Office of National Marine Sanctuaries
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Non-Market Economic Value of Recreation Use on the Outer Coast of Washington and Olympic Coast National Marine Sanctuary, An Attributes Approach: Volume 6, 2014

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Table of Contents

List of Figures and Tables

Abstract

This is the main report detailing the findings on the non-market economic value of outdoor recreation use on the Outer Coast of Washington and the Olympic Coast National Marine Sanctuary. The recreation activity was by those from Washington households that participated in outdoor recreation on the Outer Coast of Washington in 2014. The attributes approach to valuation was used to value changes in natural resource conditions from the "Status Quo" or low condition (i.e., the condition the resources will be in if existing policies and management continue over the next 10 to 20 years) and improved conditions to a medium and high condition. Many different techniques can be used and we chose the discrete choice experiment approach. Values were also estimated as a function of user characteristics (e.g., per capita income, experience with the Outer Coast for recreation and user's ecological worldview). This report is part of a six volume series of reports, which include demographic profiles, activity profiles, expenditure profiles and the economic impact of the spending on local area economies, and importance-satisfaction ratings of 25 natural resource attributes, facilities and services. Details of the survey methodology and estimation methods used in volume 1 to 3 are in volume 4. Volume 5 is the Technical Appendix to this report and provides detail about the methods and econometrics used to estimate the non-market values. Details of the estimation methods for a technical audience that may want to replicate results found in the main report (that only includes results) and for peer reviewers.

Key Words

Non-market economic value, stated preferences, conjoint, discrete choice experiment, choice modeling, attributes, coastal, ocean, recreation, policy, management, scenarios

Key Findings

General

- WA households that recreate on WA's Outer Coast are willing to pay annually the most for improving the natural resource conditions for water quality, maintaining unobstructed Viewscapes from onshore and offshore developments, marine mammals, shoreline quality-number of beaches open (not closed due to harmful algal blooms), shoreline quality-marine debris, and the opportunity to see large predators.
- Crowded conditions are currently not a major problem on WA's Outer Coast. Wilderness lovers (people who prefer uncrowded conditions) are willing to pay more than crowd lovers (people who prefer crowded conditions).
- WA households that recreate on WA's Outer Coast and who have pro environmental worldviews are willing to pay significantly more for improving natural resource conditions.
- As per capita household income increases, WA households that recreate on WA's Outer Coast are willing to pay more for improving natural resource conditions.
- WA households that are first time recreating visitors are willing to pay significantly less than more experienced visitors for improving natural resource conditions.

Four Policy/Management Scenarios

Scenario 1. This scenario evaluates a change in the amount of marine debris found on the shoreline moving from the Status Quo or Low Condition of 3.25 lbs. per 100 feet of shoreline to the Medium condition of 1.6 lbs. per 100 feet of shoreline for a net change of a reduction of 1.65 lbs. per 100 feet of shoreline.

The annual benefit is $63.3 million for the Outer Coast of WA and $9.1 million for OCNMS. This translates into a Net Present Value (NPV) of between $1.0 billion to $3.2 billion for the Outer Coast of Washington and between $157 million to $453 million for OCNMS depending on the discount rate and the period for evaluation.

Scenario 2. This scenario evaluates a change in the amount of marine debris found on the shoreline moving from the Status Quo or Low Condition of 3.25 lbs. per 100 feet of shoreline to the High condition of 0.5 lbs. per 100 feet of shoreline for a net change of a reduction of 2.75 lbs. per 100 feet of shoreline.

The annual benefit is $105.5 million for the Outer Coast of WA and $15.1 million for OCNMS. This translates into a NPV of between $1.7 billion to $5.3 billion for the Outer

Coast of Washington and between $240 million and $755 million for OCNMS depending on the discount rate and the period for evaluation.

Scenario 3. This scenario evaluates a change in offshore development to the Medium condition. To understand this scenario one has to understand the definition of the Status Quo or Low Condition. The Status Quo or Low Condition is not the current condition. Instead, it is the condition expected in 10 to 20 years under no constraints to offshore or onshore developments that affect the viewscape. The High Condition of no development is actually the current condition. So a movement from the Status Quo or Low Condition is calculated as the movement from the Low Condition to the High Condition minus the movement from the Status Quo or Low Condition to the Medium Condition where a few facilities are approved for development.

The annual benefit is $53.8 million for the Outer Coast of WA and $7.69 million for OCNMS. This translates into a NPV of between $853 million to $2.7 billion for the Outer Coast of Washington and between $122 million and $384 million for OCNMS depending on the discount rate and the period for evaluation.

Scenario 4. This scenario evaluates a change in offshore development to the High condition. To understand this scenario one has to understand the definition of the Status Quo or Low Condition. The Status Quo or Low Condition is not the current condition. Instead, it is the condition expected in 10 to 20 years under no constraints to offshore or onshore developments that affect the viewscape. The High Condition of no development is actually the current condition. So maintaining the current condition of no development of offshore or onshore facilities that would affect the viewscape is estimated as the value of the change from the Status Quo Low Condition to the High Condition.

The annual benefit is $162.2 million for the Outer Coast of WA and $23.2 million for OCNMS. This translates into a NPV of between $2.6 billion to $8.1 billion for the Outer Coast of Washington and between $368 million and $1.2 billion for OCNMS depending on the discount rate and the period for evaluation.

Ranking of Species/Species Groups using the Likeability Scale

- Five marine mammals, eight seabirds, four tidal pool organisms, and two large predators (orcas and sharks) were included. Whales ranked number one using the mean sample scores. Dolphins ranked number two followed by eagles ranked number three, orcas number four and otters number five.
- Seagulls ranked last among the 18 species/species groups. This partially explains why including seagulls in the seabirds for economic valuation of seabird conditions resulted in the high condition valued lower than the medium condition.

- None of the tidal pool organisms ranked in the top seven. Starfish was the highest ranked tidal pool organism at number 8. This partially explains the weak results for the economic valuation of changing conditions for tidal pool organisms.

1. Introduction

Background

In 2013-14, Point97 and the Surfrider Foundation conducted an Internet survey using a Knowledge Networks (KN) Panel, which included a random sample of all State of Washington households. The survey addressed visitation to the Outer Coast of Washington with emphasis on outdoor recreation activities. The survey covered visitation over the past 12 months and included information on detailed recreation activities participated in over the past 12 months and on the last trip. The last trip was important for two reasons: 1) trip expenditures and spatial use by activity type were obtained for the last trip. A special tool developed by Ecotrust/Point97 was used to obtain estimates of spatial use. Demographics were obtained for all panel members. The project was funded by the State of Washington to support their Marine Spatial Planning process.

