above scale to estimate the amount of garbage or manmade debris you saw on beaches you have been to in Orange County.

5. **In the table below, please write the names of beaches in Orange County that you went to between September 1, 2016 and August 31, 2017. You may want to refer back to the map on page 2 of this survey.**

   To the right of each beach you went to, use the debris scale from the previous page and write a number between 1 and 5, indicating the amount of garbage or manmade debris you saw on the beach. Writing a "1" indicates you saw almost none, while writing a "5" indicates you saw a high amount of garbage or manmade debris. For any beach where you don't recall the amount of debris, please write "don't recall" in place of a number.

Beach Name	How Much Garbage or Manmade Debris Did You See on the Beach? (1 = Almost None) (5 = High Amount) (Don't Recall)
Surfside Beach	4
Monarch Beach	2

Example

We have a few questions about the pictures used above to show garbage or manmade debris on beaches.

6. Are the pictures a good representation of the types of debris you have seen on beaches you visited in Orange County?
Please check ☒ one box.

- ☐ Yes, good representation
- ☐ Yes, somewhat good representation
- ☐ No, somewhat bad representation How so? _____
- ☐ No, bad representation How so? _____
- ☐ Can't say, I have not seen much debris

7. We described debris as being spread over 500 square feet (about the area of three parking spaces). Was that description of the area clear?
Please check ☒ one box.

- ☐ Yes, clear
- ☐ Yes, somewhat clear
- ☐ No, somewhat unclear How so? _____
- ☐ No, unclear How so? _____

8. The pictures showed a range of different amounts of debris. Did you find an amount that was accurate for the beaches you went to?
Please check ☒ one box.

- ☐ Yes, accurate
- ☐ Yes, somewhat accurate
- ☐ No, somewhat inaccurate How so? _____
- ☐ No, not accurate How so? _____

9. Between September 1, 2016 and August 31, 2017, if there had been almost no garbage or manmade debris at beaches in Orange County, would you have gone to the beach more often or the same number of times? Please check ☒ one box.

☐ More often ➔ **Please answer the two questions below.**

Between September 1, 2016 and August 31, 2017, how many more day trips would you have taken if there were almost no garbage or manmade debris on Orange County beaches? ☐ more day trips

Between September 1, 2016 and August 31, 2017, how many more overnight trips would you have taken if there were almost no garbage or manmade debris on Orange County beaches? ☐ more overnight trips

☐ The same number of times

10. Between September 1, 2016 and August 31, 2017, if there had been twice as much garbage or manmade debris at beaches in Orange County, would you have gone to the beach less often or the same number of times? Please check ☒ one box.

☐ Less often ➔ **Please answer the two questions below.**

Between September 1, 2016 and August 31, 2017, how many fewer day trips would you have taken if there were almost no garbage or manmade debris on Orange County beaches? ☐ fewer day trips

Between September 1, 2016 and August 31, 2017, how many fewer overnight trips would you have taken if there were almost no garbage or manmade debris on Orange County beaches? ☐ fewer overnight trips

☐ The same number of times

We have a few questions about your answers on the previous page.

11. How confident are you in your answers about whether you would <u>change the places</u> you went to if … (please check ☒ one box per row):

	Confident 1	Somewhat Confident 2	Not Confident 3
… there were almost no debris?	☐ 1	☐ 2	☐ 3
… there were twice as much debris?	☐ 1	☐ 2	☐ 3

12. How confident are you in your answers about any <u>change in the number of trips</u> you would take if … (please check ☒ one box per row):

	Confident 1	Somewhat Confident 2	Not Confident 3
… there were almost no debris?	☐ 1	☐ 2	☐ 3
… there were twice as much debris?	☐ 1	☐ 2	☐ 3

13. When you answered the questions about your trips, were you thinking primarily about garbage or manmade debris, or were you also thinking about other types of pollution, such as runoff from factories or farms? Please check ☒ one box.

☐ I was thinking primarily about debris ☐ I was also thinking about other types of pollution

The next few questions ask about your experiences with debris on beaches.

14. How concerned would you be to see the following types of garbage or manmade debris while visiting a beach? Please check ☒ one box per row.

	Not At All Concerned		Somewhat Concerned		Very Concerned
	1	2	3	4	5
Plastic items or bottles	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Styrofoam	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Paper products	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Wooden items	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Metal items or cans	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Glass	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Rubber items	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Cloth or clothing	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Cigarette butts	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Fishing gear	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Medical waste	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Animal waste	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

15. Please look at the list below and check ☒ the box next to all the types of garbage or manmade debris that you have <u>actually seen</u> on beaches in Orange County.

- ☐ Plastic items or bottles
- ☐ Styrofoam
- ☐ Paper products
- ☐ Wooden items
- ☐ Metal items or cans
- ☐ Glass
- ☐ Rubber items
- ☐ Cloth or clothing
- ☐ Cigarette butts
- ☐ Fishing gear
- ☐ Medical waste
- ☐ Animal waste
- ☐ Other (please specify) _____

16. Do you think garbage or manmade debris is a problem on Orange County beaches? Please check ☒ one box.

☐ Yes ☐ No ☐ Not sure

17. To the best of your knowledge, what do you think is the largest source of garbage or manmade debris found on beaches in Orange County?
Please check ☒ one box.

- ☐ Left by beach visitors
- ☐ Blown to the beach from nearby areas on land
- ☐ Washed ashore from the ocean
- ☐ Washed ashore from nearby rivers or storm drains
- ☐ Other (please specify) _____

Finally, we have just a few questions about you and your household. These questions are a way to make sure that we understand the values and opinions of all types of people visiting beaches in Orange County.

18. Have you participated in any beach cleanups within the last three years? Please check ☒ one box.

☐ No ☐ Yes

19. How many adults and children live in your household?

_____ Adults (18 and older) _____ Children (under 18)

20. What is your gender? Please check ☒ one box.

☐ Male ☐ Female

21. What is your age?

_____ Years

22. Are you of Hispanic, Latino, or Spanish origin? Please check ☒ one box.

☐ No ☐ Yes

23. What is your race? Select all that apply.

- ☐ American Indian or Alaskan Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or other Pacific Islander
- ☐ White
- ☐ Other (please specify) _____

24. What is the highest degree or level of school you have completed? Please check ☒ one box.

- ☐ Less than high school graduate
- ☐ High school graduate (includes GED)
- ☐ Some college or Associate's degree
- ☐ Bachelor's degree
- ☐ Graduate or professional degree, beyond a bachelor's degree

25. Which of the following income categories best describes your household income last year, before taxes? Please check ☒ one box.

- ☐ Less than $15,000
- ☐ $15,000 to $24,999
- ☐ $25,000 to $34,999
- ☐ $35,000 to $49,999
- ☐ $50,000 to $74,999
- ☐ $75,000 to $99,999
- ☐ $100,000 to $150,000
- ☐ More than $150,000

Thank you for participating!

Please return your survey in the enclosed, self-addressed, stamped envelope.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Office of Response and Restoration
Silver Spring, Maryland 20910

<date>

<given name> <surname>
<address>
<city>, <state> <zip code>-<zip+4>

Dear <title> <surname>:

Recently you agreed to take a short survey regarding beach visitation and your recreational experience. Thank you! A survey booklet is enclosed with this letter. By filling out this survey, you will be participating in an important study that will help government officials understand your priorities for the coastal environment.

Once we have received your survey, we will delete your name, street address, and email address from all lists so that your responses cannot be traced back to you. Of course, your participation is voluntary and you can refuse to answer any or all of the questions. If you have any questions about the survey, please feel free to contact Jessica Balukas (Abt Associates) at jessica_balukas@abtassoc.com or 617.520.2437.

We hope that you find this survey important and interesting, and we thank you for your assistance in this important project. The survey will take approximately 10 minutes to complete. We would greatly appreciate it if you could return the survey by <date>. Please return your completed survey using the provided postage-paid, return envelope.

Sincerely,

Amy V. Uhrin
Chief Scientist, Marine Debris Program
National Oceanic and Atmospheric Administration

Enc.

Printed on Recycled Paper

Last week the survey, *Beach Recreation Survey: <location>*, was mailed to you regarding beach visitation and your recreational experience. If you have already returned your completed survey, please accept our sincere thanks.

If you have not yet completed your survey, we ask that you please do so today. Your answers will help government officials understand your priorities for the coastal environment.

If you did not receive the survey or it was misplaced, please contact Jessica Balukas (Abt Associates) at jessica_balukas@abtassoc.com or 617.520.2437 and we will send a replacement survey to you.

Amy V. Uhrin, Chief Scientist, Marine Debris Program
National Oceanic and Atmospheric Administration

Last week the survey, *Beach Recreation Survey: <location>*, was mailed to you regarding beach visitation and your recreational experience. If you have already returned your completed survey, please accept our sincere thanks.

If you have not yet completed your survey, we ask that you please do so today. Your answers will help government officials understand your priorities for the coastal environment.

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Amy V. Uhrin, Chief Scientist, Marine Debris Program
National Oceanic and Atmospheric Administration

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If you have not yet completed your survey, we ask that you please do so today. Your answers will help government officials understand your priorities for the coastal environment.

If you did not receive the survey or it was misplaced, please contact Jessica Balukas (Abt Associates) at jessica_balukas@abtassoc.com or 617.520.2437 and we will send a replacement survey to you.

Amy V. Uhrin, Chief Scientist, Marine Debris Program
National Oceanic and Atmospheric Administration

Last week the survey, *Beach Recreation Survey: <location>*, was mailed to you regarding beach visitation and your recreational experience. If you have already returned your completed survey, please accept our sincere thanks.

If you have not yet completed your survey, we ask that you please do so today. Your answers will help government officials understand your priorities for the coastal environment.

If you did not receive the survey or it was misplaced, please contact Jessica Balukas (Abt Associates) at jessica_balukas@abtassoc.com or 617.520.2437 and we will send a replacement survey to you.

Amy V. Uhrin, Chief Scientist, Marine Debris Program
National Oceanic and Atmospheric Administration

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Office of Response and Restoration
Silver Spring, Maryland 20910

<date>

<given name> <surname>
<address>
<city>, <state> <zip code>-<zip+4>

Dear <title> <surname>:

Three weeks ago the survey, *Beach Recreation Survey: <location>*, was mailed to you concerning possible programs affecting marine debris levels and recreation at local beaches. If you have not yet completed your survey, we ask that you do so today. Your opinions are important and are needed to ensure that the survey results are complete and accurate.

The purpose of this survey is to collect information about your priorities for the coastal environment. It should take up to 10 minutes of your time. This survey:

- Asks about your experiences at local beaches within the past year and characteristics that influence your beach visitation decisions
- Presents a scale for measuring marine debris and asks about debris encountered during beach visits
- Asks how changes in marine debris levels would influence your beach visitation.

We need your opinions. Your responses to this survey will help inform resource management decisions. Please carefully read the information in this survey and answer the questions.

All answers to this survey will be kept confidential to the extent permitted by law. Once we have received your survey, we will delete your name, street address, and email address from all lists so that your responses cannot be traced back to you. Of course, your participation is voluntary and you can refuse to answer any or all of the questions.

We thank you for your assistance in this important project. We would greatly appreciate it if you could return the completed survey using the prepaid envelope by <date>. If you have any questions, please contact Jessica Balukas (Abt Associates) at jessica_balukas@abtassoc.com or 617.520.2437.

Sincerely,

Amy V. Uhrin, Chief Scientist, Marine Debris Program
National Oceanic and Atmospheric Administration

Printed on Recycled Paper

Notes for Marine Debris Monitoring Data

July 12, 2017

Tab 1 (Raw Data) – Raw monitoring data collected by the NOAA Marine Debris Program (MDP). At each site, we randomly selected four belt transects and monitored for debris in those transects. We recorded debris greater than 2.5cm found in each transect. For more information on the monitoring protocol, please see the attached documents Opfer et al. 2012, Lippiatt et al. 2013, and the MDMAP Get Started Toolbox.

Tab 2 (transect_density per 500ft^2) – In this tab, we converted the debris densities per transect from debris/m^2 data to debris/500m^2. We choose 500m^2 because this represents the area surrounding beach-goers towels/chairs and we provided a comparison that 500m^2 is about size of three parking spaces for folks to visualize the area. In the survey questionnaire (page 4) we use the language, *"The pictures below illustrate the amount of debris commonly found on United States beaches. Imagine you are picking up debris over an area of 500 square feet or approximately the area of three parking spaces, outlined in red below."*

Tab 3 (site_PivotTable_AvgMD Den.) – In the third tab, we calculated the average debris densities per site (beach), county, and state. The average debris densities are used in the remainder of the tabs (note that county and state data are used below in the region tabs).

Tab 4 (site_Hist_AvgMD-den_500ft^2) – In this tab, we ran histogram scenarios to determine the appropriate debris counts to use in the survey questionnaire. When running the histograms for the site data, our goal was to create bins with a uniform distribution. Histogram results for sites are displayed in **Tab 5 (site_histogram_output).**

- Notes:
    - Minimum average debris density per 500m2 = 0.134 debris items
    - Maximum average debris density per 500m2 = 40.084 debris items
    - From the histogram outputs, the best scenario included doubling debris counts, starting with one debris item. Thus, our debris counts for the survey questionnaire (page 4) are 1, 2, 4, 8, and 16. These counts are representative, and within the range of the field collected data (min – 0.134 items to max - 40.084 items per 500m^2). *We did not include zero debris items as an option because it is not realistic to find a beach without any debris at all. Note that with our survey protocol, we are only counting debris items equal to or greater than 2.5 cm. Thus, our debris counts are likely underestimating the debris loads on the beaches.

Tab 6 (region_Hist_AvgMD Den_500ft2) – In tab 6, we calculated average debris densities by region. Note that we had to remove some of the data because a few of the sites did not fall within the regions of the National Model. After calculating average debris densities for each region, we again ran histogram scenarios. Histogram results for region are displayed in **Tab 7 (region_Histogram_output).**

- Notes:

- Minimum average debris density per 500m2 = 1.08 debris items
- Maximum average debris density per 500m2 = 28.34 debris items
- The debris counts (1, 2, 4, 8, and 16) for the survey questionnaire are still representative, and within the range of the field collected data at the region level (min – 1.08 items to max - 28.34 items per 500m^2).

Tab 8 (Monitoring Data_basic stats) – In the last tab, we compared the debris stats at the individual transect level, the site (beach) level and the region level.

Justification of debris types represented in survey questionnaire photos:

- We looked at monitoring data from our Marine Debris Monitoring and Assessment Project (MDMAP) and the top 10 most common items are as follows:
  - Hard plastic fragments, foamed plastic fragments, plastic rope/net, filmed plastic fragments, other plastic items, bottle/container caps, metal fragments, cigarettes, food wrappers, and glass fragments
- Here is the top 10 items collected during the International Coastal Cleanup:
  - Cigarette butts, plastic beverage bottles, plastic bottle caps, food wrappers, plastic grocery bags, plastic lids, straws/stirrers, glass beverage bottles, other plastic bags, foam take-away containers.
- When staging the photos, we tried to keep the items small, so one item would not overpower the photo.

NOAA Marine Debris Shoreline Survey Field Guide

Sarah Opfer, Courtney Arthur, and Sherry Lippiatt

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
Office of Response and Restoration
Marine Debris Program

January 2012

This shoreline protocol was developed and tested by the NOAA Marine Debris Program. This document is a revised version of the August 2011 field guide, and should be treated as a draft protocol that may be altered in the future. Further testing is currently underway to develop a statistically robust survey design that will recommend the frequency of sampling, number of transects, and sampling unit size at site, location, and regional spatial scales.

Mention of trade names or commercial products does not constitute endorsement or recommendation for their use by the National Oceanic and Atmospheric Administration.

NOAA Marine Debris Shoreline Survey Field Guide

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Office of Response & Restoration
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January 2012

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Website: www.MarineDebris.noaa.gov

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Introduction

Marine debris has become one of the most widespread pollution problems in the world's oceans and waterways today. The NOAA Marine Debris Program (MDP) serves as a centralized marine debris resource within NOAA, coordinating and supporting activities within NOAA and with other federal agencies. The MDP uses partnerships to support projects carried out by state and local agencies, tribes, non-governmental organizations, academia, and industry.

Marine debris monitoring programs are necessary to compare debris sources, amounts, locations, movement, and impacts across the US and internationally. Monitoring data can be used to evaluate the effectiveness of policies to mitigate debris and provide insight into priority targets for prevention. Thus, the NOAA MDP has developed standardized marine debris shoreline survey protocols to facilitate regional and site-specific comparisons. This document provides a standard data sheet and two different methods for shoreline monitoring and assessment.

Types of Shoreline Surveys

The objectives of your study will determine how you monitor for marine debris. There are two main types of shoreline surveys: accumulation and standing-stock surveys.

- Accumulation studies provide information on the rate of deposition (flux) of debris onto the shoreline. These studies are more suited to areas that have beach cleanups, as debris is removed from the entire length of shoreline during each site visit. This type of survey is more labor-intensive and is used to determine the rate of debris deposition (# of items per unit area, per unit time). Accumulation studies can also provide information about debris type and weight. These surveys cannot be used to measure the density of debris on the shoreline because removal of debris biases the amount of debris present during subsequent surveys.
- Standing-stock studies provide information on the amount and types of debris on the shoreline. Debris within discrete transects at the shoreline site is tallied during standing-stock surveys. This is a quick assessment of the total load of debris and is used to determine the density (# of items per unit area) of debris present. Debris density reflects the long-term balance between debris inputs and removal and is important to understanding the overall impact of debris.

Table 1. Salient characteristics of standing-stock and accumulation surveys.

CHARACTERISTIC	STANDING-STOCK	ACCUMULATION
Debris removed during surveys?	No	Yes
Time required per survey	Less	More
Length of shoreline site	100 m	100 m or longer
Is a set survey interval required (e.g., once per week or per month)?	Yes	Yes
Types of data that can be collected	• Debris density (# of items / unit area) • Debris material types	• Debris deposition rate (# of items / unit area / unit time) • Debris material types • Debris weight

We suggest that users give careful consideration to which type of survey best suits their goals and objectives. Table 1 provides important information to take into account when deciding how to monitor. Once a survey type is chosen, meaningful data can be collected through regular monitoring. The following sections describe how to choose survey sites and conduct surveys.

