OREGON MARINE RESERVES

OREGON DEPARTMENT OF FISH & WILDLIFE

2016

VISITOR INTERCEPT SURVEY

Coastal Visitor Ocean Awareness

Marine Resources Program
Newport, Oregon

OREGON Fish & Wildlife

2016 VISITOR INTERCEPT SURVEY: COASTAL VISITOR OCEAN AWARENESS

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MARCH 8, 2017

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EXECUTIVE SUMMARY

INTRODUCTION

When the state of Oregon began a process to establish a limited system of marine reserves within state territorial waters in 2008, the Oregon Department of Fish and Wildlife (ODFW) was designated the lead agency responsible for implementing and managing the system. ODFW oversees the five marine reserve sites at Cape Falcon, Cascade Head, Otter Rock, Cape Perpetua, and Redfish Rocks. The goals of the Oregon Marine Reserve system are:

Conservation	Conserve marine habitats and biodiversity.
Research	Serve as scientific reference sites to investigate marine reserve protections and the Oregon territorial seas, to inform nearshore ocean management.
Communities	Avoid significant adverse impacts to ocean users and coastal communities.

To achieve these goals, ODFW established a program in 2009 for marine reserves implementation and monitoring. In this context, the Marine Reserves Human Dimensions Monitoring Program conducts studies to determine the direct and indirect social, cultural, and economic impacts which result from reserve site implementation. The information collected through this process should be relevant to other marine and coastal natural resource policy issues in Oregon. This paper reviews a study conducted to identify baseline information about existing knowledge of and perceptions about global and Oregon specific ocean issues among coastal visitors. Studies have shown a significant correlation between knowledge of marine areas and support for marine conservation (Cudaback, 2008). How the reserve system may impact the ocean awareness among coastal visitors can have significant implications for the success of Oregon marine reserves.

RESEARCH DESIGN

As one aspect of the related human dimensions research, ODFW initiated a study to determine coastal visitors' awareness and knowledge of marine natural resource issues. Previous studies have demonstrated that there is a lack of knowledge about ocean issues among the general public. Other research has found a significant relationship between knowledge of marine areas and support for marine conservation (Cudaback, 2008). The primary objective of the current research was to collect data on coastal Oregon visitor attitudes about and knowledge of ocean threats, visitors' primary coastal activities, frequency of visitation, preferred sources of information about ocean issues, and demographics. Another objective of this research was to determine what factors influence a visitor's awareness of ocean issues. Data were collected during in-person interviews of a random sample of visitors along the Oregon coast. A random rotation of sampling site by time of day and day of week was employed to achieve a random sample.

There were four sections to the survey instrument: section 1 contained questions related to demographics, frequency of visitation, and the Connectedness to Nature Scale (CNS; Mayer and Frantz, 2004); section 2 contained questions related to sources of information about ocean issues, as well as an evaluation of communication by public agencies and ease of access to this information; section 3 contained visitor attitude and perception questions to determine self-assessed ocean awareness; and

section 4 contained a six-question test to assess factual knowledge of ocean threats. To determine respondents' self-assessed ocean awareness, nine ocean policy and coastal management topics were selected. The interviewees were asked to indicate on a 7-point Likert scale how well they felt that they understood each issue. The same set of ocean issues was then used to assess the degree to which the subjects perceived the issues to be threats to Oregon marine areas. To compare the subjects' perceived knowledge and threats to their factual knowledge of ocean issues, an Ocean Quiz was included.

Demographic questions were included to determine if these variables may be related to perceived and factual knowledge of ocean issues. Respondents were also asked to indicate the sources they currently use to obtain information about ocean related issues, and their preferred source. The questionnaire included related questions about the perceived efficacy of public agency communications and ease of access to information about Oregon ocean issues. Individual concern for the environment was assessed in the questionnaire with the Connectedness to Nature Scale (CNS). This scale has been used to assess the correlation between ecological behaviors and value orientations based on agreement or disagreement with a series of statements about an individual's sense of belonging within the broader ecological community (Mayer and Frantz, 2004).