In 2014, two offices in NOAA's National Ocean Service, the Office of National Marine Sanctuaries (ONMS), Conservation Science Division and the National Centers for Coastal Ocean Sciences (NCCOS), Center for Coastal Monitoring and Assessment, Biogeography Branch partnered to obtain information on the preferences and non-market economic values and how those non-market values change with changes in natural resource attributes and user characteristics. NCCOS provided funding and ONMS issued a request for proposals to provide the information. Through the competitive bidding process, Point97 was awarded the contract. Point97 proposed a survey using their existing Internet Panel with KN. Modules were designed for a second wave of surveying to include

Economic Value & Natural Resources

Many natural resources, such as those found in national marine sanctuaries have economic value. Although, typically measured in dollars (or some currency), it is the benefit provided by goods and services to a person. The person may or may not be a user of the resource. These benefits may occur within economic markets – through the purchasing of goods and services. This is just one component of economic value. The second component is called non-market value.

Ecosystem Services

The ways in which humans benefit from ecosystems have come to be known as ecosystem goods and services. Examples include recreation and food supply. Recreation depends on water quality, quality of the viewscapes, tide pool quality, abundance and diversity of marine mammals and seabirds, etc. These ecosystem services that people benefit from have economic value.

Many goods and services are not traded in markets, meaning a person cannot go to the store and buy a unit of tide pool quality. Further, many people may never use the resource or directly benefit from the resource. This, however, does not mean that people do not have a monetary value for the resource. It simply means that market transactions, such as purchases for a tide pool do not exist and alternative methods must be used to estimate the monetary value.

Non-Market Value

Many of the goods and services provided by natural resources do not require market transactions to derive benefit. Even if a person must spend money to access the resource, such as an entrance fee to a park, the price of admission does not reflect their true value. The difference between the price a person pays and the most they would be willing to pay for the good or service is what economists refer to as consumer surplus. This consumer surplus is a person's non-market value.

the NOAA objectives. NOAA's objectives were to estimate project parameters to support the Socioeconomic Action Plan for the Olympic Coast National Marine Sanctuary, while also meeting the needs of the State of Washington in their Marine Spatial Planning process.

NOAA's objectives included obtaining information on people's preferences for different marine animals (e.g. seabirds and marine mammals), development of an environmental index for predicting people's non-market economic values, estimation of the non-market economic values, and estimation of how those values change with changes in natural resource attributes and user characteristics. This data was collected in addition to the previously described information on visitation.

NOAA's objectives were determined by the ONMS West Coast Region Socioeconomic Research and Monitoring Plan (2013-2014) and the Office of National Marine Sanctuaries (ONMS) new guidelines for its "Condition Reports" (ONMS 2015). All future ONMS Condition Reports will evaluate the status and trends of the ecosystem services provided in each sanctuary. This report provides the research necessary to support the interpretation of various indicators to evaluate the recreation ecosystem service. The figures below present the study area including, the Olympic Coast National Marine Sanctuary and points of interest in the area.