How to Pick Your Site

To select your sampling site(s), follow these steps:

1. The first step is to choose an appropriate shoreline location based on the objectives of your study. For example, if you wish to examine the impact of land use, you should select locations in watersheds with various land use types. Next, categorize the various areas within your location (it may help to use an aerial photo or map, as shown below). For example, your location may cover a span of shoreline 1 km long. Within that 1 km, there may be an area with heavy recreational use and another area where an urban stream mouth is located. Identify any barriers to shoreline access or offshore structures that may affect nearshore circulation (e.g. jetties).

2. Select shoreline sites (where you will sample) according to the characteristics below. If your location includes different use areas (for example, an area with heavy recreational use and a more remote area), it is preferable to select a site within each use category.

Shoreline sites should have the following characteristics:

- Sandy beach or pebble shoreline
- Clear, direct, year-round access
- No breakwaters or jetties
- At least 100 m in length parallel to the water (note that standing-stock surveys require a 100-m shoreline site)
- No regular cleanup activities

These characteristics should be met where possible, but can be modified.

Before You Begin Your Surveys

Before any data collection begins, the Shoreline Characterization Sheet should be completed for each shoreline site. On this data sheet you will note:

- GPS coordinates in decimal degrees at the beginning and end of your shoreline site, or at the site's four corners if the width of the beach is > 6 m;
- Shoreline characteristics (e.g. tidal range and substrate); and
- Surrounding land-use characteristics that may influence the delivery of land-based debris to the site (e.g., farmland 5 km from a small town or urban parkland 50 m from a river mouth).

The Shoreline Characterization Sheet needs to be completed only once per site per year unless major changes occur to the shoreline.

Shore IDs (on the Shoreline Characterization Sheet) should be created based on the initials of the shoreline name (e.g., Fort Smallwood = FS). This will make it easier to keep track of multiple sampling sites.

The Shoreline Characterization Sheet and Debris Density Data Sheet were adapted from Cheshire et al. (2009)[1].

You will need the following supplies in order to complete your surveys:

- Digital camera
- Hand-held GPS unit
- Extra batteries for GPS and camera (we recommend rechargeable batteries)
- Surveyor's measuring wheel - *for standing-stock surveys only*
- Flag markers or stakes
- ~100′ fiberglass measuring tape
- First aid kit (including sunscreen, bug spray, drinking water)
- Work gloves
- Sturdy 12″ ruler
- Clipboards for data sheets
- Data sheets (on waterproof paper)
- Pencils
- Trash bag or bucket - *for accumulation surveys only*

Safety is a priority. Do not touch or lift potentially hazardous or large, heavy items. Notify your local officials if such items are encountered.

All of the data collection forms you will need are included in Appendix A at the end of this document. The same data collection forms are used for accumulation and standing-stock surveys.

- Shoreline Characterization Sheet (pp. 8–9)
- Debris Density Data Sheet (pp. 10–12)

[1] Cheshire, A. C., E. Adler, et al. (2009). UNEP/IOC Guidelines on Survey and Monitoring of Marine Litter, UNEP Regional Seas Intergovernmental Oceanographic Commission: 132 pp.

Accumulation Surveys

If you decide to conduct accumulation surveys, follow this protocol:

1. BEFORE arriving at the site, check local tide tables and plan to arrive at your site during low tide.

2. ONCE ARRIVED, begin filling out the Debris Density Data Sheet's Additional Information section. Mark the beginning and end of your shoreline site, perhaps with flags or stakes. (Remember to pick up these markers at the end of your survey to make sure they do not become marine debris!) The back of the shoreline is where the primary substrate (e.g., sand) changes (e.g., sand becomes gravel) or at the first barrier (e.g., vegetation line).

3. In order to cover the entire site from water's edge to the back of the shoreline, decide whether you will traverse the survey area parallel or perpendicular to the water. See Appendix B for walking pattern schematics. If more than one surveyor is available, the survey area should be divided evenly with clearly specified areas assigned to each individual. Surveyors should traverse the survey area in a pre-determined walking pattern until the entire site is cleared of marine debris.

4. Record on your Debris Density Data Sheet counts of debris items that measure over 2.5 cm, or 1 inch (~bottle cap size), in the **longest** dimension (see Figure 1). If any part of the item is within the survey area, count the item. Record large debris items, anything bigger than 1 foot (~ 0.3 m, typical forearm length from palm to elbow) in the large debris section of the Debris Density Data Sheet.

5. Take photos of your shoreline site and some of the debris items!

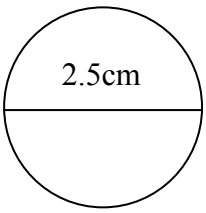


Figure 1. Minimum debris size to be counted. **This size is required to keep surveyors counting the same size items and to help keep the survey results uniform.*

Standing-stock Surveys

If you decide to conduct standing-stock surveys, follow this protocol:

1. Sketch your 100-m shoreline site and divide the 100 m into 5-m segments. There should be 20 of them. Number each section (left to right) from 1 to 20. Each 5-m segment should run from the water's edge to the back of the shoreline (Figure 2). The back of the shoreline is where the primary substrate (e.g., sand) changes (e.g., sand becomes gravel) or at the first barrier (e.g., vegetation line).

2. BEFORE arriving at the site, select four numbers from the Random Number Table (Appendix C) by first choosing a number between 1 and 5, and then a number between 1

and 4. The corresponding number in the table (1–20) is one of the four transects you will survey. Complete this exercise four times to choose four random transects (each transect can be used only once per survey). These numbers correspond to the 5-m segments you drew on your sketch and are called transect ID numbers (see Debris Density Data Sheet). You should fill out one Debris Density Data Sheet per transect. On any sampling day, 20 m of your 100-m shoreline site is analyzed (i.e., 20% coverage of the area). In addition, check local tide tables and plan to arrive at your site during low tide.

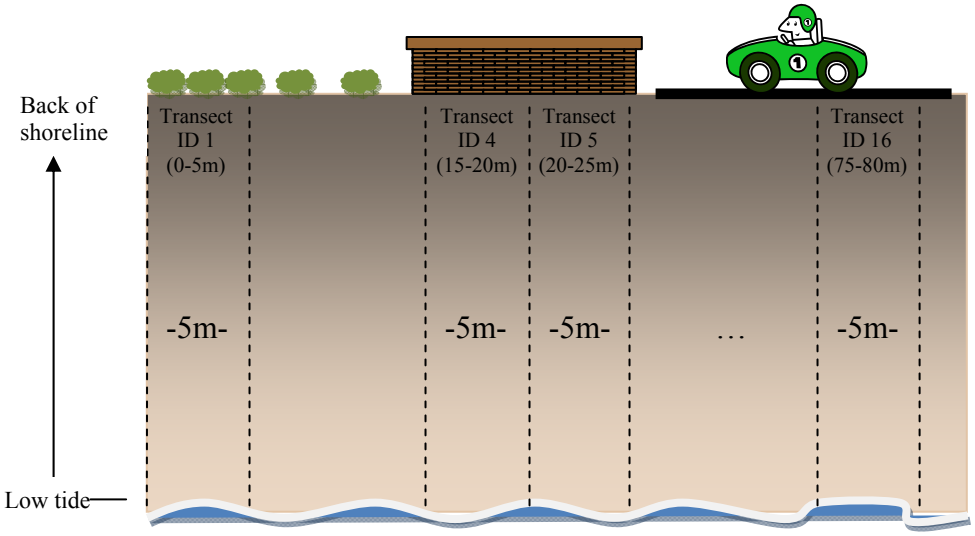


Figure 2. Shoreline section (100 m) displaying perpendicular transects from water's edge at low tide to the first barrier at the back of the shoreline section.

3. ONCE ARRIVED, begin filling out the Debris Density Data Sheet Additional Information section. Using your measuring wheel, begin at the start of your shoreline section and mark the four selected transect boundaries with flags according to the distances provided in the Transect ID table (for example, transect 12 covers 55 to 60 m from the start of your shoreline section).

4. Measure the width of each transect from water's edge to the back of the shoreline. Record GPS coordinates for each transect in decimal degree format. For shoreline segments that are less than 6 m wide from the water's edge to the back of the shoreline, GPS coordinates should be taken at the center (Figure 3). For shoreline segments that are over 6 m wide, take GPS coordinates at two spots—one nearer the back of the shoreline and one nearer the water.

5. Walking each transect from water's edge to the back of the shoreline, record on your Debris Density Data Sheet counts of debris items that measure over 2.5 cm, or 1 inch (~bottle cap size), in the **longest** dimension (see Figure 1). If any part of the item is within the sample transect, count the item. *Remember that for standing-stock surveys, debris is not removed from the shoreline.* Record large debris items, anything bigger than 1 foot (~ 0.3 m, typical forearm length from palm to elbow) in the large debris section of the Debris Density Data Sheet.

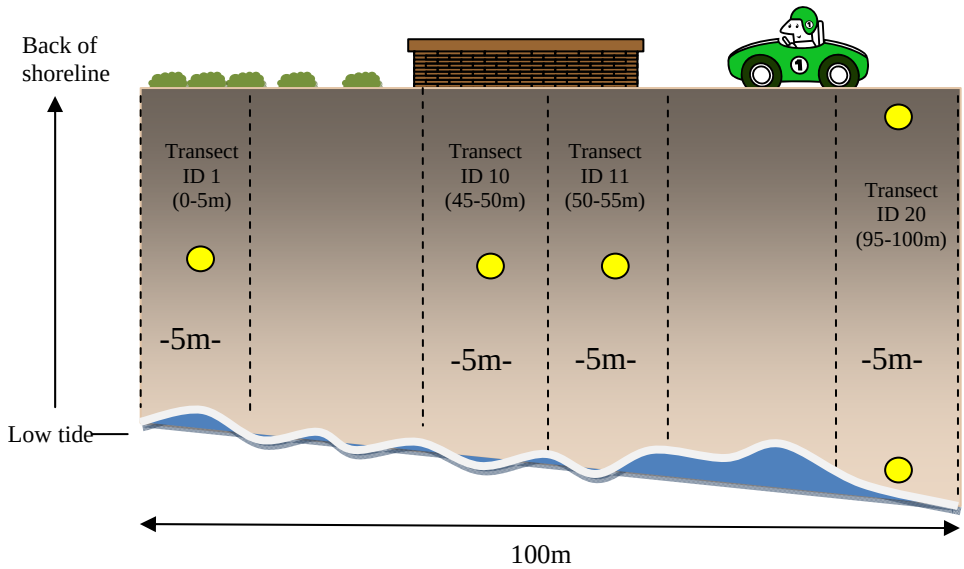


Figure 3. Example of a shoreline section (100m) with yellow circles indicating marked GPS coordinates. Width determines location of GPS coordinates.

6. Take photos of each transect and some of the debris items!

Submitting Your Shoreline Debris Data to NOAA

Marine debris monitoring groups should plan to compile and analyze their own survey results. The NOAA MDP will have periodic calls for data from monitoring groups. If you would like more information on data analysis or to be included in data calls, please send an email to MD.monitoring@noaa.gov.

Appendix A: Data Forms

SHORELINE DEBRIS **Shoreline Characterization Sheet**	Organization		Name of organization responsible for collecting the data
	Surveyor name		Name of person responsible for filling in this sheet
	Phone number		Phone contact for surveyor
Complete this form **ONCE** for each site location	Date		Date of this survey

SAMPLING AREA

Shore ID			Unique code for the shoreline
Shoreline name			Name by which the section of shoreline is known (e.g., beach name, park)
State/County			State and county where your site is located
Coordinates at start of shoreline section	Latitude	Longitude	Recorded as XXX.XXXX (decimal degrees) at start of shoreline section (in both corners if width > 6 meters)
Coordinates at end of shoreline section	Latitude	Longitude	Recorded as XXX.XXXX (decimal degrees) at end of shoreline section (in both corners if width > 6 meters)
Photo number/ID			The digital identification number(s) of photos taken of shoreline section

SHORELINE CHARACTERISTICS – from beginning of shoreline site

Length of sample area (should be 100 m if standing-stock survey)		Length measured along the midpoint of the shoreline (in meters)
Substratum type		For example, a sandy or gravel beach
Substrate uniformity		Percent coverage of the main substrate type (%)
Tidal range		Maximum & minimum vertical tidal range. Use tide chart (usually in feet).
Tidal distance		Horizontal distance (in meters) from low- to high-tide line. Measure on beach at low and high tides or estimate based on wrack lines.
Back of shoreline		Describe landward limit (e.g., vegetation, rock wall, cliff, dunes, parking lot)
Aspect		Direction you are facing when you look out at the water (e.g., northeast)

LAND-USE CHARACTERISTICS – within shoreline location

Location & major usage	Urban		Select one and indicate major usage (e.g., recreation, boat access, remote)
	Suburban		
	Rural		
Access			Vehicular (you can drive to your site), pedestrian (must walk), isolated (need a boat or plane)
Nearest town			Name of nearest town
Nearest town distance			Distance to nearest town (miles)
Nearest town direction			Direction to nearest town (cardinal direction)
Nearest river name			If applicable, name of nearest river or stream. If blank, assumed to mean no inputs nearby
Nearest river distance			Distance to nearest river/stream (km)
Nearest river direction			Direction to nearest river/stream (cardinal direction from site)
River/creek input to beach	YES	NO	Whether nearest river/stream has an outlet within this shoreline section
Pipe or drain input	YES	NO	If there is a storm drain or channelized outlet within shoreline section
Notes (including description, landmarks, fishing activity, etc.):			

SHORELINE DEBRIS **Debris Density Data Sheet**	Organization		Name of organization responsible for data collection
	Surveyor name		Name of person responsible for filling in this sheet
	Phone number		Phone contact for surveyor
Complete this form during **EACH** survey or transect (if standing-stock) per site visit	Email address		Email contact for surveyor
	Date		Date of this survey

ADDITIONAL INFORMATION

Shoreline name			Name for section of shoreline (e.g., beach name, park)
Survey Type	Accumulation ☐	Standing-stock ☐	Type of shoreline survey conducted (check box)
Transect ID # (N/A if accumulation survey)			Transect ID (include shoreline ID, date, and transect #)
Coordinates of start of shoreline site	Latitude	Longitude	Recorded as XXX.XXXX (decimal degrees). Record in both corners if width > 6 m. If transect, record at water's edge.
Coordinates of end of shoreline site	Latitude	Longitude	Recorded as XXX.XXXX (decimal degrees). Record in both corners if width > 6 m. If transect, record at back of shoreline.
Width of beach			Width of beach at time of survey from water's edge to back of shoreline (meters)
Time start/end	Start	End	Time at the beginning and end of the survey
Season			Spring, summer, fall, winter, tropical wet, etc.
Date of last survey			Date on which the last survey was conducted
Storm activity			Describe significant storm activity within the previous week (date(s), high winds, etc.)
Current weather			Describe weather on sampling day, including wind speed and % cloud coverage
Number of persons			Number of persons conducting the survey
Large items	YES	NO	Did you note large items in the large debris section?
Photo ID #s			The digital identification number(s) of debris photos taken during this survey.

Notes: Evidence of cleanup, sampling issues, etc.

DEBRIS DATA: (continued on back)

ITEM	TALLY (e.g., ~~IIII~~)			TOTAL
PLASTIC				
Plastic fragments	Hard	Foamed	Film	
Food wrappers				
Beverage bottles				
Other jugs or containers				
Bottle or container caps				
Cigar tips				
Cigarettes				
Disposable cigarette lighters				
6-pack rings				
Bags				
Plastic rope/small net pieces				
Buoys & floats				
Fishing lures & line				
Cups (including polystyrene/foamed plastic)				
Plastic utensils				
Straws				
Balloons				
Personal care products				
Other:				
METAL				
Aluminum/tin cans				
Aerosol cans				
Metal fragments				
Other:				
GLASS				
Beverage bottles				
Jars				
Glass fragments				
Other:				

ITEM	TALLY (e.g., ~~IIII~~)	TOTAL
RUBBER		
Flip-flops		
Gloves		
Tires		
Rubber fragments		
Other:		
PROCESSED LUMBER		
Cardboard cartons		
Paper and cardboard		
Paper bags		
Lumber/building material		
Other:		
CLOTH/FABRIC		
Clothing & shoes		
Gloves (non-rubber)		
Towels/rags		
Rope/net pieces (non-nylon)		
Fabric pieces		
Other:		
OTHER/UNCLASSIFIABLE		

***LARGE DEBRIS ITEMS* (> 1 foot or ~ 0.3 m)**

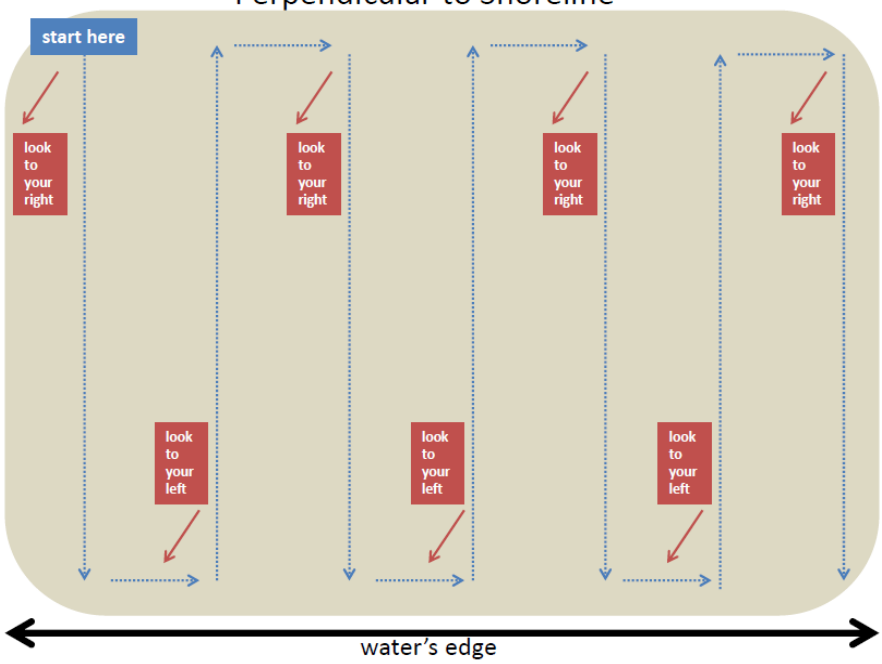
Item type (vessel, net, etc.)	Status (sunken, stranded, buried)	Approximate width (m)	Approximate length (m)	Description / photo ID #

Notes on debris items, description of "Other/unclassifiable" items, etc:

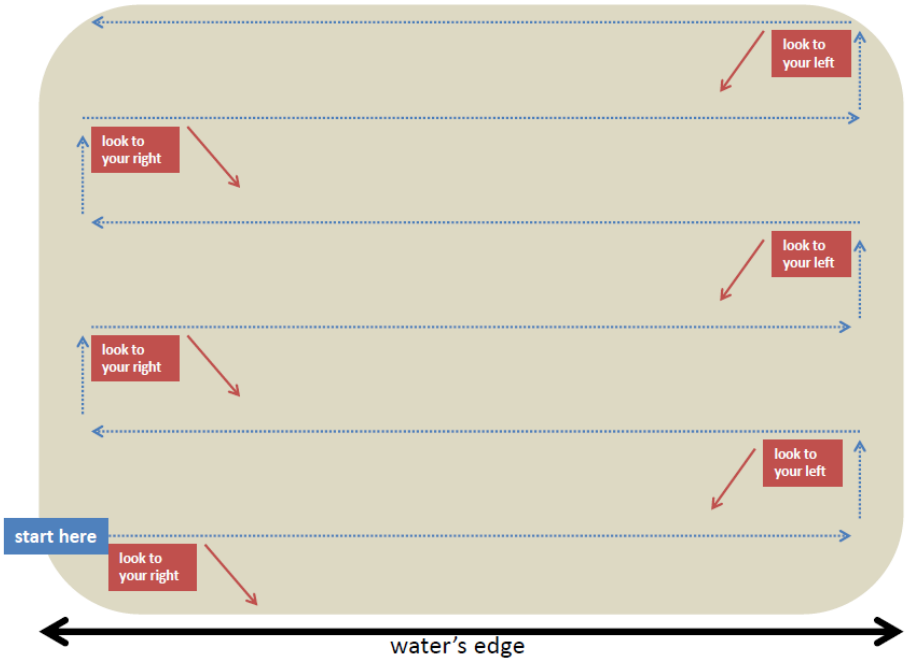
Appendix B: Shoreline Walking Patterns

The schematics below are potential survey walking patterns to ensure that the entire shoreline site or transect is covered. Suggested distance between walking lines is approximately one meter.