Data for this study were collected at 23 samples sites along a 258-mile stretch of the Oregon coast. Sample locations were categorized into three broad zones: north coast, central coast and south coast. Specific sampling sites within these zones were selected based on visitation frequency and access criteria. These sample sites include frequently visited pull-outs, scenic attractions, and parking areas with beach access in order to intercept visitors engaged in a broad range of activities along the coast.

A total of three days per week over a six-week period were designated as sample days. Each zone was thus sampled twice during the six-week data collection time frame, and each sample site was sampled six times. To achieve a random sample, interviews would start at the same time, but at a different sample site, each day. A systematic rotation by time of day per sample site was designed to control for potential variable patterns of visitation throughout the day on the coast. When the individual conducting the studies arrived at a sample location, interviews were immediately conducted for each passing visitor. After 30 minutes, the ODFW employee would go to the next sequential sample site. This procedure was repeated across all sample sites for a total of two, three-day rotations for each sampling zone.

RESULTS

Survey data were collected for 138 sampling periods during July and August of 2016, and 629 interviews were conducted. A total of 293 surveys were completed within the north coast sampling range, 237 on the central coast, and 99 on the south coast. Approximately one-third of all respondents were Oregon residents, 17% were from Washington, 7% were from California, and an equal proportion of visitors (5%) were from Canada and Idaho. The average respondent age was 48 years, and there was an approximately equal proportion of male (48%) and female (52%) respondents. The average respondent had obtained an undergraduate college degree; over one-third of the respondents had graduate-level education. Frequency of visitation was spread evenly across four categories of visitation (from 1st time visitor to more than 50 prior visits). The highest proportion (27%) of respondents had previously visited the coast between one and 10 times, while 12% were coastal residents. The primary activity that the majority of visitors (73%) engaged in while at the coast was general beach recreation. The average

score on the CNS was 26.85 (77%) from a possible score of 35. These results indicate that the respondents felt a moderately strong attachment to nature.

The most common sources respondents used to acquire information on ocean-related issues was the internet (81%), followed by television (53%), newspapers (46%), and then social media (39%). The preferred source of information was the internet (43%), followed by television (17%), newspapers (9%), and science education (9%). The majority of the visitors were either neutral (32%) or unsure (27%) about how well public agencies have communicated regarding ocean issues. One-quarter of respondents felt that public agencies were communicating this information well. Similarly, approximately half of respondents were either neutral (27%) or unsure (27%) about how easy it to obtain information about Oregon ocean issues. Over one-third of respondents indicated they felt that it is easy to obtain this information.

The survey instrument asked respondents to indicate on a 7-point Likert scale how well they understood nine potential global ocean issues to assess respondents' perceived knowledge of ocean issues. They then evaluated the degree to which they perceived these issues to be threats to Oregon marine resources. Responses to each set of items were summed to create a numeric scale score representing the degree of perceived understanding and threats of ocean issues. With nine ocean issues for each series, each scale had a possible score of 63, where a neutral opinion would be a score of 31.5 (50%), and higher scores indicated greater perceived knowledge or perceived threats. The average score on the perceived knowledge scale was 38.73 out of 63 (61%). The majority of the ocean issues provided were scored between a four and five, indicating respondents generally felt that they understood the topic somewhat well. Water pollution was ranked as the most understood ocean issue, while ocean acidification and hypoxia (OAH) and wave energy/power development were ranked as the least understood issues.

The average score on the perceived threats ocean issues pose to Oregon marine areas was 42.38 (67%) out of 63. On average, all nine potential ocean issues were ranked above neutral on the 7-point Likert scale, and thus all were considered by the respondents to be threats to Oregon marine areas. Water pollution was considered the greatest threat, while wave energy/power development was considered the least threatening issue. Finally, in a question concerning the respondents' self-assessment of the degree to which they are informed about Oregon ocean issues, the majority of respondents (73%) felt that they were informed about ocean issues in Oregon either not well (34%) or somewhat (39%). About one-quarter of the respondents indicated they were either well informed (18%) or very well informed (8%) about Oregon ocean issues.