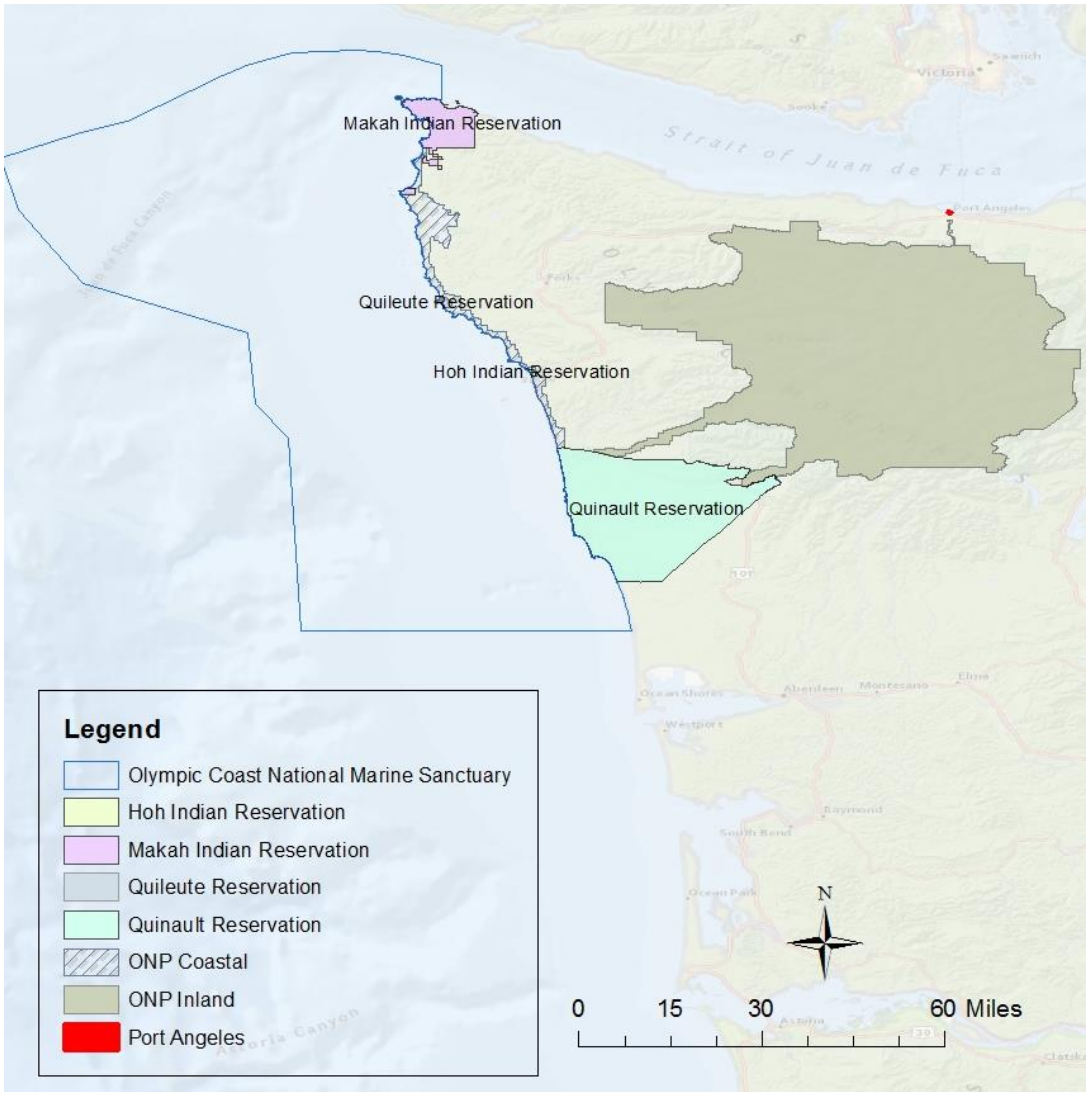

Figure 1.1 Map of the Outer Coast of Washington

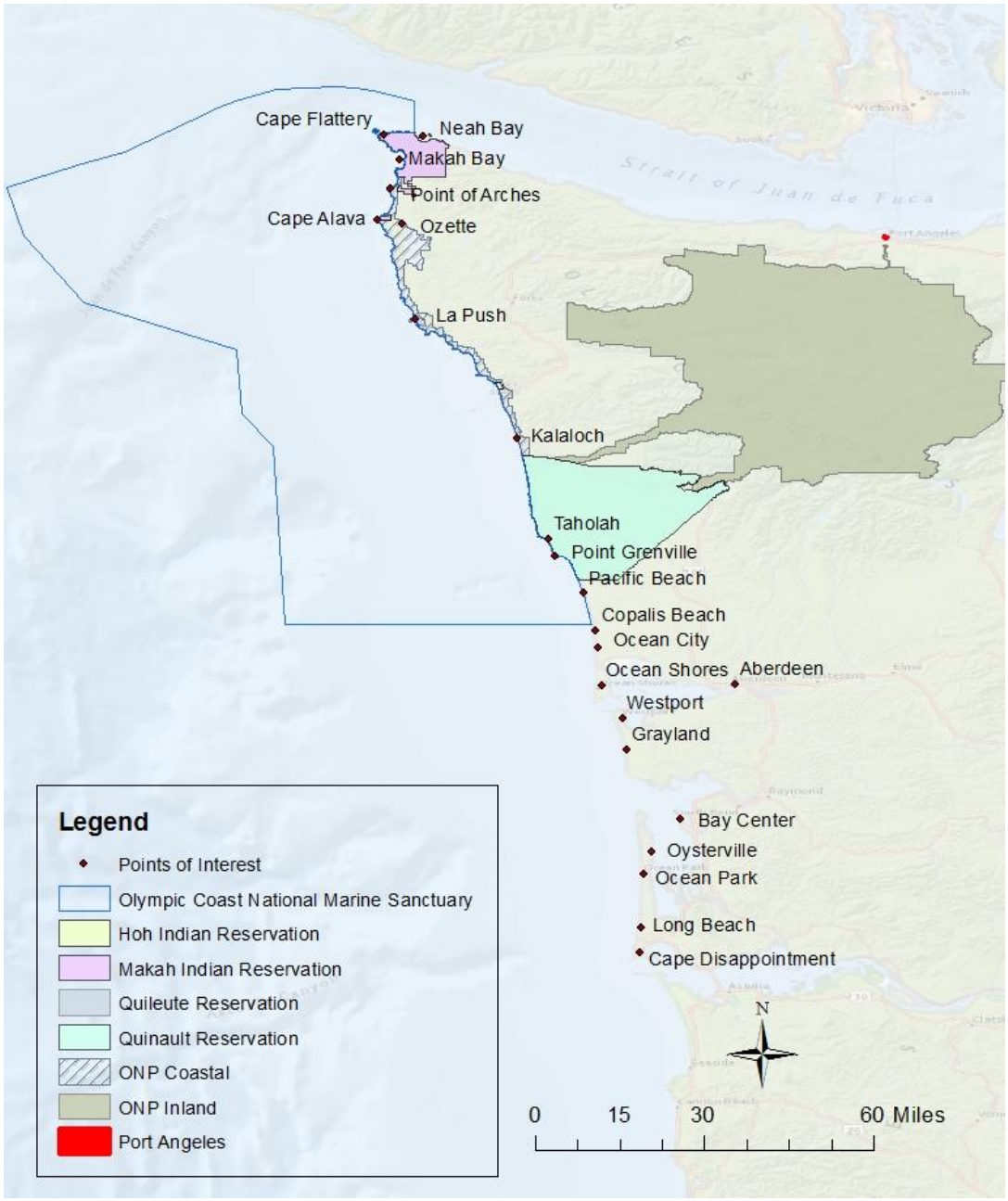

Figure 1.2 Map of Points of Interest for the Outer Coast of Washington

Survey Methodology

The survey methodology is presented in Point97 and Surfrider Foundation (2015) and in Leeworthy et al (2016d) and in Leeworthy et al. (2017). The survey was done using the Knowledge Networks, Inc. (KN) panel of the State of Washington households. To

accommodate the needs of the State of Washington and NOAA, KN supplemented their regular panel with additional recruits to expand sample sizes.

The survey was done in two waves. The first wave was conducted from June 13-30, 2014 and included 3,017 households. The second wave was conducted from November 19, 2014 to February 14, 2015 and included 3,112 households. For both waves, there were a total of 6,219 households in the panels. KN recruited panel members to obtain a random sample representative of all households in the State of Washington. The sampling frame included those 18 years or older living in State of Washington households.

Survey Response Rates. Out of the 6,129 panel members across both waves, 5,538 households responded for a response rate of 90.36%. For wave 1, the response rate was 100% (N=3,017), while for wave 2 the response rate was 81% (N=2,521). The Wave 2 response rate was likely lower due to the holiday season and the fact that in Internet Panels it is common to have some sample attrition. All non-market economic valuation questions were asked in wave 2.

Sample Weighting. KN provided sample weights for the panel to make them representative of all Washington households. KN weighted the sample for four factors: age, gender, race/ethnicity and county of residence. County of residence was included because of the estimation of spatial use. Two sets of weights were provided: weight1 was the sample weight for the regular KN panel members and weight2 was the weight for the full panel. Weight2 is the appropriate weight for the respondents that answered the non-market economic valuation questions.