Walking Pattern #1:
Perpendicular to Shoreline



Walking Pattern #2
Parallel to Shoreline



APPENDIX C: RANDOM TRANSECT SELECTION

If you are conducting a standing-stock survey, use these tables to select transects. BEFORE arriving at the site, select four numbers from the Random Number Table, by first choosing a number between 1 and 5, and then a number between 1 and 4. The corresponding number in the table (1–20) is one of the four transects you will survey. Complete this exercise four times to choose four random transects (each transect can be used only once per survey).

Random Number Table					
	1	2	3	4	5
1	4	8	17	9	1
2	7	19	2	12	20
3	18	14	6	16	11
4	3	5	15	10	13

Transect ID and distance along shore from start of 100-m shoreline section (see Figure 2 above)

Transect ID	Meters	Feet and inches
1	0–5 m	0–16' 4"
2	5–10 m	16'4"–32'9"
3	10–15 m	32'9"–49'2"
4	15–20 m	49'2"–65'7"
5	20–25 m	65'7"–82'
6	25–30 m	82'–98'5"
7	30–35 m	98'5"–114'9"
8	35–40 m	114'9"–131'2"
9	40–45 m	131'2"–147'7"
10	45–50 m	147'7"–164'
11	50–55 m	164'–180'5"
12	55–60 m	180'5"–196'10"
13	60–65 m	196'10"–213'3"
14	65–70 m	213'3"–229'7"
15	70–75 m	229'7"–246'
16	75–80 m	246'–262'5"
17	80–85 m	262'5"–278'10"
18	85–90 m	278'5"–295'3"
19	90–95 m	295'3"–311'8"
20	95–100 m	311'8" - 328'1"

United States Department of Commerce

John Bryson
Secretary

National Oceanic and Atmospheric Administration

Jane Lubchenco, Ph.D.
Undersecretary of Commerce for Oceans and Atmosphere
Administrator, National Oceanic and Atmospheric Administration

National Ocean Service

David Kennedy
Assistant Administrator for Ocean Services and
Coastal Zone Management

IEc

FINAL REPORT

Assessing the Economic Benefits of Reductions in Marine Debris: A Pilot Study of Beach Recreation in Orange County, California

FINAL | June 15, 2014

prepared for:

Marine Debris Division

National Oceanic and Atmospheric Administration

prepared by:

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INDUSTRIAL ECONOMICS, INCORPORATED

Executive Summary

Marine debris has many impacts on the ocean, wildlife, and coastal communities. In order to better understand the economic impacts of marine debris on coastal communities, the NOAA Marine Debris Program and Industrial Economics, Inc. designed a study that examines how marine debris influences people's decisions to go to the beach and what it may cost them. Prior to this study, no work had directly assessed the welfare losses imposed by marine debris on citizens who regularly use beaches for recreation. This study aimed to fill that gap in knowledge.

The study showed that marine debris has a considerable economic impact on Orange County, California residents. We found that:

- Residents are concerned about marine debris, and it significantly influences their decisions to go to the beach. They will likely avoid littered beaches and spend additional time and money getting to a cleaner beach or pursuing other activities.
- Avoiding littered beaches costs local residents millions of dollars each year.
- Reducing marine debris on beaches can prevent financial loss and provide economic benefits to residents.

Marine debris is preventable, and the benefits associated with preventing it appear to be quite large. For example, the study found that reducing marine debris by 50 percent at beaches in Orange County could generate $67 million in benefits to Orange County residents for a three-month period. Given the enormous popularity of beach recreation throughout the United States, the magnitude of recreational losses associated with marine debris has the potential to be substantial.

To estimate the potential economic losses associated with marine debris, we focused on Orange County, California. We selected this location because beach recreation is an important part of the local culture and residents have a wide variety of beaches from which to choose, some of which are likely to have high levels of marine debris.

We developed a travel cost model that economists commonly use to estimate the value people derive from recreation at beaches, lakes, and parks. We collected data on 31 beaches, including some sites in Los Angeles County and San Diego County, where Orange County residents could choose to visit during the summer of 2013. At each of the 31 beaches, we collected information on beach characteristics, including amenities and measurements of marine debris. Plastic debris and food wrappers were the most abundant debris types observed across all sites. Then, we surveyed residents on their beach activities and preferences through a general population mail survey.

The mail survey data, beach characteristics, and travel costs were then incorporated in the model, and we were able to estimate how various changes to marine debris levels could influence economic losses to this area. The model is flexible in that it allowed us to simulate various levels of debris along these beaches (a percent reduction), from 0-100 percent, and generate economic benefits associated with those different reductions.

In one scenario, we found that reducing marine debris even by 25 percent at all 31 beaches would save Orange County residents $32 million over three months in the summer. With a 100 percent reduction, the savings were $148 million for that time period.

The model also allowed us to target specific beaches and estimate benefits from reducing debris at those locations. For example, reducing marine debris by 75 percent from six beaches near the outflow of the Los Angeles River would benefit users of those beaches $5 per trip and increase visitation by 43 percent, for a total of $53 million in benefits.

Future work can build off this study to address additional economic impacts of marine debris, namely non-use benefits, benefits to residents living in other counties, and benefits associated with multiple-day trips. We can also use this data set and method to prioritize beaches or activities that reduce marine debris through both prevention and removal. Researchers believe that, given the results, the study could also be modified for assessing similar coastal communities in the United States.

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APPENDIX F: DEBRIS CHARACTERIZATION SAMPLING SITE MAPS

DEFINITIONS

1. ***Foreshore:*** The area of shore that lies between the limits of the mean high water (MHW) and mean low low water (MLLW) and is exposed during low tides.
2. ***Backshore:*** The part of the beach that lies behind the berm and is reached only by the highest tides. It is usually dry and flat.
3. ***Berm:*** The nearly horizontal portion of a beach or backshore having an abrupt fall and formed by wave deposition of material and marking the limit of ordinary high tides.
4. ***Wrack line:*** Organic or non-organic material that is deposited onshore, usually at the MHW.
5. ***Shoreline:*** The beach or location selected for the marine debris survey.
6. ***Sampling site:*** For standing stock surveys, the 100 meter stretch of shoreline to be surveyed.
7. ***Length:*** The distance or dimension that runs parallel to the water line.
8. ***Width:*** The distance or dimension that runs perpendicular to the water line.

FINAL REPORT: ASSESSING THE ECONOMIC BENEFITS OF REDUCTIONS IN MARINE DEBRIS; A PILOT STUDY OF BEACH RECREATION IN ORANGE COUNTY, CALIFORNIA

INTRODUCTION

Marine debris is widely acknowledged to be a persistent problem in many coastal areas of the United States.[1] A variety of potential economic impacts are associated with marine debris, including costs incurred by local governments and volunteer organizations to remove and dispose of marine debris, impacts on waterfront property values due to diminished aesthetic appeal, and potential effects on recreational and commercial fisheries.

One of the more significant potential economic losses involves beach visitors who are impacted by the presence of marine debris. Beach visitors are likely to be concerned about marine debris both because it poses potential physical harm due to lacerations, bacterial infections, or entanglements during swimming, and because it may detract from the perceived natural beauty of an area. In contrast to debris or litter along the roadside or in parks, there is a high potential for dermal contact with marine debris on beaches as visitors frequently go barefoot, lie directly on the sand, and dig in the sand. Furthermore, many visitors may view marine debris on the shore as an indicator of poor water quality. The existence of numerous volunteer efforts to remove debris from beaches and the fact that many municipalities regularly rake beaches to remove debris is an indication that beach visitors are negatively impacted by the presence of marine debris.

Marine debris can lead to welfare losses for beach visitors by diminishing the quality of their visits to the beach, by causing them to travel to alternative beaches, or by causing them to pursue alternative activities. Given the enormous popularity of beach recreation throughout the United States, the magnitude of recreational losses associated with marine debris has the potential to be substantial.

The Marine Debris Division of the National Oceanic and Atmospheric Administration (NOAA) retained Industrial Economics, Inc. (IEc) to assess the economic benefits associated with the removal of marine debris from beaches. To address this issue, IEc developed a study that measures the impact of marine debris on beach recreation. The study focuses on Orange County, California as a case study, and specifically estimates the economic benefits associated with reductions in marine debris.

1 Marine debris is defined here as any persistent solid material that is manufactured or processed and disposed of or abandoned in the marine environment.

STUDY DESIGN

To quantify the economic benefits of marine debris reductions, we developed a random utility maximization (RUM) travel cost model. The RUM travel cost model (Haab and McConnell, 2002) is commonly used by economists to estimate the value individuals derive from engaging in recreational activities at beaches, lakes, and parks. With this model, individuals choose to visit a particular recreation site based on the utility (satisfaction) that they expect to experience relative to all of the other sites they could have chosen. The utility associated with a given site is assumed to be a function of its attributes and the cost of traveling to the site. Site attributes may include ease of access, water quality, parking, neighborhood characteristics, facilities, aesthetics, or the amount of marine debris. The cost of traveling to each site is also treated as a site attribute that individuals factor into site selection, but travel cost is unique in that it varies across both sites and individuals. Travel cost is defined as the cost of travel plus the opportunity cost of the time taken to travel to the site. Using this approach, we can derive per trip and per person values associated with recreation at each site. The RUM travel cost model also allows us to determine how changes in the attributes, such as changes in the quantity of marine debris, affect these values.

We collected two types of data to estimate the RUM model. First, we collected beach characteristic data (including quantitative measurements of marine debris) for all significant beach sites located within a reasonable driving distance of Orange County. Second, we obtained data on day trips to local beaches through a general population mail survey. We describe these two data sources in detail in the sections below.

Orange County was selected as a study location because beach recreation is an important part of the local culture and residents have a wide variety of beaches from which to choose, some of which are likely to have high levels of marine debris (Moore et al. 2001). The presence of a variety of local beaches provides an opportunity to determine, through statistical modeling of beach choices, whether residents choose to travel farther from their homes or to visit beaches that are less desirable in other respects, in order to recreate at beaches that have lower densities of marine debris.

This area is well suited for the study, as it has numerous well-defined, popular beaches located very close to a large urban area. In addition, we anticipated there would be sufficient variation in factors potentially associated with marine debris (e.g., population densities, local land use, frequency of beach cleaning, locations of river mouths, etc.) to expect marine debris levels to vary across sites.

DATA COLLECTION

As noted above, we collected two types of data to estimate the parameters of the RUM model: beach characteristics data and data on local beach day trips. Data collection occurred in three phases:

1. Off-site review of beach sites to determine raking patterns, water quality, and general beach dimensions.
2. On-site visits by field staff to quantify marine debris, verify the occurrence of raking, and determine beach site amenities.
3. A general population survey to characterize local beach visitation.

The initial off-site review began in spring of 2013, in advance of the on-site component, which was completed during two trips in July and August 2013. The general population survey was mailed out in November 2013 and data collection was completed in January 2014 (see Exhibit 1).

EXHIBIT 1. DATA COLLECTION SCHEDULE

MONTH	DATA COLLECTION ACTIVITY
July, 2013	Measure marine debris at all sites (10 days)
August, 2013	Measure marine debris at all sites (10 days)
November, 2013 – January 2014	General population mail survey

STUDY LOCATION

We obtained data on beach characteristics for all significant sandy beaches within a reasonable driving distance of Orange County, CA (Exhibits 2 and 3). The southernmost boundary of the study area was San Onofre Beach. We made the assumption that it would be unlikely that many Orange County residents would travel south of San Onofre for a day trip to the beach, as one must drive approximately 20 miles past the Camp Pendleton Marine Corps Base to access the next beach to the south. The northernmost boundary of the study area was Zuma Beach. Zuma Beach is located a little over an hour from the nearest point in Orange County.

There are hundreds of beach access points between San Onofre Beach and Zuma Beach. In order to make the research issue tractable, we focused on modeling trips to sandy public beaches that have clear public access, lifeguards, restrooms, shower facilities, and dedicated parking areas. The beaches between Zuma and San Onofre that have these amenities are listed in Exhibit 2:

EXHIBIT 2. BEACH SITES (NORTH TO SOUTH)

1. Zuma	17. Huntington City
2. Point Dume	18. Huntington State
3. Topanga	19. Newport
4. Will Rogers	20. Balboa
5. Santa Monica	21. Corona Del Mar
6. Venice	22. Crystal Cove
7. Dockweiler	23. Laguna Beach (Coves)
8. El Segundo	24. Laguna Beach (Main)
9. Manhattan	25. Aliso Beach
10. Hermosa	26. Salt Creek
11. Redondo	27. Doheny State Beach
12. Torrance/Malaga Cove	28. Capistrano
13. Long Beach	29. San Clemente City/Pier
14. Seal Beach	30. Calafia/San Clemente State
15. Sunset/Surfside	31. San Onofre
16. Bolsa Chica	

BEACH CHARACTERISTICS

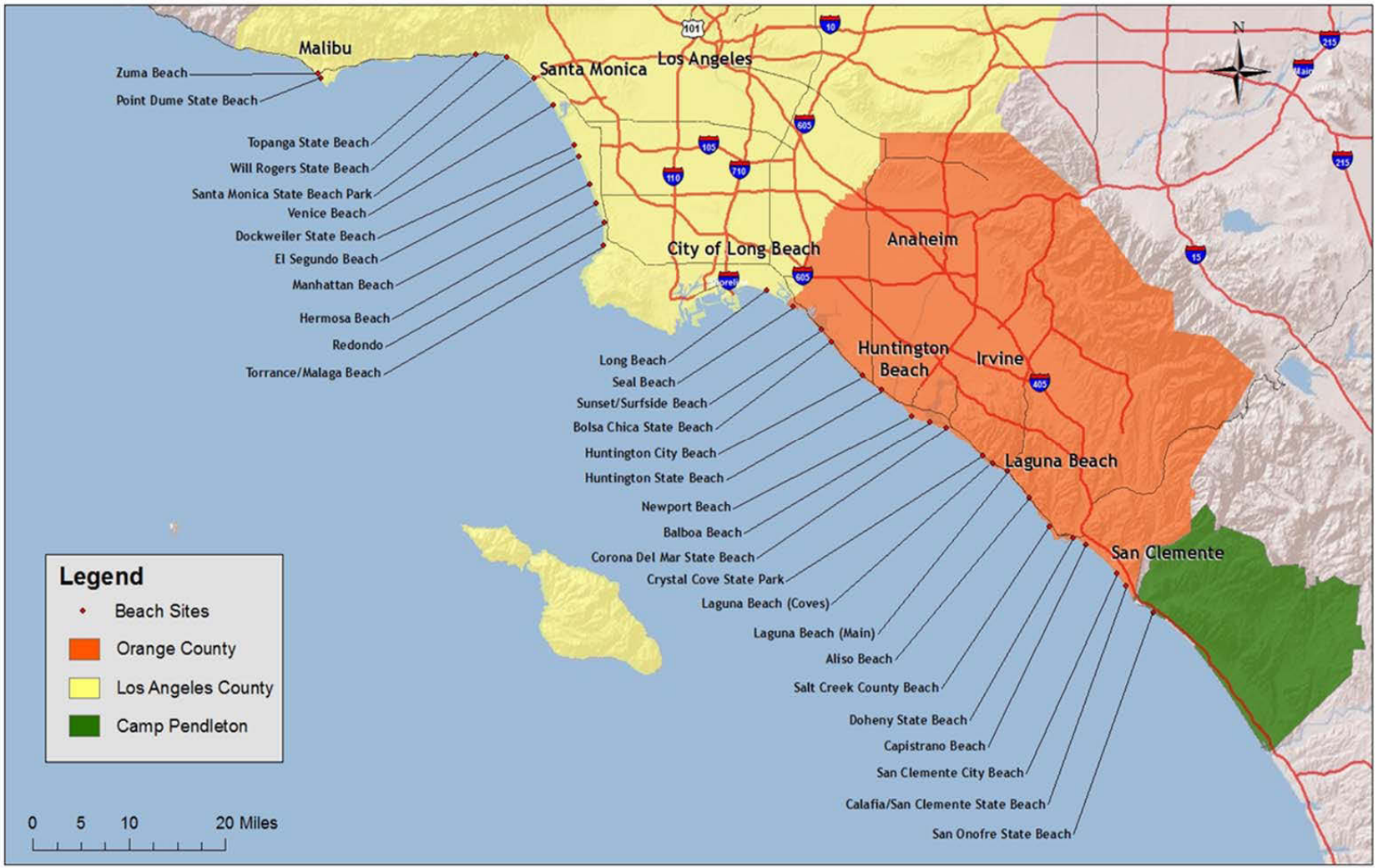
We collected beach characteristics data in two phases. First, we collected readily available information regarding each site. Second, we visited each site to gather specific data for the RUM model. Our on-site data collection efforts included a site reconnaissance to narrow the suite of potential study sites and two trips to collect information about the quantity of marine debris at each site.