Sample Sizes for Non-market Economic Value Estimation. As noted above, 2,521 Internet Panel members responded to wave 2 of the survey, which included the non-market economic valuation questions. Of these, 42.24% participated in outdoor recreation on the Outer Coast in the past 12 months for an eligible sample size of 1,065. Twenty of these panel members did not answer any of the willingness-to-pay questions leaving a sample size of 1,045. Actual sample sizes used in model estimation are different due to the fact that each respondent is presented four choices with each choice including three scenarios/alternatives thus each respondent has 12 scenarios/alternatives with which to make their choices yielding a sample size for model estimation of 12,540. Of these 12,540 choices, one respondent only answered one choice with three scenarios/alternatives so the sample size for choices was reduced to 12,531. However, many of these observations are eliminated in final model estimation due to respondents' classification as "protestors", (i.e., those who may have value but rejected the valuation scenario for various reasons). Details can be found in the Technical Appendix to this document (Leeworthy et al., 2017).

2. Designing the Survey Questionnaire and Experimental Design

Characterization of the Decision Problem

The details of survey questionnaire and experimental design are provided in Leeworthy et al. (2017). The survey was designed to address OCNMS Management Plan needs and the needs of a future OCNMS Condition Report that will evaluate ecosystem services in the sanctuary. In evaluating ecosystem services, a suite of ecological, economic and non-economic human dimensions' indicators is required. The attribute approach to valuation using discrete choice modeling allows for estimating people's preferences for different natural resource attributes using dollar metrics. This also allows for the identification of the attributes of the natural environment that people care about and which ecological indicators would apply to the recreation ecosystem service. The importance-satisfaction ratings in Leeworthy et al. (2016c) provide non-economic human dimensions' indicators for this evaluation.

The attribute approach to economic valuation has historically used travel cost random utility models to value natural and cultural resource attributes by looking at how site choices are related to the cost of access and the levels of resource attributes across sites. The problem faced by users of these models is that site characteristics (attributes) are often highly correlated resulting in multi-collinearity and the inability to identify statistically significant estimates of attributes' importance (Hanneman et al., 2004). Economists using random utility theory to address this problem (Louviere, Hensher and Swait, 2009) adapted the stated preference method used by psychologists. This method uses experimental design to allow for orthogonal (uncorrelated) estimates of attribute values and thus identification of statistically significant effects of attributes on economic values. Therefore, we chose this approach in designing our questionnaire and experimental design.

Choice of Attributes and Attribute Levels

There were four steps used in the process of selecting attributes to test which attributes are important:

1. review of the literature;
2. NCCOS Biogeography Team's research and monitoring results for various attributes for the Outer Coast of Washington;
3. focus groups to test what attributes were important to people who recreate on Washington's Outer Coast and what changes in levels of those attributes would change their economic values; and

4. a pre-test of the survey to test the finding of the focus groups and design the dollar bids to be used. These steps are provided in detail in the Technical Appendix to the report (Leeworthy, et al., 2017).

Detailed descriptions provided to respondents in the questionnaires of the natural resource attributes and the "Status Quo" or Low Condition, the Medium Condition, and the High Condition are in Table 2.1. The status quo was defined by working with NCCOS Biogeography team to identify the condition of the resources in several years, should current management practices and trends continue. The "Medium" and "High" Conditions are the state of the resources should, management and policy change to enhance conservation efforts or improve the resources.

Table 2.1 Attribute Definitions

Attributes	Status Quo (Low)	Medium	High
Marine Mammals: Number of different kinds (diversity) and Abundance (healthy, sustainable populations)	**L**: Currently 29 species; 8 endangered or threatened; 11 on list of species of concern; Expect future loss in number of species. Rare species never seen. Populations affected by human disturbances to the point of declining and unsustainable populations.	**M**: No Increase in threatened and endangered species or loss of species. Rare species occasionally seen. Human disturbances reduced with half of the populations of all species with stable and sustainable populations.	**H**: A decrease in number of threatened and endangered and all 11 species removed from species of concern. Rare species become less rare and more commonly seen. Human disturbances reduced to the point with all species with sustainable populations.
Seabirds: Number of different kinds (diversity) and Abundance (healthy, sustainable populations).	**L**: Currently 19 species nest here and many more migrate through the area: 5 endangered or threatened; 9 on list of concern; Expect future loss in number of species. Populations affected by human disturbances to the point of declining and unsustainable populations.	**M**: No increase in threatened and endangered species or loss of species. Rare species occasionally seen. Human disturbances reduced with half of the populations of all species with stable and sustainable populations.	**H**: A decrease in the number of threatened and endangered species and no species on list of concern. Rare species become less rare and more commonly seen. Human disturbances reduced to the point with all species with sustainable populations.
Opportunity to see large predators such as killer whales, sharks, etc.	**L**: Never seen.	**M**: Occasionally seen.	**H**: Commonly seen.
Tide Pool Organisms: Number of different kinds (diversity) and Abundance (healthy, sustainable populations)	**L**: 10 to 20 species. Expect significant loss of species. Rare species never seen. Invasive species common.	**M**: 20 to 40 species with no expected loss of species. Rare species are occasionally seen. Invasive species reduced but are occasionally seen.	**H**: Greater than 40 species. Rare species become less rare and more commonly seen. Invasive species are rarely or never seen.
Tide Pool Access	**L**: Distance from access point greater than 2 miles.	**M**: Distance from access point is 0.25 to 2 miles.	**H**: Distance from access point is 0.25 miles or less.

Attributes	Status Quo (Low)	Medium	High
Clean water (no to low pollutants) to support water-based activities.	**L**: 27 to 40 beach closures for a total of 216 to 323 days of closure. 11 to 15 beach advisories with 83 to 124 beach days with advisories. Conditions generally do not meet health standards.	**M**: 14 to 26 beach closures for a total of 108 to 215 days of closure. 6 to 10 beach advisories with 41 to 82 beach days with advisories. Conditions mostly meet health standards.	**H**: 0 to 13 beach closures for a total of 0 to 107 days of closure. 0 to 5 beach advisories with 0 to 40 beach days with advisories. All conditions meet health standards.
Beach and shoreline quality (absence of debris/garbage).	**L**: Large amounts of debris or trash visible on the shore 3.25 lbs. per 100 feet of shoreline.	**M**: Moderate amounts of debris or trash visible on the shore 1.6 lbs. per 100 feet of shoreline.	**H**: Minimal debris or trash visible on the shore 0.5 lbs. per 100 feet of shoreline.
Beach and shoreline quality (absence of harmful algal blooms).	**L**: Numerous harmful algal blooms causing respiratory distress to beach and shoreline users. 0 to 15 beaches open for razor clam digging per year.	**M**: A few harmful algal blooms causing respiratory distress to beach and shoreline users. 16 to 30 beaches open for razor clam digging per year.	**H**: No harmful algal blooms causing respiratory distress to beach and shoreline users. 31 to 58 beaches open for razor clam digging per year.
Views not obstructed by onshore or offshore development.	**L**: Currently low development with no obstructed views. Low condition would be medium to high development on land and offshore development such as wind or wave energy. Limited or no access to beach or shorelines.	**M**: Limited to low intensity development with views partially obstructed by a few offshore structures. Some access to beaches and shoreline.	**H**: Low impacts of development with no offshore structures and easy access to beaches and shores.
Uncrowded by other recreational users.	**L**: 21 or more people encountered during a beach visit.	**M**: 11 to 20 people encountered on a beach visit.	**H**: 0 to 10 people encountered on a beach visit.

Other Variables Considered

Ecological World View. The "New Ecological Paradigm (NEP)" (Dunlap et al. 2000 and Dunlap 2008) was included in the survey questionnaire based on past efforts to explain willingness-to-pay for outdoor recreation (Aldrich et al. 2007). Respondents were asked to indicate their level of agreement or disagreement with the 15 NEP statements. Responses were coded using a seven-point Likert scale ranging from 1=strongly disagree to 7=strongly agree. Agreement with eight particular NEP statements indicates endorsement of the NEP pro environmental stance, whereas agreement with the remaining seven indicates endorsement of the Dominant Social Paradigm (DSP) or pro development stance.

Cluster analysis using STATA Version 14 (StataCorp, 2015) yielded three distinct ecological worldview groups: a strong ecological worldview group, a moderate ecological worldview group, and a dominant social worldview group. Three dummy variables, NEP_strong, NEP_mod, and DSP, were created for these groups.

Price, Use and Income. Price refers to the annual cost to the household for each alternative and its development was discussed above in the focus group and pre-tests. The payment vehicle was defined for respondents in the information sheet provided in the questionnaire Technical Appendix (Leeworthy, et al., 2017). There were six prices randomly assigned in the optimal design to different alternatives: $20, $40, $80, $175, $350 and $700. This was the annual cost to the household for alternatives. For the Status Quo or all conditions at the "Low" condition (opt out choice) was always priced at $0. For estimation, price was scaled to thousands of dollars (price_1000).

Use. Experience was specified using the variable (how_long) which was the answer to question 5 in the questionnaire.

Q5. For how long have you been visiting the Pacific coast of Washington and enjoying one or more of the activities you identified [this was preceded by a listing of all the recreation activities they did on the Outer Coast]?

1= Just last year
2= One to three years
3= About four to ten years
4 = More than ten years
5 = All my life

If Q5 was equal to one, then a dummy variable was created (first_time) where 1=first time visitor (Q5=1) and 0=not first time visitor (Q5 greater than or equal to two).

Income. Income was obtained from all panel members with no missing information. Missing information for income is typical of most survey research. Annual Household Income was obtained in 19 categories. From this a numeric interval variable was created (inc_value) by assigning the mid-point of each interval for each category from 1 to 18. For the upper limit (category 19), the income was set to $200,000 (Leeworthy et al., 2017).

As per capita income has been found to be a better explanatory variable in willingness-to-pay studies (Alberini, Longo and Veronesi, 2006), per capita income was calculated by dividing total annual household income by the household size. It was then scaled to thousands of dollars for model estimation (per_capita_income_1000).

3. Economic Model and Economic Values

Statistical Model

Details of the statistical models estimated and the averaging of model results across econometric model specifications can be found in Leeworthy et al. (2017). Generally, annual household willingness to pay is a function of natural resource attribute condition levels and user characteristics.

The annual household value estimated is for changes from the "Status Quo", which is the "Low Condition" for natural resource attributes to either the medium or the high-level conditions. The "Status Quo" or "Low Condition" is not the current condition of the resources, but what the condition of the resources are expected to be in 10 to 20 years under existing management and policies. The values estimated then are the benefit of policy/management actions that either maintain conditions to the medium or high condition or avoid declines from the medium or high conditions to the low conditions. This will be discussed more in application of the model to policy/management scenarios.

Natural Resource Conditions

The natural resource conditions are specified in Table 2.1. Variables were created to allow for the estimation of how economic values change with changing conditions (see Leeworthy et al. 2017).

Of special note was the issue of crowding. Crowding is a more complex issue since it involves not only the simple measures of how many people are using a given space, but people's preferences. Some people like crowded conditions as it represents a chance to meet and interact with others. We called them crowd lovers. Others do not like crowded conditions and we called them wilderness lovers. We created variables to capture the differences in how people value the change in crowding conditions.

The low condition for crowding was equal to 21 people, the medium condition was 15.5 (mid-point of interval) and 5 for the high condition. As crowding condition increases (become more crowded), those who prefer a wilderness experience values' decline, while for crowd lovers, values increased with crowding conditions.

User Characteristics

Several user characteristics were statistically significant in explaining WA households willingness to pay for their recreation experience on the Outer Coast of WA. This

included per capita household income measured in thousands of dollars (per_capita_income_1000), experience with visiting the WA Outer Coast (first time visitor versus a more experienced user). People's worldview using the New Environmental Paradigm (NEP) scale that uses 15 questions to develop an index score that rates people's preferences for environmental protection (Leeworthy et al. 2017).

Price

In economic theory, price is the most important variable in the model because it determines if the model is consistent with economic theory (i.e. the demand for a good or service, and thus its value, declines with increases in prices). Price was measured here in the annual cost per household per year in thousands of dollars.

Model Estimation Results

The details of model estimation will not be presented here; instead, they are detailed in the Technical Appendix (Leeworthy et al., 2017). The qualitative findings will be summarized here for a non-technical audience.