Off-Site Beach Characteristics Research

Prior to visiting each site, IEc conducted research to determine the following:

- **Water Quality:** IEc obtained water quality data for each site from Heal the Bay. For each site, we evaluated the impact of three Heal the Bay water quality grades: one for summer 2013, one for winter 2012-2013, and a wet grade for 2012-2013. IEc determined the summer grade using historical weekly data available on Heal the Bay's website. We determined the winter and wet grades from Heal the Bay's 2012-2013 Beach Report Card annual report (Heal the Bay, 2013). The summer and winter grades are based on bacteria concentrations during dry weather; the wet grade is based on bacteria concentrations at a site in the 72 hours after a rainstorm.

EXHIBIT 3. MAP OF BEACH SITES



- **Raking:** Many of the larger beaches are raked daily with mechanical equipment to minimize refuse and provide a smooth surface for recreation. We contacted the managers of each beach to ascertain whether the beach is raked and how frequently.
- **Beach Length & Shoreline Characteristics:** We calculated the length of each shoreline site using coordinates collected on-site and satellite imagery. We also determined the nearest towns, nearest rivers, aspect and location/major usage for each site. These data were verified by the field staff once on-site. IEc also calculated the tidal range by locating the nearest tidal gauge for each site, downloading the ranges for the study period, and calculating the distance between the highest high tide and lowest low tide (U.S. DOC, 2013).
- **Sample Transect Selection:** To characterize debris at each beach, IEc randomly selected sampling locations (transects) prior to arriving on-site. At each sampling location, IEc randomly selected four transects for debris characterization. For each transect, we filled out the "Transect #" and "Transect Range" fields on the sampling site characterization sheet (Appendix A). Doing this in advance of each site visit allowed the field staff to quickly flag the pre-determined transects during the initial site set-up.

On-Site Beach Characteristics Collection

We obtained data on beach characteristics primarily through on-site observations and measurements during two periods: July 9, 2013 to July 15, 2013 and August 13, 2013 to August 20, 2013. During these site visits, we collected data on the following characteristics:

- **Beach Width:** We measured beach width on site from the water line to the back of the beach using a GPS unit. The measurement was taken at the entrance to the beach from the main parking lot. If there were multiple entrances to the beach from the main parking lot, then width was measured at the midpoint between the outer entrances. We later calculated the distance between these points using the coordinates recorded by the GPS unit.
- **Beach Amenities:** We recorded the presence/absence of the following amenities: volleyball nets, fire pits, piers, a bike path/boardwalk, food concessions, and playgrounds.
- **Type of Neighborhood:** We recorded whether the neighborhood adjacent to the beach was primarily urban, suburban, or rural. To validate our on-site observations, we used US Census data to determine whether a site was in an urban or rural census block (U.S. Census Bureau, 2013). We re-classified sites that fell in a rural census block as rural. If the site was in an urban block, we evaluated whether the site fell within a principal city. We classified sites within a principal city as urban and sites outside of the principal city as suburban.

- **Parking Cost:** We calculated the cost of parking for an eight hour period in the beach parking lot.
- **Cobbles:** We noted whether or not the beach had areas where the sand has washed away and large cobbles remain (i.e., larger than four inches in diameter).
- **Beach Raking:** During the on-site visit, field staff documented whether raking had occurred in the beach study area at the time of data collection.
- **Marine Debris:** Field staff measured and recorded the amount of marine debris as described below.

We obtained marine debris data through detailed measurements at each site using methods similar to those specified in NOAA's Marine Debris Shoreline Survey Field Guide (Opfer et al. 2012) for standing stock studies. Please see the debris characterization handbook in Appendix B for detailed instructions, protocols, and forms used by field staff.

During each assessment, field personnel counted and categorized all observed macro debris (debris larger than 2.5 cm on the longest dimension) along the four randomly selected 5m wide transects within a 100m segment of beach.[2] Each transect spanned the beach from water's edge to the back of the shoreline and was divided into two sections for counting purposes, the "foreshore" and the "backshore." The foreshore is defined as the section of beach "which lies between high and low water mark at ordinary tide" (IHO 1994). It is the steeply-sloped section of the beach where waves wash up (Exhibit 4). The backshore is defined as the mildly-sloped or flat section of beach "which is usually dry, being reached only by the highest tides (IHO 1994).[3] At most beaches in the study area, the backshore is regularly raked, so there is minimal, if any wrack in the backshore area. However, at beaches that are not regularly raked, wrack can occur in both the foreshore and the backshore areas.

2 Field personnel did not measure micro debris, as it was not expected to have a significant impact on the behavior of beach visitors.

3 Some authors (e.g., Ellis 1978) refer to the backshore as the "berm" and use the term "berm crest" to describe the boundary between the foreshore and backshore.

EXHIBIT 4. FORESHORE AND BACKSHORE

Once on-site, field staff filled out the remaining fields on the shoreline characterization form and verified the observations recorded off-site (Appendix A). They then recorded waypoints at the back of the shoreline and at the water line using a GPS unit.

Using this GPS unit and printed satellite imagery photos as a guide, the staff proceeded to the sampling site; if the pre-determined sampling site was too congested, the staff moved either north or south of the original site (based on a coin toss) to an area of beach that was less congested. Similarly, if beach visitors arrived in a transect after the sampling site was already determined, an alternate transect to the north or south (based on a coin toss) was selected. Of the 248 measured transects, only one alternate was used. During the site set-up, the field staff filled out the sampling site form which recorded information specific to that day's site visit (weather, sampling time, presence of raking and geographic information). A site was considered raked if evidence of recent raking existed (e.g., rake lines clearly visible and not degraded by the tide, footsteps or wind; raking ongoing) at the time of the visit.

After field staff set up the site, they proceeded to measure macro debris along the entire wrack line and in each of the four randomly selected transects. Any unusual or unidentifiable debris were photographed. Each of these measurements was further broken down on the Transect Debris and Wrack Line Debris data sheets (see Appendix A) into the following categories:

1. Plastics – plastic fragments (hard, foamed, film), food wrappers, beverage bottles/containers, bottle caps, cigar tips, cigarettes, disposable lighters, 6-pack rings, bags, rope/net, buoys/floats, fishing lure/line, cups, utensils, straws, balloons, personal care products.
2. Metals – aluminum cans, aerosol cans, metal fragments.
3. Glass – beverage bottles, jars, glass fragments.
4. Rubber – flip-flops, gloves, tires, rubber fragments.
5. Processed Lumber – cardboard cartons, paper and cardboard, paper bags, lumber/building material.
6. Cloth/Fabrics – clothing/shoes, gloves (non-rubber), towels/rags, rope/net pieces (non-nylon), fabric pieces.
7. Other/Unclassifiable – food, etc.
8. Large Debris- items greater than one foot in longest dimension.

For the wrack line measurements, the field staff followed the wrack line from the northern or southern edge of the sampling site to the opposite edge, a distance of 100 meters. Along this distance, debris was measured if it fell within 2 meters of the center of the wrack line. In areas with no wrack line present, the field staff followed the berm line.

For the transect measurements, the field staff flagged each transect prior to debris characterization using two 20 meter rope-lines for the backshore and a rope spool for the foreshore. Each transect extended from the water's edge up to 20 meters past the berm line[4] and was 5 meters long (Exhibit 5). Transect widths ranged from 13.5 meters at San Onofre State Beach to 64 meters at Seal Beach. The longest transect widths were recorded at beaches with long, gradually sloping foreshores.

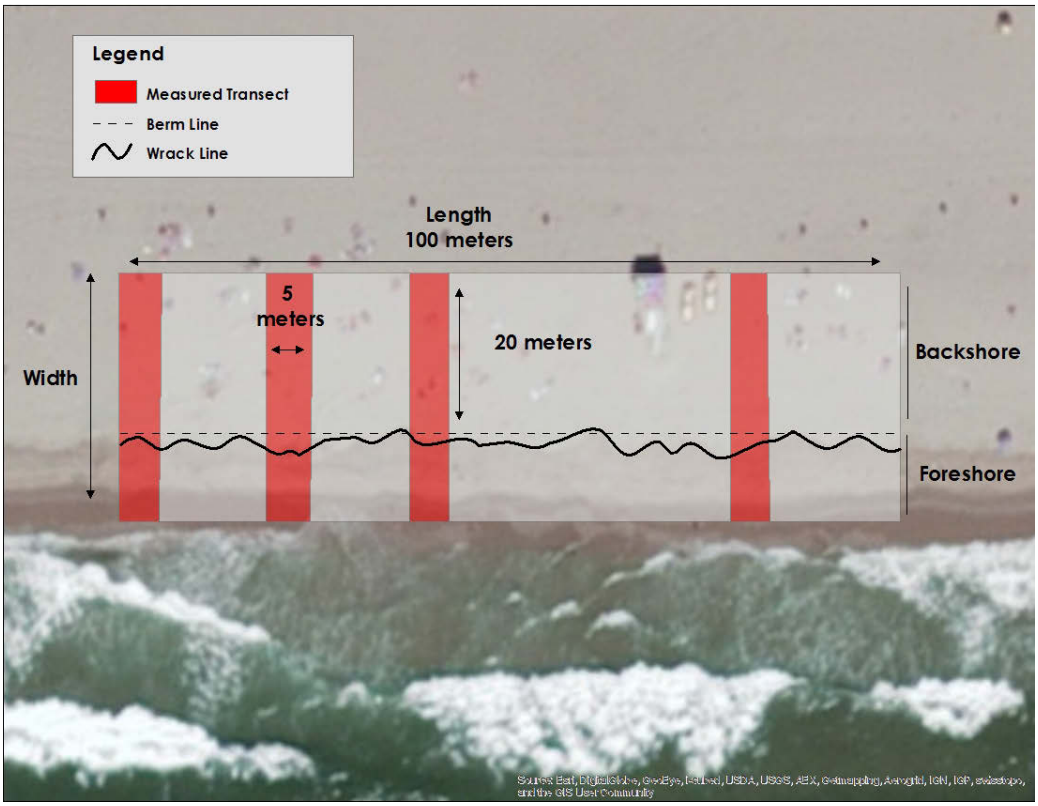
LOCAL BEACH DAY TRIPS DATA

Data on beach visits were obtained through a general population mail survey of Orange County households. The survey included questions that focused on beach day trips, beach activities, marine debris at local beaches, and demographic characteristics (see survey instrument in Appendix C). The survey also asked respondents to indicate how important certain beach characteristics are when deciding to visit local beaches and level of concern with debris on beaches. With regard to beach day trips, the respondent was asked to indicate the specific local beaches that he or she visited in June, July and August of 2013 and the number of day trips taken, by month, to each location. We pre-tested draft versions of the survey through two focus groups (nine participants total) in Irvine,

[4] Field staff measured up to 20 meters past the berm line; however, if the beach ended (i.e., field staff reached the parking lot) before 20 meters, they stopped at the beach's edge.

California on February 6th and 7th, 2013. We received approval on the final versions of the survey instrument from the Office of Management and Budget on October 31, 2013.[5]

EXHIBIT 5. SAMPLING SITE OVERVIEW



The survey was implemented in November and December 2013 by mail, using a simple random sample of 4,000 residential addresses (including P.O. Boxes) in Orange County from the United States Postal Service's Computerized Delivery Sequence File (CDSF). The implementation sequence for the mail survey was as follows:

Day 1: An advance letter was sent to all sampled households. The letter notified the household that a survey was on the way, described the purpose of the survey, and encouraged the individual to respond.

Day 5: The survey instrument was mailed to all sampled households via first class mail. The survey instrument included a $2 response incentive, a letter, a color map of local beaches, and a self-addressed, stamped envelope.

5 OMB Control Number 0648-0681.

Day 12: A thank you/reminder postcard was mailed to all sampled households thanking them for responding and encouraging them to complete the survey if they hadn't already.

Day 26: A replacement survey instrument was mailed to all sampled households who had not yet responded. The replacement survey included a letter, a color map and a self-addressed, stamped envelope.

To investigate the potential for non-response bias, we conducted a non-respondent follow-up mail survey with a sub-sample of 600 individuals who did not respond to the survey.[6] To maximize the likelihood of response, the non-respondent follow-up survey was extremely short (five questions) and was sent via two-day Federal Express (Appendix D). The questions in the non-respondent follow-up survey were a subset of the questions from the main survey, selected to characterize non-respondents with respect to number of beach trips and attitude towards marine debris. No demographic questions were included on the non-respondent follow-up survey, as response bias associated with demographic characteristics can be adequately assessed by comparing demographic characteristics of respondents with county-level census data and using raking procedures if there are substantial differences. The non-response follow-up survey was implemented four weeks after the replacement survey was mailed.

SUMMARY RESULTS

Overall, we collected hundreds of data points on all 31 selected sites during our data collection efforts, as well as 18 measurements of marine debris at each site. We received 1,436 completed mail surveys, providing an overall response rate of 36.5 percent (AAPOR 3). In addition, we received 93 non-response follow-up surveys, providing a response rate of 15.6 percent.[7]

We used double data entry into an Access database for all beach characteristics data, and verified and corrected all discrepancies. We standardized all units and values in the data and text fields (e.g., converted miles to meters) to facilitate summary and analysis. We also calculated beach widths and transect widths using the waypoints collected during the on-site period and converted them to distances. The mail survey and non-response survey data were entered into an electronic database using double-key data entry, with any discrepancies evaluated and resolved.

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6 Initially, we had planned to allocate half of the sample of 600 non-respondents to a phone survey mode. However a recent study comparing mail and phone follow-up surveys found the telephone follow-up to be inferior to a mail follow-up implemented via FedEx (Han et al. 2010). This is at least partly due to the fact that phone numbers can be matched to only about 60 percent of the sampled addresses, and phone number matches cannot be obtained for cell-only households.

7 For the main survey, 4,001 surveys were mailed. There were 1,436 completed surveys, 66 undeliverable surveys (i.e., bad addresses), 39 explicit refusals, 3 returned but marked as ineligible due to illness/health, and 2,457 surveys that were never returned. The main survey response rate is calculated as 0.365 = 1,436 ÷ (1,436 + 2,457 + 39). For the non-respondent follow-up survey, 600 surveys were mailed. There were 93 completed surveys, 4 undeliverable surveys, and 503 that were never returned. The follow-up survey response rate is calculated as 0.156 = 93 ÷ (93 + 503).

BEACH CHARACTERISTICS

As noted above, we recorded the presence/absence of the following beach characteristics during our on-site visits: boardwalk/bike path, cobbles, concession, fire pits, piers, playgrounds, and volleyball nets. We also noted if there were views of industrial complexes from the beach, and we calculated the cost to park for a full day (i.e., eight hours) at the beach. Over half of the sites have a boardwalk or bike path (19 beaches); for example, the South Bay bike trail that extends from Santa Monica Beach to Redondo Beach. Very few beaches had evidence of cobbles (only four beaches). Concessions were also relatively available (18 beaches), but very few sites had playgrounds (five beaches). Parking costs range from free to $15 per day, with an average cost of $10 per day. Exhibit 8 summarizes the amenities for each beach, Exhibit 9 provides some examples of observed characteristics.

The dimensions of the beach sites varied substantially (Exhibit 6). Shoreline length ranged from 281 meters (Capistrano Beach) to 6,638 meters (Santa Monica Beach), with an average of 2,701 meters. Beach width ranged from 21 meters (Topanga Beach) to 247 (Santa Monica Beach) meters, with an average of 77 meters.

EXHIBIT 6. SHORELINE DIMENSIONS

DIMENSION	MEAN (METERS)	MINIMUM (METERS)	MAXIMUM (METERS)
Shoreline Length[1]	2,701	281	6,638
Beach Width[2]	77	21	247

Notes:
[1] Shoreline length is measured north to south (i.e., parallel to the water line)
[2] Beach width is measured east to west (i.e., from the water line back)

Most beaches have a high level of water quality in summer, with lower water quality scores on average in the winter and the lowest grades in the wet season (Exhibit 7). Summer grades range from 90 to 98, with an average score of 97; winter grades range from 62 to 98, with an average of 93; and wet season grades range from 55 to 98, with an average score of 86.

EXHIBIT 7. WATER QUALITY SCORES

GRADE	MEAN SCORE	MINIMUM SCORE	MAXIMUM SCORE
Summer Grade[1]	97	90	98
Winter Grade[2]	93	62	98
Wet Season Grade[3]	86	55	98

Notes:
[1] Summer Grades are from June 1st, 2013 to August 28, 2013
[2] Winter grades are from November 2012 to March 2013
[3] Wet Season Grades are from April 2012-March 2013

EXHIBIT 8. SHORELINE AMENITIES

SHORELINE NAME	BOARDWALK/ BIKE PATH	COBBLES	CONCESSIONS	FIREPITS	INDUSTRY VIEWS	PIER	PLAYGROUND	VOLLEY BALL NETS	PARKING COST (DOLLARS PER 8 HOURS)
Topanga		Yes							10
Will Rogers								Yes	12
Zuma Beach	Yes		Yes					Yes	10
Santa Monica	Yes		Yes			Yes		Yes	8
Point Dume									10
Venice Beach	Yes		Yes			Yes	Yes	Yes	12
Dockweiler State Beach	Yes			Yes	Yes			Yes	8
El Segundo Beach	Yes				Yes			Yes	10
Manhattan Beach	Yes		Yes			Yes		Yes	10
Hermosa Beach	Yes		Yes			Yes	Yes	Yes	10
Redondo Beach	Yes		Yes			Yes			8
Torrance/Malaga Beach	Yes							Yes	7
Long Beach	Yes		Yes		Yes	Yes		Yes	8
Seal Beach					Yes	Yes		Yes	6
Sunset/Surfside Beach					Yes			Yes	0
Bolsa Chica Beach	Yes		Yes	Yes	Yes				15
Huntington City Beach	Yes		Yes	Yes	Yes	Yes		Yes	12
Huntington State Beach	Yes		Yes	Yes	Yes			Yes	15
Newport Beach	Yes		Yes			Yes		Yes	12
Balboa Beach			Yes			Yes			12
Corona Del Mar			Yes	Yes				Yes	15
Crystal Cove									15
Laguna Coves								Yes	0
Laguna Beach Main	Yes		Yes				Yes	Yes	10
Aliso Beach				Yes			Yes	Yes	8
Salt Creek State Beach			Yes						8
Doheny State Beach	Yes	Yes	Yes	Yes				Yes	15
Capistrano Beach	Yes	Yes						Yes	8
San Clemente City Beach	Yes	Yes	Yes	Yes		Yes	Yes		12
Calafia/San Clemente State Beach	Yes		Yes						15
San Onofre State Beach				Yes	Yes			Yes	15

EXHIBIT 9. EXAMPLE BEACH AMENITIES

Pier/Concessions

Industry Views

Cobbles

Lifeguard

Marine Debris

Overall, we found that marine debris varied greatly between sites, both in terms of total debris counts, and in total debris density. To account for transects with larger areas, we calculated the debris density as the total debris count divided by the transect area.[8] Exhibit 13 below displays both the total debris count and debris density by site. In general, sites with a large total debris count also had a high debris density.