It was hypothesized that for all natural resource attributes as conditions improved the economic value would increase. Changes in value were estimated for changes in condition from low to medium and low to high conditions. The value of the change going from medium to high condition could then be derived by subtracting the change from low to medium from the change from low to high.

The estimation did not conform to our hypothesis for a couple of natural resource attributes. For the condition of seabirds, a movement from low to medium did conform to our hypothesis, but the movement from low to high did not. The explanation seems to be that including seagulls in with other seabirds results in a negative reaction. People were okay with a certain amount of seagulls, but having a high amount was interpreted negatively. So including seagulls in with other seabirds resulted in us not being able to identify the full relationship for seabirds (See Chapter 5 which shows the relatively low ranking of sea gulls).

For the number of tidal pool organisms, the correct relationship was identified but it was not statistically significant. The direction of the change in value as conditions improved was consistent with expectations, but were at very low amounts (0.8 cents to 1.4 cents going from low to medium and low to high, see Table 3.1).

For tidal pool access, the opposite relationship was found with value increasing the further away the point of access to the Outer Coast was from the tidal pools. We are not

sure if this result is confounded with the crowding issue i.e., do people who access and use the tidal pools like them to be further away from the access points so they are less crowded? This area needs further research.

For crowd lovers, the correct relationship as hypothesized was found, but it was not statistically significant. Crowd lovers were a very small percent of those sampled (1.72%) and crowding conditions on the Outer Coast of WA are such that people sampled have never experienced high levels of crowding.

All the other natural resource attribute conditions were as hypothesized, as resource conditions moved to higher condition levels economic value was positive and increased.

All user characteristics had the hypothesized relationships. As per capita household income increased, economic value increased. As people's worldview changed from being pro development to pro environmental protection economic values increased. Finally, first time visitors had lower economic values than those who have visited the Outer Coast of WA for recreation in the past. However, only 11.8% of the sampled population were first time visitors.

Price or annual cost per household was as hypothesized, which provided confirmation that the estimated model was consistent with economic theory and therefore would allow for estimating economic values.

Estimated Economic Values

As noted above, the approach used in this study was not to estimate the current economic values of the natural resources of the Outer Coast of WA for recreation use. Instead, the approach estimates how economic values would change with changes in policy/management actions that either protected resources so either they are maintained in their medium or high condition or changes in policy/management are made to avoid future declines in resource conditions to the low condition or a movement from the high condition to the medium condition. This makes the results useful for evaluating alternative policy/management strategies.

The highest values are for improving conditions for water quality, obstructed views from development, marine mammals and shoreline quality-number of beaches open. Next in value is shoreline quality-marine debris and large predators (Table 3.1).

As noted above, the number of tidal pool organisms was positive but not significant. The benefits are extremely small. Tidal pool access had the opposite relationship than hypothesized and, as the access points are moved closer to the tidal pools, the value declines. As discussed above, as the condition of seabirds moves from the low to medium condition there are added benefits ($47.38 per household per year), but improving this

condition to the high condition resulted in a decline in value. Again, this may be the result of the inclusion of sea gulls in with all other seabirds.

The impacts of crowding require some explanation. As crowding conditions improve (i.e. the number of people visible to those recreating declines), wilderness lovers have increased values, while crowd lovers have declines in value (they like the crowded conditions).

For user characteristics, the values are calculated at the sample means for those WA households that visit the Outer Coast for Recreation. Households that have strong environmental protection preferences (28.45% of the population of WA households that recreate on the Outer Coast of WA), on average they are willing to pay $259.20 per year, while those who have moderate environmental protection preferences are willing to pay $262.37 per year. For households with a mean per capita income of $35,800 per year, they are willing to pay $185.09 per year. Finally, first time visitors are willing to pay $29.74 less per year than other recreating households who have been to the Outer Coast (Table 3.2).

Table 3.1 Change in Economic Values with Changes in Conditions: Natural Resource Attributes 2014 $ per Household Per Year

Variable	Low to Medium	Medium to High	Low to High
Marine Mammals	101.86	36.85	138.71
Seabirds	47.38	-29.41	17.97
Large Predators	73.05	19.50	92.55
Number Tidal Pool Organisms	0.008	0.006	0.014
Tidal Pool Access	-52.87	-52.86	-105.73
Water Quality	96.95	66.35	163.30
Shoreline Quality - Marine Debris	59.29	39.52	98.81
Shoreline Quality - Number of Beaches Open	44.80	65.70	110.50
Obstructed views from Development	101.52	50.34	151.86
Wilderness Lovers	10.10	19.27	29.37
Crowd Lovers	-0.88	-1.68	-2.56

Table 3.2 Change in Economic Value for User Characteristics (2014 $ Per Household per Year)

Variable	$ at Sample Mean	Mean
Strong Environmentalist	259.20	0.2845
Moderate Environmentalist	262.37	0.4374
Per Capita Income (thousands of $)	185.09	35.8
First Time Visitor	-29.74	0.1182

4. Policy/Management Scenarios

In this chapter, four policy/management scenarios selected by OCNMS management are evaluated using the results of the estimated models. Three scenarios were estimated in the Technical Appendix (Leeworthy et al. 2017). The extremes of setting all natural resource conditions to their medium and high levels were estimated and a third scenario used a mixture of low, medium and high conditions. This was done for peer review of the methods, but may not be policy/management relevant.

Here the estimated models are used to evaluate four policy/management scenarios. Changes in the annual benefit per household are estimated then aggregated to the annual total benefits for all households that recreated in 2014 on Washington's Outer Coast and separately for the number of those households that recreated in the Olympic Coast National Marine Sanctuary (OCNMS) using the two-kilometer inland buffer for defining the sanctuary.

The estimates of total annual benefits are then capitalized to estimate the net present value of the changes. This is done for three periods: 1) 20 years, 2) 30 years and 3) Perpetuity or the indefinite future.

The capitalized value of net present value (NPV) is the value someone would pay today for the flow of annual returns over time. A good example is a house that delivers a flow of services over time, but, at any point in time, there is a price people are willing to pay for the house. The same concept can be applied to natural resources and the environment.

To estimate NPV several assumptions are required. The assumptions used lead to estimates of NPV that are considered lower bound estimates.