Plastics made up the majority of the debris, with a total of 78 percent of total debris counted in transects and 83 percent in the wrack line (Exhibit 10). Processed lumber, including paper products, make up the next largest category, with 15 percent of total debris counted in transects and 11 percent in the wrack line. Exhibit 14 provides some examples of different types of observed debris.

EXHIBIT 10. TOTAL DEBRIS COUNTS BY DEBRIS CATEGORY

DEBRIS CATEGORY	TRANSECT		WRACK LINE	
	N	PERCENT	N	PERCENT
Plastic	2,591	78%	2,568	83%
Processed Lumber	510	15%	326	11%
Metal	53	2%	40	1%
Other/Unclassifiable	104	3%	97	3%
Cloth/Fabric	53	2%	46	1%
Rubber	17	1%	9	0%
Glass	8	0%	8	0%
Total	3,336	100%	3,094	100%

Overall, we observed more debris in the backshore than the foreshore, with backshore debris density on average more than twice the density in the foreshore (Exhibit 12). The wrack line overall had the highest density of debris, with 0.25 counts per square meter. Exhibit 11 provides an example of observed debris in the wrack line.

8 Although we always counted debris for 20 meters past the berm, sites varied substantially in width of foreshore, and therefore total transect width.

EXHIBIT 11. EXAMPLE DEBRIS IN WRACK LINE

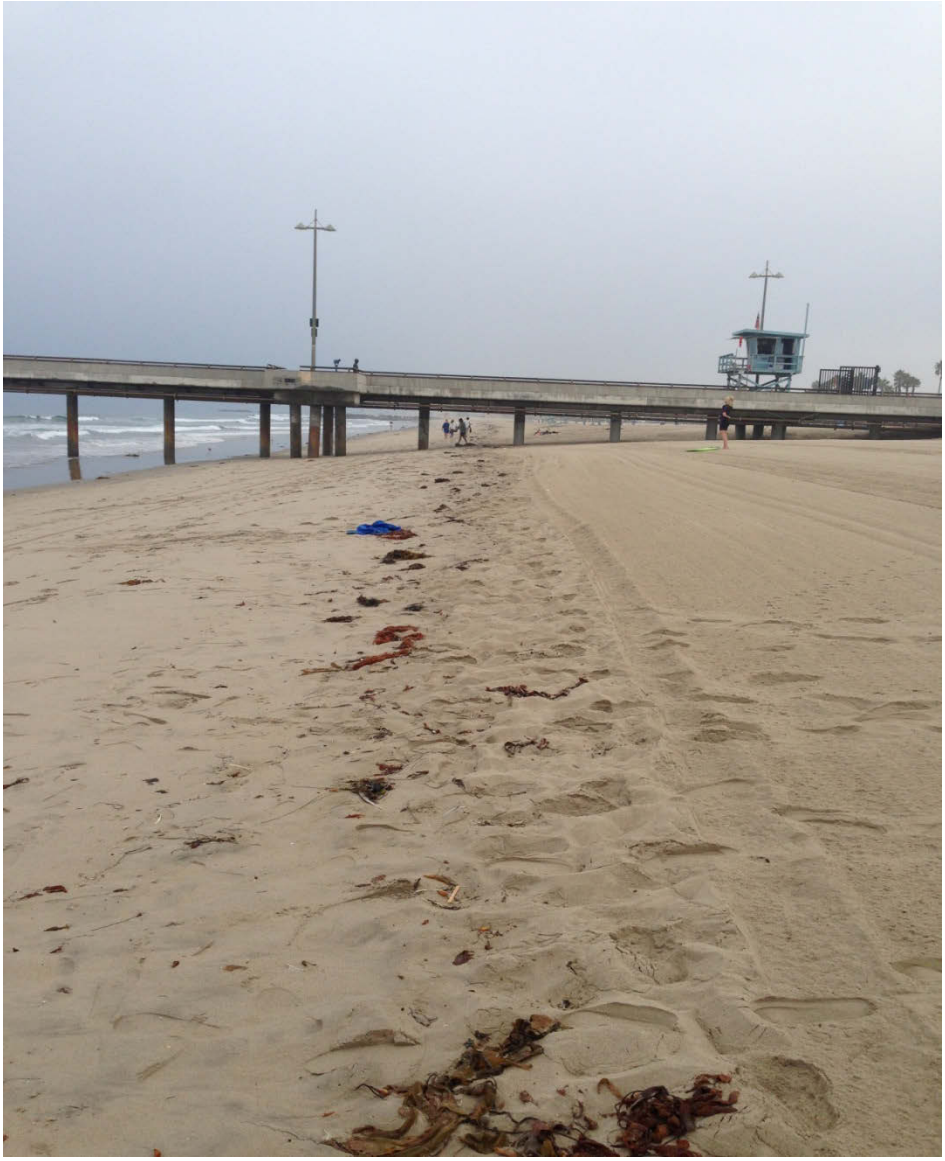

EXHIBIT 12. DEBRIS DENSITY BY MEASUREMENT TYPE

DEBRIS DENSITY (DEBRIS COUNT/METER^2)	MEAN	MINIMUM	MAXIMUM
Transect	0.083	0.014	0.208
Transect Foreshore	0.057	0.002	0.432
Transect Backshore	0.112	0.014	0.306
Wrack Line	0.250	0.025	0.798

EXHIBIT 13. DEBRIS DENSITY BY SITE

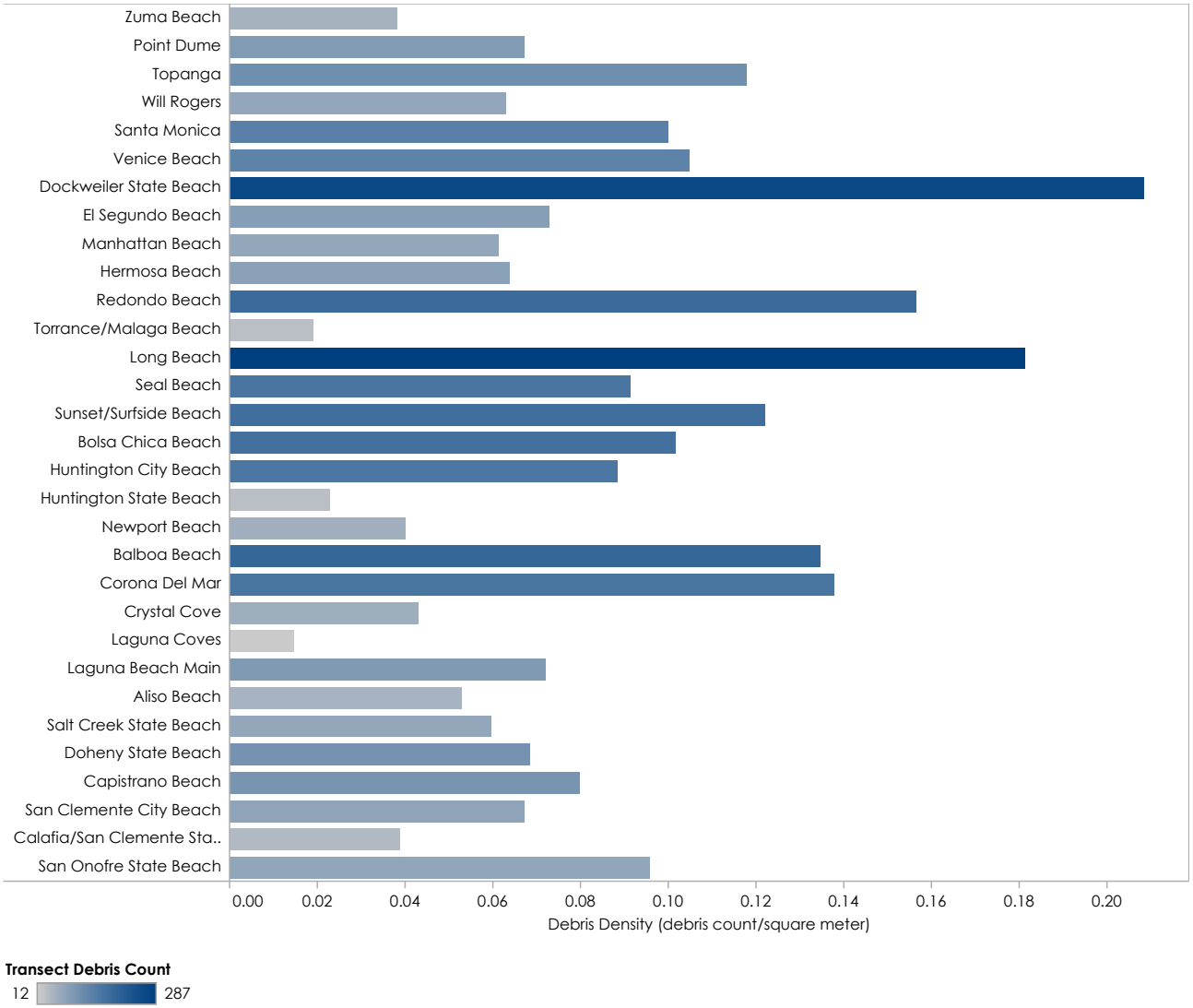

EXHIBIT 14. DEBRIS EXAMPLES

Plastic: Food Wrapper

Plastic: Styrofoam

Metal: fragments

Aluminum/Tin Can & Plastic: Hard

PRIMARY SURVEY

Summary statistics for all questions in the primary mail survey are provided in Appendix E. Respondents had substantial experience at local beaches, with 97 percent reporting that they have ever visited a local beach (Exhibits 15 and 16). In addition, only eight percent of respondents did not take a trip to a local beach in the last year. About half of respondents (54 percent) took between one and 10 trips to local beaches in the last year, with 34 percent taking between 11 and 100 trips to local beaches in the last year. A small percentage (five percent) of respondents took more than 100 trips to local beaches in the last year.

EXHIBIT 15. BEACH VISITS AND RESPONDENT ORIGINS

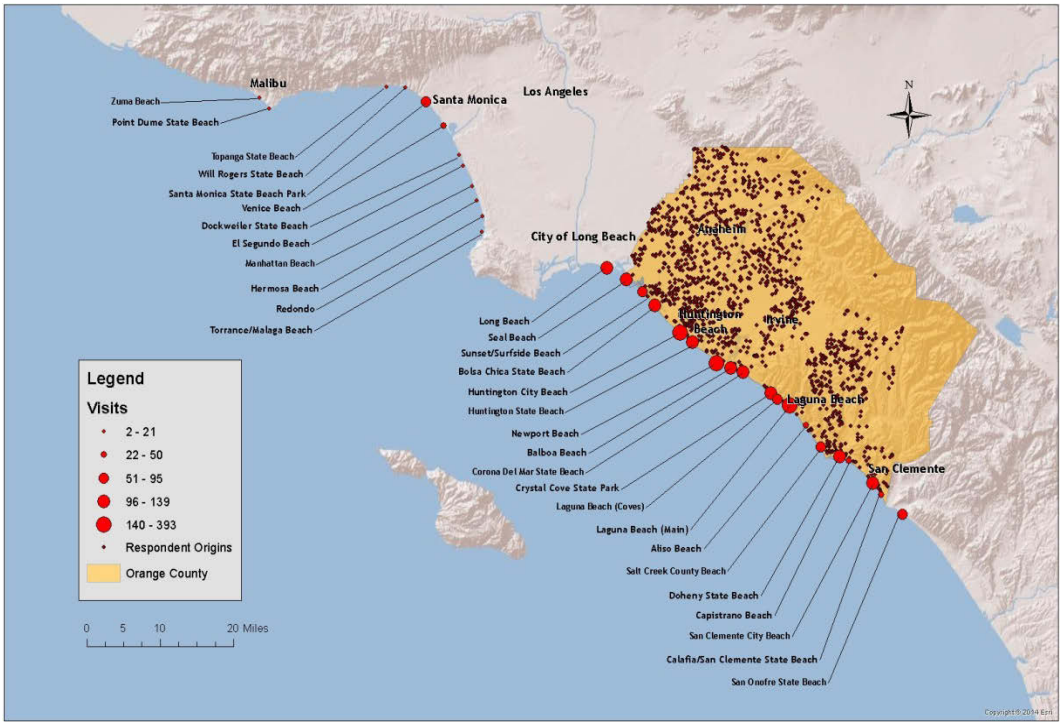

EXHIBIT 16. NUMBER OF DAYS TRIPS TAKEN TO LOCAL BEACHES IN THE LAST YEAR

# OF ANNUAL DAY TRIPS	N	PERCENT	CUMULATIVE PERCENT
None	104	8%	8%
1-5	490	36%	44%
6-10	245	18%	62%
11-15	102	7%	69%
16-20	86	6%	75%
21-30	92	7%	82%
31-40	57	4%	86%
41-50	41	3%	89%
51-75	47	3%	92%
76-100	37	3%	95%
>100	69	5%	100%

The most popular activity in which respondents typically participate is walking/running (77 percent), followed by sunbathing (51 percent), and picnicking (42 percent) (Exhibit 17). Fishing and volleyball were the least common activities, with eight and seven percent respectively. The majority of respondents typically drive to local beaches (91 percent), with only 12 percent walking or biking, and two percent taking the bus.[9]

EXHIBIT 17. TYPICAL ACTIVITIES AT LOCAL BEACHES

ACTIVITY	N	PERCENT
Sunbathing	703	51%
Wading	525	38%
Swimming	469	34%
Bodysurfing	274	20%
Volleyball	102	7%
Partying/Bonfires	475	35%
Surfing	163	12%
Picnicking	579	42%
Fishing	110	8%
Walking/Running	1058	77%
Biking	348	25%

A majority of respondents (66 percent) reported that the absence of marine debris and good water quality are very important when deciding which local beach to visit (Exhibit 18). Respondents also consider free/inexpensive and convenient parking are very important (44 and 49 percent respectively). The fewest respondents rank fishing and good surfing as very important, with eight and ten percent respectively. In addition, 62 percent of respondents report that they would be very concerned to see garbage or manmade debris on the sand or surf while visiting a local beach.

9 While we expected respondents to select one of these options, some respondents (62 total) provided more than one response to this question; therefore, these values total more than 100 percent.

EXHIBIT 18. IMPORTANCE OF CHARACTERISTICS WHEN DECIDING WHICH LOCAL BEACH TO VISIT

Characteristic	Not Important				Very Important	Total	n
	1	2	3	4	5		
Scenic beauty or view	1%	2%	13%	28%	57%	100	1,338
Good water quality	2%	2%	9%	21%	66%	100	1,341
Close to home	3%	6%	25%	28%	39%	100	1,356
Parking is convenient	3%	3%	13%	32%	49%	100	1,347
Parking is free or inexpensive	6%	6%	17%	28%	44%	100	1,317
Good surfing available	55%	15%	13%	7%	10%	100	1,307
Sandy (rather than rocky)	7%	6%	21%	33%	33%	100	1,340
Not crowded	4%	5%	33%	34%	24%	100	1,332
Long enough for a walk/run	10%	11%	27%	28%	24%	100	1,342
Bike path available	29%	17%	24%	15%	15%	100	1,309
Fishing available	57%	15%	14%	7%	8%	100	1,323
No marine debris	2%	3%	7%	22%	66%	100	1,361
No natural debris	21%	18%	31%	18%	12%	100	1,346

EXHIBIT 19. LEVEL OF CONCERN WITH DEBRIS WHILE VISITING A LOCAL BEACH

HOW CONCERNED ARE YOU TO SEE MARINE DEBRIS ON THE SAND OR IN THE SURF?	N	PERCENT	CUMULATIVE PERCENT
Not at all Concerned: 1	18	1%	1%
2	38	3%	4%
3	153	11%	15%
4	306	23%	38%
Very Concerned: 5	843	62%	100%

Several demographic questions in the main survey were designed to be identical to questions in the Census Bureau's American Community Survey (ACS). This allows us to compare respondent demographics to Census Bureau demographic data for Orange County adults (Exhibit 20).

The results are generally consistent with what is typically observed with general population mail surveys: women, older residents, and well educated respondents are over-represented. In addition, Hispanics are under-represented, a result one might expect for a survey administered only in English to a population that is 29 percent Hispanic. The over-representation of women was relatively minor, but the differences with respect to age, education, and Hispanic ethnicity were large and were therefore addressed in the development of survey weights (see below). In contrast, the survey respondents appear to be broadly similar to the Orange County population with respect to household income and self-reported race.

NON-RESPONDENT FOLLOW-UP SURVEY

The follow-up survey, which was sent to a simple random sample of primary survey non-respondents, included four questions that were also included in the primary survey. Thus, for these four questions, primary survey respondents can be compared with primary survey non-respondents using a combination of data from the primary survey (for respondents) and the follow-up survey (for non-respondents).

These comparisons are presented in Exhibit 21. The results indicate that respondents were similar to non-respondents with respect to their attitudes towards marine debris. Specifically, the percentage of respondents who indicated that they would be "very concerned" about seeing marine debris is very similar for respondents (62.1 percent) and non-respondents (61.5 percent). In addition, respondents were actually *less* likely than non-respondents to indicate that they had participated in a beach cleanup within the last three years (17.1 percent for respondents, 23.7 percent for non-respondents).

However, respondents were more likely to be avid beach visitors than non-respondents. The largest difference was associated with residents who rarely visit local beaches: while 90.1 percent of respondents had visited a local beach within the last year, only 76.3 percent of non-respondents had done so. Among those who *had* visited a local beach within the past year, the distribution of the number of visits was broadly similar. With regard to June/July/August trips, the direction of the difference was the same, but the gap between respondents and non-respondents was somewhat smaller: 75.3 percent of respondents and 71.4 percent of non-respondents reported taking at least one trip to a local beach during this time period.

These comparisons are unfortunately complicated by the fact that the response rate for the follow-up survey was low (15.6 percent). As a result, the follow-up respondents may be a biased representation of primary survey non-respondents. It is possible that the differences discussed above would be exacerbated if we had 100 percent response in the follow-up survey, as the mechanisms that lead to non-response in the primary survey are likely to also lead to non-response in the follow-up survey.

EXHIBIT 20. SURVEY RESPONDENTS VS. CENSUS ESTIMATES FOR ORANGE COUNTY ADULTS

	U.S. CENSUS	SURVEY RESPONDENTS
Gender (n = 1,401)		
Male	48.9%	45.8%
Female	51.1%	54.2%
	100.0%	100.0%
Age (n = 1,348)		
18-24	13.4%	4.5%
25-34	18.2%	11.6%
35-44	19.3%	18.6%
45-54	19.4%	21.3%
55-64	14.2%	23.9%
65+	15.5%	20.1%
	100.0%	100.0%
Education (n = 1,341)		
Less than HS graduate	16.4%	1.7%
High school graduate	17.9%	7.8%
Some college	21.3%	21.9%
Associate's degree	7.8%	11.6%
Bachelor's degree	23.9%	33.2%
Graduate or professional degree	12.7%	23.9%
	100.0%	100.0%
Household Income (n = 1,293)		
< $10,000	4.1%	2.5%
$10,000 to $49,999	28.9%	23.2%
$50,000 to $74,999	16.7%	18.9%
$75,000 to $99,999	13.4%	13.2%
$100,000 to $149,999	18.0%	22.2%
$150,000 +	18.9%	20.0%
	100.0%	100.0%
Hispanic or Latino (n = 1,393)		
Hispanic or Latino	29.4%	15.1%
Not Hispanic or Latino	70.6%	84.9%
	100.0%	100.0%
Race (n = 1,343)		
American Indian or Alaskan Native	0.4%	1.0%
Asian	18.1%	16.1%
Black or African American	1.6%	1.4%
Native Hawaiian or other Pacific Islander	0.3%	1.3%
White	62.4%	70.5%
Some other race	13.9%	6.1%
Two or more races	3.2%	3.6%
	100.0%	100.0%

EXHIBIT 21. RESPONDENTS VS. NON-RESPONDENTS (MAIN SURVEY)

	MAIN SURVEY NON-RESPONDENTS (N = 93)	MAIN SURVEY RESPONDENTS (N = 1,433)
Number of day trips to ocean beaches in the local area within the last year		
None	23.7%	9.9%
1-10	40.9	52.3
11-20	8.6	13.4
21-30	3.2	6.6
31-40	4.3	4.1
41-50	4.3	2.9
50+	15.1	10.9
	100%	100%
Number of day trips to ocean beaches in the local area in June, July, or August of 2013?		
None	28.6%	24.7%
1-10	49.5	41.0
11-20	6.6	12.6
20+	15.4	21.7
	100%	100%
Level of concern about seeing marine debris on the sand or in the surf (1 = Not concerned; 5 = Very concerned)		
1	1.1%	1.3%
2	2.2	2.8
3	12.1	11.3
4	23.1	22.5
5	61.5	62.1
	100%	100%
Participated in a beach cleanup within the last three years?		
YES	23.7%	17.1%
NO	76.3	82.9
	100%	100%

RUM MODEL RESULTS

Model Overview

The survey data, beach characteristics, and travel costs were used to estimate a repeated nested logit random utility model (see Haab and McConnell 2002). The model describes individuals as making a series of independent choices throughout the summer months: each day (or "choice occasion"), they choose (1) whether or not to go to the beach and (2) which beach to visit if they choose to go to the beach. The first decision is often described as the "participation" decision, and it is modeled as a function of demographic characteristics. The second decision is typically described as the "site choice" decision, and it is modeled as a function of beach characteristics and travel cost. The data on beach trips provide information on how survey respondents make trade-offs among beach attributes (e.g., quantity of marine debris), and travel costs, which allows one to estimate the gains or losses associated with changes in these attributes.

Model Structure

More formally, the utility associated with a visit to beach *j* by individual *i* (i.e., the "site choice" decision) is given by

$$u_{ij} = \beta_{TC} C_{ij} + \boldsymbol{\gamma}' \boldsymbol{X}_j + \varepsilon_{ij}$$
$$= v_{ij} + \varepsilon_{ij}$$

where:

C_{ij} = the cost to individual *i* of traveling to beach *j*
$\boldsymbol{\gamma}$ = a vector of unknown parameters associated with beach attributes
$\boldsymbol{X}_j$ = a vector of attributes associated with beach *j*
ε_{ij} = an error distributed as generalized extreme value

The utility associated with a decision <u>not</u> to visit the beach (i.e., the "participation" decision) is given by

$$u_{i0} = \alpha + \boldsymbol{\theta}' \boldsymbol{Z_i} + \varepsilon_{i0}$$
$$= v_{i0} + \varepsilon_{i0}$$

where:

α = a constant
$\boldsymbol{\theta}$ = a vector of unknown parameters associated with demographic characteristics
$\boldsymbol{Z_i}$ = a vector of demographic characteristics associated with individual i
ε_{i0} = an error distributed as *i.i.d.* extreme value

Given these utilities and assuming the errors are jointly distributed as generalized extreme value, the probability that individual *i* will select site *j* on any given choice occasion is given by (Kling and Thomson 1996):

$$P_{ij} = \frac{\exp\left({v_{ij}}/{\rho}\right)}{\exp(I_i)} x \frac{\exp(\rho I_i)}{\exp(\rho I_i) + \exp(v_{i0})}$$

with the probability associated with choosing not to visit a beach given by

$$P_{i0} = \frac{\exp(v_{i0})}{\exp(\rho I_i) + \exp(v_{i0})}$$

where I_i represents the "inclusive value" for individual *i* and is defined as:

$$I_i = ln \sum_{j=1}^{J} \exp\left({v_{ij}}/{\rho}\right)$$

In the inclusive value definition, *J* is the total number of beaches (31) and ρ is the "dissimilarity coefficient" that represents the degree of substitution between trip-taking and staying home. Given these probabilities, the model can be estimated by maximizing the following likelihood function

$$L = \prod_{i=1}^{N} \prod_{j=0}^{J} (P_{ij})^{T_{ij}}$$

where T_{ij} represents the number of choice occasions where individual *i* selected site *j*. The second product includes *j* = 0, which represents the no-trip alternative, so that T_{i0} is the number of choice occasions where individual *i* chose <u>not</u> to take a trip to a local beach.

The compensating variation per choice occasion associated with a change in the characteristics of one or more sites can be expressed as (Hanemann 1982)

$$CV_i = \frac{\ln\left[\exp(v_{i0}) + \exp(\rho I_i^1)\right] - \ln\left[\exp(v_{i0}) + \exp(\rho I_i^0)\right]}{\beta_{TC}}$$

where I_i^0 represents the inclusive value for individual *i* with the original site characteristics and I_i^1 represents the inclusive value for individual *i* with the new site characteristics.

Site Characteristics

The beach attributes included in the site choice component of the model are summarized in Exhibit 22. The DEBRIS variable is intended to capture differences across sites with respect to the quantity of marine debris, and it is the key variable for the current research effort. It is equal to the average marine debris density (total item count per square meter) across all eight transects at a given site (four transects in July and four in August). Marine debris was only included in these counts if it was larger than 2.5 cm on the longest dimension. Each transect was five meters wide and ran perpendicular to the shoreline from the water's edge to a point approximately 20 meters beyond the berm. The specific locations for the transects were randomly selected within a 100-meter interval centered at

the entrance to the beach from the main parking lot. Additional details regarding marine debris measurements are provided in Appendix B.

The approximate size of the beach is captured by the LENGTH and WIDTH variables, both of which were measured using GIS. The width of the beach was measured near the main entrance.

Three binary (0/1) variables were included to capture the presence or absence of specific beach amenities: CONCESSION, PIER, and FIREPITS.[10] The CONCESSION variable indicates whether a concession stand with food options was available at the beach. The PIER variable reflects the availability of a publicly accessible pier. The piers in this area are typically quite long and often offer concessions, restaurants, fishing opportunities, and other amenities. The FIREPITS variable reflects the availability of fire pits, which are designated locations where visitors can have bonfires, typically located at the back of the beach near the parking lot.

The binary COBBLES variable was included to capture the presence or absence of large (i.e., greater than 4 inches) cobbles that make it difficult to pursue typical beach activities. Although certain beaches are known to be more prone to cobbling than others, the extent of cobbling can vary both seasonally and spatially, depending on natural erosion and deposition patterns. The COBBLES variable reflects the presence or absence of cobbles on the stretch of beach where marine debris was measured.

As many survey respondents expressed concern about personal safety at beaches in open-ended responses, an attempt was made to identify crime data for the area. However, the available crime rate data did not vary adequately over space. As an alternative, a binary URBAN variable was included which reflected the land use surrounding each beach. This variable might capture differences in crime rates, but it may also capture additional driving costs (due to congestion) or the presence of additional amenities nearby such as restaurants and shops.

The WATERQ variable was included to capture differences across sites in the concentration of potentially harmful bacteria. Heal the Bay, a non-profit organization, publishes grades associated with weekly sampling events at beaches in Los Angeles and Orange County. The WATERQ variable represents the average of Heal the Bay's weekly summer grades for each site.

Some of the beaches may be less attractive to visitors because power plants or other potentially unattractive structures are visible from the beach. This phenomenon was captured through a binary INDUSTRY variable, which is equal to one for beaches where there is a view of a power plant, offshore drilling platforms, airport, water treatment facility or other potential disamenity.

10 Although restrooms, lifeguards, showers, and parking are important beach amenities, they were not included in the model because all of the sites had these amenities.

The possibility of crowding may also make some beaches less attractive to visitors. While crowding is difficult to measure objectively, a subjective measure of crowding is included in one of the models presented below. The CROWDING variable is constructed as the percentage of survey respondents who indicated that a particular beach was frequently overcrowded (question 13), calculated out of the total number of survey respondents who were aware of that beach (question 7).

EXHIBIT 22. SUMMARY OF BEACH ATTRIBUTES (N = 31)

VARIABLE	DESCRIPTION	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
DEBRIS	Average debris count per m^2 across eight transects (see text for details)	0.08	0.05	0.01	0.21
LENGTH	Beach length (km)	2.70	1.70	0.28	6.64
WIDTH	Beach width (m)	77.35	50.66	20.83	246.84
CONCESSIONS	= 1 if concessions/restaurant available at beach (=0 otherwise)	0.58	0.50	0	1
PIER	= 1 if pier available at beach (=0 otherwise)	0.35	0.49	0	1
FIREPITS	= 1 if firepits available at beach (=0 otherwise)	0.29	0.46	0	1
COBBLES	= 1 if evidence of rocks larger than 4 inches at beach (=0 otherwise)	0.13	0.34	0	1
URBAN	= 1 if surrounding neighborhood is urban (=0 otherwise)	0.32	0.48	0	1
WATERQ	Mean June/July/August water quality grade from Heal the Bay	96.73	1.93	89.90	98.00
CROWDING	Percentage of respondents indicating the beach is frequently overcrowded	14.44	12.06	3.55	44.53
INDUSTRY	= 1 if view of power plant, oil platform, etc. from beach (=0 otherwise)	0.29	0.46	0.00	1.00
TCOST	Travel cost (in dollars) for beach day trips. See text for details.[11]	17.73	11.65	0.02	128.17

11 From the perspective of the survey respondent, travel cost is analogous to a beach attribute. The summary statistics for this variable are calculated across all 18,916 day trips to local beaches.

Travel Cost

Travel cost is calculated as the sum of the out-of-pocket costs associated with traveling to and from the beach, the opportunity cost of time associated with travelling to and from the beach, and the cost of parking at the beach for the day.[12] The opportunity cost of time is calculated as one-third the respondent's implied hourly household income. Specifically, the travel cost to individual *i* of traveling to beach *j* is calculated as:

$$C_{ij} = \frac{(\mu * DIST_{ij} + TOLLS_{ij} + PARK_j)}{PPV_i} + \left(\frac{1}{3}\right)\frac{INCOME_i * TIME_{ij}}{2000}$$

where:

C_{ij} = the cost to individual *i* of traveling to beach *j*

μ = the per mile out-of-pocket cost of driving, set to 25.39 cents based on data from the American Automobile Association (2013).[13]

$DIST_{ij}$ = the round trip distance between individual *i's* home and the main parking lot of beach *j* as calculated using PCMiler

$TOLLS_{ij}$ = the round trip tolls associated with a trip from individual *i's* home and the main parking lot of beach *j* as calculated using PCMiler

PPV_i = the number of adults that the respondent indicates are typically in his or her vehicle on trips to the beach (the average number of adults is 2.1).

$PARK_j$ = The out-of-pocket costs associated with parking. Parking costs were determined by obtaining data on the cost of parking at the main parking lot for an entire day. For lots with meters, it was assumed that visitors would park for eight hours. The average parking cost for the 31 sites is $10.19 per day.

$INCOME_i$ = The respondent's total household income. The median income ($87,500) was used for the 10 percent of respondents who did not respond to the income question.

$TIME_{ij}$ = the round trip driving time between individual *i's* home and the main parking lot of beach *j* as calculated using PCMiler

The mean travel cost calculated across the 18,916 day trips in the dataset was $17.73, with a minimum of $0.02 and a maximum of $128.17.

12 It is assumed that all respondents will drive to any beach that they choose to visit. This assumption substantially simplifies travel cost calculations and ensures consistency in these calculations across sites. However, we note that 13.2 percent of respondents indicated that they typically walk to the beach or take public transportation.

13 We use the average cost across small, medium, and large sedans. The AAA costs include gasoline, maintenance, and tires (20.42 cents per mile), plus depreciation (4.97 cents per mile).

Demographic Characteristics

The demographic characteristics included in the participation component of the model are summarized in Exhibit 23. All of the demographic variables are binary (0/1) variables indicating the presence (1) or absence (0) of a given attribute. COLLEGE indicates whether or not the respondent completed college; ASIAN indicates whether or not the respondent classified him or herself as Asian; HISPANIC indicates whether or not the respondent classified him or herself as being of Hispanic, Latino, or Spanish origin; ANYKIDS indicates whether or not there are children under the age of 18 in the respondent's household; and MALE indicates the respondent's gender. A series of binary age class variables (AGE20s, AGE30s, AGE40s, AGE50s, AGE60s, and AGE70s) captures the impact of age without imposing any assumptions on the form of the relationship between age and beach visitation.

EXHIBIT 23. SUMMARY OF DEMOGRAPHIC CHARACTERISTICS (N = 1,433)

VARIABLE	DESCRIPTION	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
COLLEGE	= 1 if respondent has college education or higher (= 0 otherwise)	0.55	0.50	0	1
ASIAN	= 1 if respondent is Asian (= 0 otherwise)	0.16	0.37	0	1
HISPANIC	= 1 if respondent is Hispanic (= 0 otherwise)	0.15	0.35	0	1
ANYKIDS	= 1 if there are children under 18 in the respondent's household (= 0 otherwise)	0.34	0.48	0	1
MALE	= 1 if the respondent is male (= 0 otherwise)	0.45	0.50	0	1
AGE20S	= 1 if the respondent is age 18 to 29 (= 0 otherwise)	0.08	0.27	0	1
AGE30S	= 1 if the respondent is age 30 to 39 (= 0 otherwise)	0.15	0.36	0	1
AGE40S	= 1 if the respondent is age 40 to 49 (= 0 otherwise)	0.18	0.39	0	1
AGE50S	= 1 if the respondent is age 50 to 59 (= 0 otherwise)	0.27	0.45	0	1
AGE60S	= 1 if the respondent is age 60 to 69 (= 0 otherwise)	0.18	0.39	0	1
AGE70S	= 1 if the respondent is 70 or older (= 0 otherwise)	0.13	0.34	0	1

Weights

The survey data were weighted prior to the analysis to (1) adjust for differential selection probabilities in the sampling design, (2) adjust for unit non-response, and (3) match the demographic characteristics of the sample with those of the Orange County adult population. These three steps are described in detail below.

The first step involved the development of a "base weight," which is equal to the inverse of the selection probability for each respondent. There are 2,285,156 adults in Orange County in 2013, and 1,433 adults in our sample. Thus, if we had drawn a simple random sample of adults, the base weight would be 1,595, or 2,285,156 divided by 1,433. However, the sample design involved drawing a simple random sample of households, then randomly selecting a single adult from within each household. As a result, the selection probability for a given respondent is proportional to the inverse of the number of adults in his or her household. The base weights are therefore equal to the number of adults in the household times a constant that scales the sum of the weights to the population size, or 2,285,156.

The second step involved a non-response adjustment. The non-response follow-up survey provided evidence that respondents may have been more likely to visit the beach than non-respondents (see discussion above). However, data from that survey were not used to adjust the weights due to the low response rate achieved in the follow-up survey and the resulting small sample size. Instead, a non-response adjustment was implemented that used information available on non-respondents from the sampling frame. Specifically, the residential address is known for both respondents and nonrespondents, and this information can be used to approximate the likelihood of responding to the survey as a function of distance from the coast. First, all sampled addresses were placed in bins based on straight-line distance to the coast by zip code (0-2 miles, 2-4 miles, 4-6 miles, etc.), and a separate response rate was calculated for each bin (Exhibit 24). Second, the base weights were multiplied by the inverse of these bin-specific response rates and scaled to match the population size. This procedure increases the relative weight for respondents in low response rate bins and decreases the relative weight for respondents in high response rate bins.[14]

EXHIBIT 24. RESPONSE RATE BY DISTANCE FROM THE COAST

DISTANCE FROM COAST (MILES)	RESPONSE RATE
0 – 2	43.6%
2 – 4	42.4%
4 – 6	37.0%
6 – 8	32.9%
8 – 10	34.4%
10 – 12	30.6%
12 – 14	37.7%
14 – 16	33.0%
16 – 18	34.6%
18 - 20	39.2%

14 Although response rates declined steadily with distance from the coast from zero to eight miles, as one might expect, the trend did not continue for areas further from the coast. After eight miles from the coast, any relationship between distance and likelihood of response appears to be masked by other factors (e.g., differences in demographic characteristics across distance zones).