Assumptions:

1. The number of Washington Households that visit the Outer Coast of Washington and the OCNMS remain constant in the future;
2. The annual non-market value of changes in attributes per household remains constant in real terms (dollars net of inflation);
3. The real discount rate or interest rate net of inflation that is used to discount future flows of annual benefits to NPV is 2% or 3% (these rates are used in NOAA damage assessment cases and restoration projects);
4. The periods for calculating NPV are 20 years, 30 years and Perpetuity.

Four Policy/Management Scenarios

Four policy/management scenarios were selected for evaluation by OCNMS staff. Two of the scenarios evaluate changes in the conditions of the shorelines in terms of the amount of marine debris and two of the scenarios evaluate changes in offshore energy facilities that would obstruct Viewscapes.

Scenario 1

This scenario evaluates a change in the amount of marine debris found on the shoreline moving from the Status Quo or Low Condition of 3.25 lbs. per 100 feet of shoreline to the Medium condition of 1.6 lbs. per 100 feet of shoreline for a net change of a reduction of 1.65 lbs. per 100 feet of shoreline.

The annual benefit is $63.3 million for the Outer Coast of WA and $9.1 million for OCNMS. This translates into a NPV of between $1.0 billion to $3.2 billion for the Outer Coast of Washington and between $157 million to $453 million for OCNMS depending on the discount rate and the period for evaluation (Table 4.1).

Table 4.1 Capitalized Net Present Value of Scenario 1: Marine Debris to Medium Condition[1]

	Time Period for Capitalization[2]		
Area/Real Discount Rate[3]	20 Years (Billions 2014 $)	30 Years (Billions 2014 $)	Perpetuity (Billions 2014 $)
Outer Coast			
Discount Rate 2%	1.1	1.4	3.2
Discount Rate 3%	1.0	1.3	2.1
OCNMS - 2 Km			
Discount Rate 2%	0.157	0.207	0.453
Discount Rate 3%	0.144	0.183	0.302

1. Medium Condition for marine debris on shoreline is a change from the Status Quo or Low Condition of 3.25 lbs. per 100 feet of shoreline to 1.6 lbs. per 100 feet of shoreline or a decrease of 1.65 lbs per 100 feet of shoreline
2. Perpetuity is the indefinite future.
3. The Real Discount Rate is the interest rate net of inflation that converts future flows of benefits to the value today (net present value).

Scenario 2

This scenario evaluates a change in the amount of marine debris found on the shoreline moving from the Status Quo or Low Condition of 3.25 lbs. per 100 feet of shoreline to the High condition of 0.5 lbs. per 100 feet of shoreline for a net change of a reduction of 2.75 lbs. per 100 feet of shoreline.

The annual benefit is $105.5 million for the Outer Coast of WA and $15.1 million for OCNMS. This translates into a NPV of between $1.7 billion to $5.3 billion for the Outer Coast of Washington and between $240 million and $755 million for OCNMS depending on the discount rate and the period for evaluation (Table 4.2).

Table 4.2 Capitalized Net Present Value of Scenario 1: Marine Debris to High Condition[1]

	Time Period for Capitalization[2]		
Area/Real Discount Rate[3]	20 Years (Billions 2014 $)	30 Years (Billions 2014 $)	Perpetuity (Billions 2014 $)
Outer Coast			
Discount Rate 2%	1.8	2.4	5.3
Discount Rate 3%	1.7	2.1	3.5
OCNMS - 2 Km			
Discount Rate 2%	0.262	0.345	0.755
Discount Rate 3%	0.240	0.305	0.503

1. High Condition for marine debris on shoreline is a change from the Status Quo or Low Condition of 3.25 lbs. per 100 feet of shoreline to .5 lbs. per 100 feet of shoreline or a decrease of 1.65 lbs per 100 feet of shoreline
2. Perpetuity is the indefinite future.
3. The Real Discount Rate is the interest rate net of inflation that converts future flows of benefits to the value today (net present value).

Scenario 3

This scenario evaluates a change in offshore development to the Medium condition. To understand this scenario one has to understand the definition of the Status Quo or Low Condition. The Status Quo or Low Condition is not the current condition. Instead, it is the condition expected in 10 to 20 years under no constraints to offshore or onshore developments that affect the viewscape. The High Condition of no development is actually the current condition. So a movement from the Status Quo or Low Condition is calculated as the movement from the Low Condition to the High Condition minus the

movement from the Status Quo or Low Condition to the Medium Condition where a few facilities are approved for development.

The annual benefit is $53.8 million for the Outer Coast of WA and $7.69 million for OCNMS. This translates into a NPV of between $853 million to $2.7 billion for the Outer Coast of Washington and between $122 million and $384 million for OCNMS depending on the discount rate and the period for evaluation (Table 4.3).

Table 4.3 Capitalized Net Present Value of Scenario 3: Offshore Development to Medium Condition[1]

	Time Period for Capitalization[2]		
Area/Real Discount Rate[3]	20 Years (Billions 2014 $)	30 Years (Billions 2014 $)	Perpetuity (Billions 2014 $)
Outer Coast			
Discount Rate 2%	0.93	1.2	2.7
Discount Rate 3%	0.853	1.1	1.8
OCNMS - 2 Km			
Discount Rate 2%	0.133	0.176	0.384
Discount Rate 3%	0.122	0.155	0.256

1. Medium Condition for offshore development is a change from current situation of no development to the Medium condition of low intensity development i.e. allowing a few offshore facilities. The value is the difference of the movement from the Status Quo or unconstrained development to the High Condition minus the movement form the Status Quo to the Medium Condition.
2. Perpetuity is the indefinite future.
3. The real discount rate is the interest rate net of inflation that converts future flows of benefits to the value today (net present value).

Scenario 4

This scenario evaluates a change in offshore development to the High condition. To understand this scenario one has to understand the definition of the Status Quo or Low Condition. The Status Quo or Low Condition is not the current condition. Instead, it is the condition expected in 10 to 20 years under no constraints to offshore or onshore developments that affect the viewscape. The High Condition of no development is actually the current condition. So maintaining the current condition of no development of offshore or onshore facilities that would affect the viewscape is estimated as the value of the change from the Status Quo Low Condition to the High Condition.

The annual benefit is $162.2 million for the Outer Coast of WA and $23.2 million for OCNMS. This translates into a NPV of between $2.6 billion to $8.1 billion for the Outer Coast of Washington and between $368 million and $1.2 billion for OCNMS depending on the discount rate and the period for evaluation (Table 4.4).