The third step involved raking the weights from the second step so that the final weighted sample matched the population with respect to age, education, and percent Hispanic (Kalton 1983). As described above, these were the three demographic characteristics for which the sample displayed substantial deviations from U.S. Census Bureau estimates for Orange County (U.S. Census Bureau, 2013). The raking was implemented using 18 mutually exclusive, exhaustive categories created by crossing three categories for age (< 35, 35-54, and 55+), three categories for education (high school or less, some college, and bachelor's or higher), and two categories for ethnicity (Hispanic/Latino or not Hispanic/Latino). A single scaling factor was identified for each of the 18 categories such that the sum of the scaled weights would match the population marginal totals for age, education, and ethnicity (Exhibit 20). The overall impact of the raking is to increase the relative weights for Hispanics, younger respondents, and less educated respondents. This is illustrated in Exhibit 25, where the scaling factors are larger for respondents belonging to those groups.

EXHIBIT 25. SCALING FACTORS AFTER RAKING TO U.S. CENSUS DATA

		HISPANIC			NON-HISPANIC		
		HIGH SCHOOL	SOME COLLEGE	COLLEGE+	HIGH SCHOOL	SOME COLLEGE	COLLEGE+
AGE	<35	6.2	1.8	1.5	4.6	1.3	1.1
	35-54	3.3	1.0	0.8	2.5	0.7	0.6
	55+	2.8	0.8	0.7	2.1	0.6	0.5

ESTIMATION RESULTS

Primary Models

The estimation results for four models are presented in Exhibit 26. The first three models (Model 1, 2, and 3) are site choice only models, while the fourth model (Model 4) incorporates both site choice and participation. The models were estimated using Stata 12 with the *clogit* (non-nested model with site choice only) and *nlogit* (nested model with site choice and participation) commands, clustered standard errors, and weights described above.[15] All four models use data on 18,914 beach trips taken to the 31 sites by the 1,433

15 Note that coefficients associated with the site choice variables in Model 4 must be divided by the dissimilarity coefficient (0.213203) before comparing these coefficients with similar coefficients in Models 1-3. For example, the scaled coefficient on DEBRIS in Model 4 is -9.488 = -2.021271 = -/0.213203, which is similar to the coefficient on marine debris in Model 2 and Model 3, but larger than the coefficient on DEBRIS in Model 1.

survey respondents. Model 4 uses 184 choice occasions in estimating the participation component of the model (two per day throughout June, July, and August).

Model 1 is an extremely simple model with only travel cost (TCOST) and marine debris (DEBRIS). Although this model has only minimal controls and is likely to suffer from omitted variable bias, it was nonetheless included to provide a general indication of the strength of the DEBRIS variable in explaining site choice *before* making decisions about the appropriate model specification.

Model 2 incorporates a set of objectively measured control variables in order to address omitted variables bias associated with Model 1, while Model 3 adds two subjectively measured, but potentially important, control variables, INDUSTRY, and CROWDING. Finally, Model 4 uses Model 2 (objective controls only) as a starting point and incorporates the participation decision in addition to the site choice decision.

As anticipated, the travel cost variable (TCOST) is negative and significant at the one percent level across all four models, indicating that respondents generally prefer beaches that are located closer to their homes. Marine debris (DEBRIS) is also negative and significant at the one percent level across all four models, indicating that respondents prefer to visit beaches that have less marine debris. This result proved to be quite robust to changes in model specification: the DEBRIS variable was consistently negative and significant across numerous model specifications.

The impact of beach size appears to be mixed. The coefficient on LENGTH is consistently positive, indicating that respondents prefer longer beaches, but it is significantly different from zero in only two of the three models where it was included (at the five percent level in one and at the ten percent level in the other). The coefficient on WIDTH is consistently negative but it is significant in only one of the three models. It is possible that some respondents prefer narrower beaches in the Orange County area, as many of the major beaches are extremely wide (seven were over one hundred meters wide) and the long walk to the water line from the parking lot may be onerous for some individuals.

The coefficients associated with the three amenity variables (CONCESSIONS, PIER, and FIREPITS) were all consistently positive and generally highly significant. The coefficient on CONCESSIONS was roughly twice as large as the coefficients on PIER and FIREPITS, indicating the importance of having food options available during beach visits.

The coefficient associated with COBBLES is negative and significant in two of the three models, and negative (but not significant) in the third. The coefficient associated with the URBAN variable is not statistically significant in any of the models.

The coefficient associated with water quality (WATERQ) is positive and significant (at the five and ten percent levels), as expected, in two of the models, and positive (but not significant) in the third. The absence of a strong, consistent water quality effect may

simply reflect the fact that in the Orange County area, water quality (as measured by bacteria counts) is typically very good at all 31 sites throughout the summer months.

The coefficients associated with the CROWDING and INDUSTRY variables were both positive and significant in Model 3, which was unexpected. As discussed above, however, these two variables are somewhat subjective, and they may be measured with significant error. While it is not inconceivable that visitors might enjoy crowded beaches (some might enjoy a busy beach), the result for the INDUSTRY variable is certainly counterintuitive. Furthermore, the coefficient on the CROWDING variable may simply reflect the correlation between CROWDING and beach amenities: estimated coefficients for CONCESSIONS, PIER, and FIREPITS decline substantially when the CROWDING variable is added. The CROWDING and INDUSTRY variables were excluded from the nested logit model (Model 4) given that these two variables were somewhat subjective, and given the counterintuitive results associated with several variables in Model 3.

The estimation results for the participation component of Model 4 are presented at the bottom of Exhibit 26. In these results, a negative coefficient is associated with a greater likelihood of visiting the beach. Thus, the large positive constant simply reflects the fact that on any given day, the typical resident is more likely to stay home or pursue another activity than visit a beach. The results indicate that respondents are less likely to visit a beach if they characterize themselves as Hispanic or Asian (the coefficients on ASIAN and HISPANIC are both negative and significant at the one percent level). In addition, it appears that men visit the beach somewhat more often than women (the coefficient on MALE is negative and significant at the ten percent level). The impact of age is not particularly strong and certainly not monotonic: elderly respondents (AGE70S) are less likely to visit the beach than younger respondents (significant at the one percent level), but the coefficients associated with the other binary age variables do not exhibit any obvious pattern and are not significantly different from zero.

Alternative Marine Debris Measures

The marine debris measure used in the above models (DEBRIS) is simply the average marine debris count (items per square meter) across the eight transects completed at each beach. This measure was included in the above models primarily because it is broadly consistent with NOAA's current protocols for marine debris measurements, which greatly facilitates benefit transfer and policy analysis. However, the mechanism by which marine debris influences beach choices is not well known, and it is certainly possible that alternative measures of marine debris are more closely linked to site choices.

This issue was explored by estimating multiple versions of Model 2, each with a different measure of marine debris, but with identical sets of covariates. The estimation results for six different marine debris variables are presented in Exhibit 27, and the correlation matrix for the six measures is presented in Exhibit 28. Measure 1 is the baseline marine debris measure, equivalent to the measure reported in Exhibit 26. The next two measures isolate marine debris density on either the foreshore (Measure 2) or the backshore (Measure 3). The foreshore is the section of the beach below the berm that slopes down to

the water. This is the area where the waves wash up on the sand. The backshore is the flat area beyond the berm where visitors lay out towels and chairs. It is not clear *a priori* which of the two areas would be more important to beach visitors with regard to marine debris. The results indicate that the marine debris variable is negative and highly significant with both Measure 2 (foreshore) and Measure 3 (backshore), but the coefficients are both smaller in absolute value than the coefficient associated with Measure 1.[16]

EXHIBIT 26. ESTIMATION RESULTS

VARIABLE	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	COEF.	T-STAT	COEF.	T-STAT	COEF.	T-STAT	COEF.	T-STAT
SITE CHOICE VARIABLES								
TCOST	-0.122***	-20.16	-0.140***	-13.94	-0.131***	-12.79	-0.031***	-2.70
DEBRIS	-5.86***	-8.24	-9.224***	-10.01	-9.884***	-7.43	-2.021***	-2.68
LENGTH			0.0822**	2.09	0.046	1.31	0.017*	1.84
WIDTH			-0.002	-1.61	-0.008***	-4.45	0.000	-1.54
CONCESSIONS			0.990***	5.16	0.886***	4.08	0.217***	2.75
PIER			0.505***	4.76	0.311***	2.63	0.106**	2.11
FIREPITS			0.629***	4.90	0.452***	3.72	0.139***	2.56
COBBLES			-0.495***	-2.84	-0.120	-0.61	-0.101**	-1.96
URBAN			0.095	0.80	0.206	1.63	0.018	0.64
WATERQ			0.057**	2.06	0.016	0.56	0.012*	1.74
CROWDING					0.021***	4.08		
INDUSTRY					0.557***	2.94		
PARTICIPATION VARIABLES								
COLLEGE							-0.202	-1.40
ASIAN							1.022***	3.69
HISPANIC							0.737***	3.16
ANYKIDS							-0.195	-0.93
MALE							-0.278*	-1.74
AGE20S							-0.034	-0.13
AGE30S							0.427	1.41
AGE40S							0.177	0.98
AGE60S							0.140	0.54
AGE70S							0.725***	3.18
CONSTANT							3.823***	5.59
Dissimilarity Coefficient							0.213***	2.92

16 When Measures 2 and 3 were included together in a single model, both coefficients were negative and statistically significant, but the coefficient associated with Measure 2 (foreshore) was larger (in absolute value terms) than the coefficient associated with Measure 3 (backshore). The sum of the two coefficients was approximately equal to negative nine, the coefficient associated with Measure 1, which supports the idea that the impact of marine debris can be captured by using a measure that combines the foreshore and backshore counts.

Measure 4 is the marine debris count associated with the wrack line, the line of kelp and debris left behind by the most recent high tide. The coefficient on Measure 4 was negative and highly significant. When Measures 1 and 4 were included together in a single model, both coefficients were negative, but only the coefficient on Measure 4 was significant. As Measures 1 and 4 are highly correlated ($\rho = 0.85$), this does not necessarily indicate that wrack line debris is more important to beach visitors. Instead, debris in the wrack line may simply serve as a proxy for marine debris on the remainder of the beach. The wrack line measure was not used in additional models because it is difficult to measure wrack line debris objectively in the field (the wrack line curves, varies in length, and is not always continuous). As a result, the wrack line measure would likely be less useful for policy purposes.

Two subjective measures of debris were constructed and incorporated in the models as Measure 5 and Measure 6. Measure 5 was the average marine debris rating (on a scale from 1 to 5) assigned to each beach by the subset of respondents who visited that beach. Measure 6 was the percentage of respondents who indicated that they thought marine debris was a problem at a particular beach. This percentage was calculated for the subset of respondents who were aware of the beach in question. The coefficient associated with Measure 5 was negative and significant (at the five percent level), but the coefficient associated with Measure 6 was positive and not significant. Measurement error is likely to plague measures 5 and 6, which may be why the results are not as strong for these measures, and why the measures are only weakly correlated with Measure 1 ($\rho = 0.34$ for Measure 5 and $\rho = 0.19$ for Measure 6). With both measures, respondents may interpret the survey questions in different ways: respondents may have different internal scales for the 1 to 5 ratings (Measure 5) and they may have different thresholds for deciding that beaches have a "problem" with marine debris (Measure 6).

EXHIBIT 27. ESTIMATION RESULTS FOR MODEL 2 WITH ALTERNATIVE MARINE DEBRIS MEASURES

MEASURE	DEFINITION	COEFFICIENT	T-STATISTIC
1	Average marine debris density across eight transects in July and August (equivalent to Model 2 in Exhibit 26)	-9.224***	-10.01
2	Average marine debris density across eight transects in July and August (foreshore only)	-8.829***	-6.47
3	Average marine debris density across eight transects in July and August (backshore only)	-3.656***	-7.68
4	Average wrack line marine debris count in July and August	0.006***	-10.40
5	Average marine debris rating for respondents who visit the beach (Question 10)	-0.398**	-2.55
6	Percentage of respondents who indicate that marine debris is a problem at the beach (Question 16)	0.007	1.12

EXHIBIT 28. CORRELATION MATRIX FOR ALTERNATIVE MARINE DEBRIS MEASURES

	Measure 1	Measure 2	Measure 3	Measure 4	Measure 5	Measure 6
Measure 1	1.00					
Measure 2	0.70	1.00				
Measure 3	0.66	0.16	1.00			
Measure 4	0.85	0.72	0.50	1.00		
Measure 5	0.34	0.33	0.15	0.49	1.00	
Measure 6	0.19	0.10	0.17	0.26	0.67	1.00

POLICY SCENARIOS AND WELFARE ANALYSIS

The estimated model was used to assess the welfare impacts associated with several different policy scenarios related to changes in marine debris concentrations on beaches in the Orange County area (Exhibit 29). Marine debris can lead to welfare losses for beach visitors by diminishing the quality of their visits to the beach, by causing them to travel to alternative beaches, or by causing them to pursue alternative activities. Estimation results for Model 4 were used in the assessment of these welfare impacts. Model 4 was preferred over Models 1, 2, and 3 in assessing welfare effects because in contrast to these models, Model 4 allows individuals to increase or decrease the number of beach trips that they take in response to changes in marine debris. The specific policy scenarios evaluated were selected by NOAA's Marine Debris Division.

In estimating welfare impacts, we assume that each hypothetical change remains in place throughout a *single* summer season (June/July/August), and the estimated gains/losses are therefore specific to that time period. In other words, if a hypothetical change continued beyond a single summer season, the magnitude of the gains/losses would be larger than those reported below.

The first five policy scenarios involve uniform percentage reductions in marine debris at all 31 beach sites in the choice set. Benefits are estimated for marine debris reductions of 100 percent, 75 percent, 50 percent and 25 percent. The benefits associated with a 100 percent reduction in marine debris at all sites were estimated as $64.93 per capita. When applied to all 2.28 million adults in Orange County, this is equivalent to an aggregate benefit of $148 million. As the percentage reduction in marine debris declines, the estimated benefits decline proportionally: estimated benefits are $46.39 per capita for a 75 percent reduction, $29.50 per capita for a 50 percent reduction, and $14.09 per capita for a 25 percent reduction. The losses associated with a 50 percent *increase* in marine debris at all sites was estimated as $24.74 per capita.

The next two scenarios involve changes in marine debris density that occurs at a subset of the sites. Specifically, the sixth scenario involves a 75 percent reduction in marine debris at a set of six nearly contiguous beaches in northern Orange County: Long Beach, Seal Beach, Bolsa Chica, Sunset Beach, Huntington City, and Huntington State. The estimated benefit associated with this scenario is $22.36 per capita, or $53.4 million in aggregate benefits for Orange County adults.

The seventh scenario involves a 100 percent reduction in marine debris at the five sites that currently have the highest marine debris densities: Dockweiler (0.21 items/m^2), Long Beach (0.18 items/m^2), Redondo Beach (0.16 items/m^2), Corona Del Mar (0.14 items/m^2), and Balboa (0.13 items/m^2). The estimated benefit associated with this scenario is $27.60 per capita, or $63.1 million in aggregate benefits for Orange County adults.

The final scenario assesses the benefits associated with the removal of all parking fees at the 31 beach sites. This scenario assumes that the removal of these fees would not cause congestion problems due to increased use of beach parking lots. It also assumes that under current conditions, the fees themselves generate no benefits to Orange County residents. That is, it assumes that removing these fees would not lead to any reductions in services or deferred maintenance of beach facilities. Although these assumptions are somewhat unrealistic, this scenario is nonetheless useful for comparison purposes. The estimated benefit associated with this scenario is $161.57 per capita, or $369 million in aggregate benefits for Orange County adults. With an estimated 26.4 million beach trips taken by Orange County residents under current conditions, this is equivalent to approximately $14 in benefits for every beach trip, which is similar to the typical cost of parking for the day at an Orange County beach.

PER TRIP VALUES

In addition to standard aggregate estimates of welfare losses/gains, *per trip* values are often useful within the context of benefit transfer efforts. As these transfers are implemented in a variety of contexts, two different types of per trip values are provided here. First, for each policy scenario, we divide the estimated aggregate gain/loss by the total predicted trips to the impacted sites under baseline conditions (i.e., prior to implementing the policy). The resulting values range from -$2.14 per trip for a 50% increase in marine debris at all sites to $18.84 per trip for eliminating all marine debris at the five worst sites (Exhibit 29).

Second, the ratio of any coefficient from the site choice model to the travel cost coefficient can be interpreted as the per-trip benefit associated with a one-unit change in the selected coefficient – assuming that both the total number of trips and the allocation of those trips across sites are held constant. For example, by dividing the coefficient on DEBRIS in model 4 (2.021) by the coefficient on TCOST (0.031), we obtain $65.19. This can be interpreted as the per-trip benefit to visitors at a given beach of a one-unit decline in DEBRIS at that beach. However, with the current set of sites, a one-unit decline in DEBRIS is not feasible, as the beach with the largest amount of debris (Dockweiler) only has 0.21 items/m^2. Alternatively, consider a 25% reduction in marine debris at a site with average debris density (0.08 items/m^2), or a reduction of 0.02 items/m^2. The per trip benefit associated with this 25% reduction is equal to 0.02 x $65.19, or $1.30 per trip. This approach can provide a per trip value that aligns more closely with the specific change that will occur at the policy site, but it relies on the assumption that beach visitors will not substitute to the improved site.

EXHIBIT 29. POLICY SCENARIOS

POLICY SCENARIO	ESTIMATED PER CAPITA BENEFITS	ESTIMATED AGGREGATE BENEFITS	PREDICTED TRIPS TO IMPACTED SITES BEFORE POLICY IMPLEMENTED	CHANGE IN PREDICTED TRIPS TO IMPACTED SITES DUE TO POLICY	BENEFIT PER BASELINE TRIP TO IMPACTED SITES
Reduce marine debris by 100% at all 31 beaches	$64.93	$148M	26.4M	+16.0%	$5.61
Reduce marine debris by 75% at all 31 beaches	$46.39	$106M	26.4M	+11.4%	$4.02
Reduce marine debris by 50% at all 31 beaches	$29.50	$67.4M	26.4M	+7.3%	$2.55
Reduce marine debris by 25% at all 31 beaches	$14.09	$32.2	26.4M	+3.5%	$1.22
Increase marine debris by 50% at all 31 beaches	($24.74)	($56.5M)	26.4M	-6.1%	($2.14)
Reduce marine debris by 75% at all beaches from Long Beach to Huntington State	$23.36	$53.4M	10.0M	+43.3%	$5.34
Eliminate all marine debris from the five beaches with the highest marine debris levels	$27.60	$63.1M	3.35M	+211%	$18.84
Remove parking fees from all 31 beaches	$161.57	$369M	26.4M	+51.3%	$13.98

DISCUSSION

Marine debris was found to have a significant impact on Orange County residents' beach choices and this impact was statistically significant across a variety of model specifications. This result is significant, as this is the first study in the United States that combines a revealed preference valuation approach with objective measurements of marine debris at beaches.

The magnitude of the benefits associated with reductions in marine debris appears to be quite large: a 75% reduction in marine debris at six popular beaches led to $53.4 million in benefits to Orange County residents for a three-month period. Furthermore, these estimates exclude any non-use benefits, benefits to residents living in other counties, and benefits associated with multiple-day trips.

Despite the strength of the statistical results, there are a variety of reasons to be cautious in interpreting this result and applying it to other locations. Potential caveats associated with the results include:

- As is typical with revealed preference valuation studies, this was not a controlled experiment: marine debris levels were not applied randomly across sites. As a

result, it is impossible to completely rule out the possibility of omitted variables bias. Suppose, for example, that municipalities in the area dedicate more resources to controlling and removing marine debris at sites that are already popular with visitors for other reasons. If these other factors are not included in our model, then the parameter estimate associated with marine debris may be biased.

- The survey was implemented in November/December, but it collected data on beach trips taken several months earlier – in June, July, and August. This gap may lead to recall errors, and the extent to which recall errors affects trip reporting in the current dataset is unknown.
- Marine debris levels may vary throughout the day due to natural processes (winds, waves, currents), visitors leaving garbage on the sand, and beach raking activities. Ideally, debris measurements would be made during the peak time period for beach visitation so the measurements reflect debris concentrations that the majority of visitors observe during a trip. However, during the peak period, it is also extremely difficult to lay out transects for beach counts in randomly selected locations without disturbing visitors. As a result, measurements were generally made in the morning before beaches became too crowded.
- For approximately 18 percent of the beach trips, the precise destination is uncertain due to respondents' vague site descriptions. Specifically, some respondents listed "Huntington" as the destination and did not distinguish between Huntington State and Huntington City. Similarly, some respondents listed "Laguna" as the destination rather than "Laguna Coves" or "Laguna Main." These trips with ambiguous destinations where allocated randomly to the more specific sites, with probabilities proportional to the percentage of trips to each site.
- An examination of trip patterns appears to indicate that respondents occasionally went for long walks, runs, or bike rides and visited several beaches during a single day trip. In retrospect, the survey instrument did not provide clear instructions for these situations, and it appears that a subset of respondents may have recorded each of these more than once. If this occurred, then travel costs would be overstated because round-trip travel costs would effectively be assigned to every destination visited during a single day trip. No adequate solution to this issue could be identified, as the data do not allow us to unambiguously identify such trips. As a partial solution for avid visitors, visits were scaled down (proportionally) to an average of two trips per day for respondents who reported more than two trips per day in any given month.

TRANSFERABILITY OF RESULTS

The current study was designed as a pilot, with the primary goals being to (1) assess benefits to Orange County residents of reductions in marine debris and (2) assess the usefulness of a specific technique for estimating benefits associated with marine debris removal. As the survey was mailed to a simple random sample of all Orange County residential addresses, the benefit estimates can be extrapolated to the adult population of

Orange County with confidence, allowing for caveats related to potential non-response bias.

Transferring these estimated benefits outside of the summer period and outside of Orange County requires careful assessment of potential differences between the study site and alternative site should be completed. Potential issues that should be evaluated include:

- *Baseline Marine Debris Levels*. For example, if Orange County beaches are generally cleaner than the alternative site, then a 50 percent reduction in debris may provide greater value at the alternative site: the reduction may bring the debris levels below a threshold level of acceptability for beach visitors.
- *Types of Marine Debris*. For example, if large debris items on Orange County beaches are primarily plastic, but an alternative site is plagued by metal cans and glass, the benefits associated with reductions in the total debris counts may not be similar.
- *Residents' Sensitivity to Marine Debris*. In some cultures and in some areas of the country, it may be considered more acceptable to have marine debris on the beach. If that is the case, then the benefits associated with removing debris in these locations may be lower than in Orange County.
- *Available Substitutes*. The benefits associated with reductions in marine debris will be greater in locations where there are fewer high quality substitutes for recreating at beaches plagued by high concentrations of marine debris. For example, if nearby alternative beaches are scarce or if there are no alternative swimming options (e.g., community swimming pools), then the benefits of reductions in marine debris will be greater.
- *Climate*. As beach visitation is higher during warmer months, reductions in marine debris will provide lower per capita benefits in climates where beach visitation is rare in the winter (i.e., in New England).

Given the similarity of the available substitutes, the benefits to Orange County residents could potentially be applied to estimate benefits to residents of Los Angeles County. The most appropriate approach to implementing this transfer would be through a benefit function approach (possibly at the zip code level), which would allow one to account for the spatial distribution of the population as well as demographic differences between the two counties. In addition, it may be reasonable to transfer benefits (on a per trip basis) to non-summer months within Orange and Los Angeles Counties. Transfers beyond the Orange County/Los Angeles area would require careful consideration of the above issues.

RECOMMENDATIONS FOR FUTURE RESEARCH

The current study was designed as a pilot effort to explore the feasibility of applying a revealed preference valuation approach to estimate the benefits associated with reductions in marine debris. However, the study was useful not only in achieving the relatively narrowly-defined goal of estimating benefits to Orange County residents, but also in

providing insights for future research efforts related to marine debris valuation. This section describes recommendations related to future research.

1. Selection of Alternative Site for Application of Current Methodology: The current effort provided estimates of the benefits of reductions in marine debris to Orange County residents. However, similar reductions in other locations may not provide similar benefits for a variety of reasons, including those mentioned above. As a result it would likely be informative to apply a similar approach to alternative locations to assess the robustness of the results. The following issues should be considered in selecting an alternative study location:

   - The available beaches must vary with respect to the amount of marine debris that is observable to visitors. The model makes inferences about willingness-to-pay for reductions in marine debris by observing choices among beaches that differ in the amount of debris and in the cost of traveling to the beach. Without variation in marine debris across beaches, visitors' beach choices would not provide any information about the benefits of debris removal.[17]
   - There must be a sufficient number of beaches in the local area. If there are a limited number of beaches available to local residents, then it may be difficult to isolate the impact of marine debris (separate from the impact of other beach characteristics). For example, if only one beach in the area has significant marine debris problems, then it would be difficult to determine whether visitors are avoiding that beach because of marine debris or because of other characteristics uniquely associated with that location (e.g., it may be the only beach in the local area without restrooms or without adequate parking). Ideally, there would be at least ten beaches from which local residents could choose for a day trip.
   - The beaches must be well defined and easily identified by visitors. The valuation approach relies on visitors' ability to describe which beach was visited, so that trip data can be linked with data on marine debris for specific locations. As a result, the local beaches must have well-known names or other distinguishing characteristics that would allow survey respondents to provide information about specific destinations that were visited. Locations with long, uninterrupted expanses of shoreline with nearly continuous access opportunities (e.g., the Outer Banks of North Carolina) would likely be difficult to study, as survey respondents may not be able to identify specific beaches that were visited.
   - The beaches must be visited frequently by residents of the local area. The methodology requires data on beach trips, so it is important that the beaches be

17 Note that this is not equivalent to saying that there would be no benefits associated with marine debris removal at these locations: there may be benefits, but they cannot be measured using revealed preference valuation techniques.

relatively popular with local residents, thus increasing the likelihood of encountering beach visitors through a general population survey. In Alaska, for example, there may be well defined beaches with varying levels of marine debris, but the climate is unlikely to be conducive to a large number of beach visits by local residents.

2. Modifications to Current Valuation Methodology: If the current valuation approach is replicated at an alternative location, we would recommend a number of changes based on the experience gained through the current study:

   - The recall period for beach trips should be reduced to one or two months in order to minimize recall error and the potential for telescoping bias. While we have no evidence that recall issues plagued the current study, we also cannot rule out recall problems, and they seem likely to have arisen for the high-frequency beach visitors in the dataset (e.g., respondents who took more than 100 trips).
   - While the planned recall period was three months in the current study, it expanded due to requirements the Paperwork Reduction Act (PRA) approval process. In future efforts, we recommend that the PRA process be completed prior to the collection of any marine debris data.
   - With a recall period of one or two months, multiple survey waves would likely be necessary to cover the primary beach visitation months. We recommend drawing independent samples of the population for each wave, as repeat-contact surveys are plagued by attrition, thus complicating modeling efforts.
   - The current study used a mail survey mode (rather than telephone or in-person). We believe the mail survey implementation was generally successful and offers the best combination of a reasonable response rate and low cost. However, one disadvantage of a mail survey is the inability to ask follow-up questions that clarify unusual responses. In particular, we suspect that a subset of the beach "trips" that were recorded in the current effort may not have been separate trips from the respondent's home (with additional round-trip travel costs incurred) but instead were simply extensions of another trip that had already been recorded. For example, rather than taking a trip to Balboa Beach and a trip to Newport Beach, the respondent may have simply walked along the beach and therefore visited both sites during a single trip from home. A follow-up study should clarify the questionnaire language in order to clearly identify such trips.
   - The non-respondent follow-up survey identified preliminary evidence of avidity bias, with frequent beach visitors potentially being over-represented among the respondents to the main survey. However, despite sending surveys via FedEx and despite having an extremely short (five-question) questionnaire, the response rate for the non-respondent follow-up survey was low, leading to a final sample size that was not adequate for use in reweighting data from the

main survey. Furthermore, although survey weights were developed that adjusted for differences in responses rates across geographic areas and calibrated the survey data to match census demographics for Orange County, we cannot be certain that these weights adequately addressed avidity bias. In future work, we recommend addressing this issue by either: (1) considerably increasing the resources devoted to the non-response follow-up study (e.g., multiple contacts, contacts via multiple modes, etc.) or (2) presenting upper and lower bound benefit estimates, where the upper bound assumes that non-respondents are identical to respondents and the lower bound assumes that non-respondents have zero benefits.

- One option for increasing the response rate would be to include a postcard with each mailing that allows non-beach visitors to opt out of the study by checking a box that says something like "Please do not send me additional survey materials because I never visit local beaches." These individuals would then be classified as ineligible when calculating the overall response rate, and the population size for aggregating benefits would be reduced by the percentage of sampled individuals who were deemed ineligible.
- One alternative to the current method that would allow for additional flexibility in exploring perceptions of debris would be to implement an on-site choice experiment study, with debris levels illustrated for the respondent using "test plots" in the sand near the back of the beach. Visitors would be intercepted as they are leaving the beach, and they would be asked to complete a short questionnaire that would include a series of hypothetical beach choices. The characteristics of the hypothetical beaches would vary by design, and one of those characteristics would be level of marine debris. The respondent would be asked to refer to side-by side test plots in the sand that depict varying levels of debris associated with the hypothetical beaches in the choice questions. The debris could be collected at the site so that it mimics the type of debris that one would expect visitors to observe. The primary advantage of this approach is that it allows the researcher to experimentally change the quantity and type of debris, which is generally not possible with revealed preference studies. This would allow for a more nuanced assessment of the impact of marine debris on behavior. The response rate is also likely to be fairly high with an on-site intercept survey. The primary disadvantage of this approach is that it does not rely on actual behavior. In addition, aggregating any benefits to the population of users would be more complicated due to on-site sampling.

REFERENCES

Haab, T.C. and K.E. McConnell. (2002). *Valuing Environmental and Natural Resources: The Econometrics of Non-Market Valuation*. Cheltenham, UK: Edward Elgar.

Hanemann, W.M. (1982). "Applied Welfare Analysis with Qualitative Response Models". Working Paper No. 241, Giannini Foundation of Agricultural Economics, University of California: Berkeley.

Heal the Bay. (2013). "Heal the Bay's 2012-2013 Annual Beach Report Card. Santa Monica, California. http://www.healthebay.org/sites/default/files/pdf/BRC_2014_WEB.pdf

International Hydrographic Organization (IHO). (1999). *S-32 – Hydrographic Dictionary, Fifth Edition*. Special Publication No. 32: Part 1, Vol. 1. 1994. Jones, C.A. and F. Lupi. "The Effect of Modeling Substitute Activities on Recreational Benefit Estimates." *Marine Resource Economics* 14(4): 357-374.

Kalton, G. (1983). "Compensating for Missing Survey Data". Survey Research Center, Institute for Social Research, University of Michigan.

Kling, C. L., Thomson, C.J. (1996). "The Implications of Model Specification for Welfare Estimation in Nested Logit Models". *American Journal of Agricultural Economics* 78: 103-114.

Moore, S.L., D. Gregorio, M. Carreon, S.B. Weisberg, and M.K. Leecaster. "Composition and Distribution of Beach Debris in Orange County, California" *Marine Pollution Bulletin,* 42(3): 241-245. 2001.

Opfer, S., C. Arthur, and S. Lippiatt. *NOAA Marine Debris Shoreline Survey Field Guide.* January 2012.

U.S. DOC. (2013). National Oceanic and Atmospheric Administration, Tides and Currents. NOAA Tide Predictions- California. (http://tidesandcurrents.noaa.gov/tide_predictions.html?gid=235).

U.S. Census Bureau. (2013). *2013 TIGER/Line Shapefiles*. (http://www.census.gov/cgi-bin/geo/shapefiles2013/main).

U.S. Census Bureau. (2013). *State and County QuickFacts*. Updated May 23, 2013 (http://quickfacts.census.gov/qfd/index.html).

The MDP operates within the Office of Response and Restoration as part of NOAA's National Ocean Service.

II. Method of Collection

Respondents to this collection may choose to submit electronically or in paper format.

III. Data

OMB Control Number: 0648–0718.
Form Number(s): None.
Type of Review: Regular submission (extension of an existing information collection).
Affected Public: Business or other for-profit organizations, not-for-profit institutions, state, local or tribal government.
Estimated Number of Respondents: 70.
Estimated Time per Response: 10 hours (semi-annually).
Estimated Total Annual Burden Hours: 1,400.
Estimated Total Annual Cost to Public: $0 in recordkeeping/reporting costs.

IV. Request for Comments

Comments are invited on: (a) Whether the proposed collection of information is necessary for the proper performance of the functions of the agency, including whether the information shall have practical utility; (b) the accuracy of the agency's estimate of the burden (including hours and cost) of the proposed collection of information; (c) ways to enhance the quality, utility, and clarity of the information to be collected; and (d) ways to minimize the burden of the collection of information on respondents, including through the use of automated collection techniques or other forms of information technology.

Comments submitted in response to this notice will be summarized and/or included in the request for OMB approval of this information collection; they also will become a matter of public record.

Dated: May 16, 2018.

Sarah Brabson,

NOAA PRA Clearance Officer.

[FR Doc. 2018–10748 Filed 5–18–18; 8:45 am]

BILLING CODE 3510–JE–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

Submission for OMB Review; Comment Request

The Department of Commerce will submit to the Office of Management and Budget (OMB) for clearance the following proposal for collection of information under the provisions of the Paperwork Reduction Act (44 U.S.C. Chapter 35).

Agency: National Oceanic and Atmospheric Administration (NOAA).
Title: Preliminary Case Study Assessing Economic Benefits of Marine Debris Reduction.
OMB Control Number: 0648–0756.
Form Number(s): None.
Type of Request: Regular (revision of a currently approved information collection).
Number of Respondents: 1,600.
Average Hours per Response: On-site intercept, 2 minutes; full survey, 10 minutes.
Burden Hours: 729.
Needs and Uses: This request is for revision of a currently approved information collection. A pretest was conducted at one site, and the survey is now being extended to 4 sites.

The National Ocean Service, Office of Response and Restoration, Marine Debris Program is sponsoring this data collection. The Marine Debris Program was created under the 2006 ''Marine Debris Research, Prevention, and Reduction Act'' (33 U.S.C. 1951 *et seq.*) which was reauthorized in 2012 as the ''Marine Debris Act Amendments of 2012'' (H.R. 1171) as part of the Coast Guard Maritime Transportation Act (H.R. 2838). Among other activities, the bill requires NOAA ''. . . to address the adverse impacts of marine debris on the United States economy . . .'' To that aim, the proposed data collection will support the goals of a larger study whose purpose is to develop a regional economic model to estimate the value to local economies of increased spending on recreation and tourism from the reduction or elimination of marine debris on beaches in seven coastal communities of the continental U.S. The data collection will consist of on-site sampling to generate a pool of respondents who will be sent a mail survey that asks questions related to beach attributes, local beach familiarity, number of beach trips taken, and ratings of marine debris encountered while on these trips. Onsite sampling will involve intercepting people at several beaches in each study area and asking them to participate in a mail survey. For those willing to take the mail survey, a brief onsite interview will ask the respondent's name and mailing address, as well as several demographic questions such as age and education. Those who do not agree to participate in the mail survey will only be asked the demographic questions, whether they participated in a single or multi-day trip, and zip code. A mail-survey mode will be used for the follow-up questionnaire. The mail survey instrument will combine a selection of questions from a previously OMB-approved survey instrument used in Orange County, California with new contingent behavior questions developed specifically for this study to determine the impact of the presence of marine debris on respondents' recreation choices. This data collection will determine the impact of marine debris on survey respondents' recreation choices at these seven coastal communities and represents the first component to be undertaken as part of the larger study.

Affected Public: Individuals or households.
Frequency: One time.
Respondent's Obligation: Voluntary.

This information collection request may be viewed at *reginfo.gov*. Follow the instructions to view Department of Commerce collections currently under review by OMB.

Written comments and recommendations for the proposed information collection should be sent within 30 days of publication of this notice to *OIRA_Submission@omb.eop.gov* or fax to (202) 395–5806.

Dated: May 16, 2018.

Sarah Brabson,

NOAA PRA Clearance Officer.

[FR Doc. 2018–10746 Filed 5–18–18; 8:45 am]

BILLING CODE 3510–JE–P

DEPARTMENT OF COMMERCE

Patent and Trademark Office

Generic Clearance for the Collection of Qualitative Feedback on Agency Service Delivery

ACTION: Proposed collection; comment request.

SUMMARY: The United States Patent and Trademark Office (USPTO), as required by the Paperwork Reduction Act of 1995, invites comments on a proposed extension of an existing information collection; 0651–0080: Qualitative Feedback on Agency Service Delivery.

DATES: Written comments must be submitted on or before July 20, 2018.

ADDRESSES: You may submit comments by any of the following methods:

- *Email: InformationCollection@uspto.gov.* Include ''0651–0080: Generic Clearance comment'' in the subject line of the message.
- *Federal Rulemaking Portal: http://www.regulations.gov.*