Table 4.4 Capitalized Net Present Value of Scenario 3: Offshore Development to High Condition[1]

	Time Period for Capitalization[2]		
Area/Real Discount Rate[3]	20 Years (Billions 2014 $)	30 Years (Billions 2014 $)	Perpetuity (Billions 2014 $)
Outer Coast			
Discount Rate 2%	2.8	3.7	8.1
Discount Rate 3%	2.6	3.3	5.4
OCNMS - 2 Km			
Discount Rate 2%	0.402	0.530	1.2
Discount Rate 3%	0.368	0.468	0.773

1. High Condition for offshore development is from Status Quo of Low Condition where growth in offshore facilities are unconstrained to the High Condition where no additional facilities are allowed.
2. Perpetuity is the indefinite future.
3. The real discount rate is the interest rate net of inflation that converts future flows of benefits to the value today (net present value).

How these Results can be Used

For scenarios 1 and 2 on marine debris conditions, the results show the benefits of shoreline clean-up efforts. One can compare the benefits versus the costs of the clean-up efforts.

For scenarios 3 and 4 on constraining the development of offshore or onshore developments that affect the viewscape, the results show the benefits of constraining future developments i.e. the benefits of denying permits for development or limiting approvals for development. One can compare these values to the values obtained from, for example, wave or wind facilities for energy development. The benefits of energy developments would be the savings in energy costs to businesses and households.

5. Preferences for Marine Mammals, Seabirds and Other Fish and Invertebrates

The economic valuation work in this study was not able to value changes in the status of individual species of marine mammals, seabirds, large predators or tidal pool organisms. To address this the survey included a module of questions to evaluate relative preferences for different species/species groups. A 7-point Likert scale was used to measure likeability, where 1=strongly dislike to 7=strongly like.

Five marine mammals, eight seabirds, four tidal pool organisms, and two large predators (orcas and sharks) were included (Table 5.1). Whales ranked number one using the mean sample scores. Dolphins ranked number two followed by eagles ranked number three, orcas number four and otters number five.

Seagulls ranked last among the 18 species/species groups. This partially explains why including seagulls in the seabirds for economic valuation of seabird conditions resulted in the high condition valued lower than the medium condition. Plovers and terns had higher proportions of "Don't know" responses. This too might have contributed to the unexpected result that increasing seabird conditions from the low condition to the high condition was worth less than increasing the seabird condition from the low to medium condition.

None of the tidal pool organisms ranked in the top seven. Starfish was the highest ranked tidal pool organism at number 8. This partially explains the weak results for the economic valuation of changing conditions for tidal pool organisms.

Table 5.1 Ranking of Species/Species Groups using Likeability Scores[1]

Variable	Mean	Standard Error	Min	Max	N	Rank
whales	6.5496	0.0078	1	7	12,243	1
dolphins	6.5264	0.0080	1	7	12,231	2
eagles	6.4681	0.0086	1	7	12,291	3
orcas	6.4568	0.0089	1	7	12,255	4
otters	6.4003	0.0087	1	7	12,267	5
seals	6.1392	0.0108	1	7	12,267	6
hawks	6.1301	0.0101	1	7	12,315	7
starfish	6.0501	0.0100	1	7	12,207	8
corals	5.9254	0.0106	1	7	12,183	9
puffins	5.9087	0.0112	1	7	11,367	10
ducks	5.7885	0.0101	1	7	12,339	11
anemones	5.7155	0.0116	1	7	12,051	12
sandpipers	5.6909	0.0117	1	7	10,959	13
urchins	5.6269	0.0120	1	7	12,207	14
plovers	5.4889	0.0134	1	7	8,751	15
terns	5.3811	0.0132	1	7	9,714	16
sharks	5.0875	0.0160	1	7	12,171	17
seagulls	4.6124	0.0157	1	7	12,282	18

1. Species scored using a seven-point Likert scale. Total sample size of 12,531. Don't know was coded equal to eight (8) and set to missing for statistical summary. Plovers and terns

6. Conclusion

Summary

This research demonstrated that Washington households that recreate on WA's Outer Coast are willing to pay most for improving the natural resource conditions for water quality, maintaining unobstructed viewscapes from onshore and offshore developments, marine mammals, shoreline quality-number of beaches open (not closed due to harmful algal blooms), shoreline quality-marine debris, and the opportunity to see large predators. Further, wilderness lovers, those who have been to the outer coast more than once and those with a pro environmental worldview are willing to pay more than crowd lovers, first time visitors and non pro environmental worldview persons to improve natural resource conditions are willing to pay less. Lastly, as per capita household income increases, WA households that recreate on WA's Outer Coast are willing to pay more for improving natural resource conditions.

Much was learned about the preferences Washington households have for different species and species groups too. Among five marine mammals, eight seabirds, four tidal pool organisms, and two large predators (orcas and sharks), whales ranked number one on the likeability index. Dolphins ranked number two followed by eagles, orcas and otters. Seagulls ranked last among the 18 species/species groups. This partially explains why including seagulls in the seabirds for economic valuation of seabird conditions resulted in the high condition valued lower than the medium condition. Although, none of the tidal pool organisms ranked in the top seven, within this category, starfish were ranked the highest and number 8 overall. This lower ranking and lower rankings of tidal pool organisms overall partially explains the weak results for the economic valuation of changing conditions for tidal pool organisms.

Limitations

Our sample was limited to WA households that visited the Outer Coast for recreation. Past research in coastal Washington has shown that Olympic National Park and coastal State Parks have a high proportion of non-WA households using the areas. Therefore, the estimates presented here under estimate the use and economic value of the use and under estimate the benefits in the policy/management scenarios. Future research should extend the study to non-WA residents that visit the Outer Coast of WA for recreation. This would supply a more complete picture of the valuation of natural resources of the Outer Coast.

Future Efforts

A project is currently underway to forecast the future number of Washington households that would visit the Outer Coast of Washington and the OCNMS for recreation. This would allow for the relaxation of the assumptions holding the number of households that will recreate in each of the jurisdictions remain constant.

Evaluation of other scenarios is possible using the current estimated models. See Leeworthy e. al 2017 for the detailed models and the attributes and changes in levels of attribute conditions that can be evaluated. A tool has been developed using Excel for evaluating other scenarios.

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AMERICA'S UNDERWATER TREASURES