A series of six multiple choice questions was included in the survey instrument to assess respondents' factual knowledge concerning ocean issues. The six topics of concern in marine resource management that were addressed in the Ocean Quiz (OQ) were marine debris, fisheries decline, wave energy, harmful algal blooms, oil spills, and ocean acidification. The average score was 3.84 (64%) out of six, with a relatively normal distribution (i.e., a "bell curve") across the distribution of scores. Five of the six questions were answered correctly by the majority of respondents, with the highest correct response rate (80%) achieved for a question concerning the most common type of marine debris accumulating in the ocean. The question that the majority of respondents (77%) answered incorrectly concerned the proportion of the world's fisheries estimated to be overexploited.

A series of statistical analyses was performed comparing the bivariate relationships between many of the variables. The purpose of these comparisons was to investigate: (1) how perceptions and

knowledge are related to the attributes of respondents, and (2) how attitudes and perceptions are related to factual knowledge.

Perceived understanding of ocean issues (Q3) was positively correlated with most variables, including age (Q17), education (Q19), gender (Q18, higher among males), local residence (Q16), visitation (Q1), perceived degree informed about Oregon ocean issues (Q4), perceived threats (Q5), CNS scores (Q9), and factual knowledge (OQ scores; Q10-15). Respondents who indicated they understood the ocean issues best were more likely to be male, educated, older, local residents or more frequent visitors, who considered themselves better informed about Oregon ocean issues, and had a higher level of identity with nature. These respondents also thought the ocean issues represent threats to Oregon ocean areas.

The respondents' ratings of perceived threats to Oregon ocean areas were not correlated with as many variables as perceived understanding of ocean issues. This outcome could be expected since fewer of the respondents would be as familiar with issues specific to Oregon. There were statistically significant relationships between perceived threats and age, local residence or more frequent visitation, identity with nature, perceived understanding, and perceived degree one is informed about Oregon ocean issues. Those respondents who considered themselves to be well informed about Oregon ocean issues (Q4) also tended to be older, local or more frequent visitors, and had higher degrees of perceived ocean threats in Oregon. As one would expect, these respondents also had a higher degree of perceived understanding of global ocean issues.

Respondents identity with nature (CNS scores) was positively correlated with education, gender (females scored higher), perceived understanding of global ocean issues, and the degree that the ocean issues were perceived as threats to Oregon marine areas. These results indicate that respondents who had higher CNS scores tended to have a higher level of education, indicate that they understood ocean issues, and indicate that those issues represent threats to Oregon marine resources. Factual knowledge (OQ scores) was positively correlated with gender (males tended to score higher), education, and perceived understanding of ocean issues.

Local residents and those who more frequently visit the Oregon coast were more likely to feel that they understand issues associated with Oregon's ocean. Coastal residents indicated that they understood the global ocean issues best, and ranked those potential threats as the greatest threats to Oregon's ocean. Respondents who had visited the coast more than ten times scored the highest on the Ocean Quiz.

CONCLUSIONS

The lower proportion of surveys completed within the south coast compared to the central and north coast is representative of Oregon coastal visitation patterns. The majority of coastal visitors go to the central and north coasts, possibly due to accessibility and proximity to the population centers of Oregon. As a result, there are numerous tourism-dependent towns in those areas which continue to attract more tourists. The northern coastal communities are also in close proximity to Washington State, which probably accounts for the large proportion of Washington residents in the sample.

The median age among residents of most Oregon coastal communities is much higher than the state average, which results in towns that are accommodating to senior residents. These communities are thus well adapted for accommodating the proportionally large number of older survey respondents.

The high education level achieved by respondents is indicative of visitor populations who have the resources to travel.

The average score for the CNS was 26.85, which indicates that respondents generally agreed with the statements related to identity with nature. Studies have shown that a strong sense of identity with nature is related to positive ecological behaviors (Mayer and Frantz, 2004).

Discovering the sources visitors use to obtain information about ocean-related issues is key in creating effective outreach. The respondents used a variety of sources to obtain ocean information, with the internet being the preferred source. Still, only 43% of respondents indicated that the internet is their preferred source, suggesting that multiple communication methods must be utilized in order to reach a large audience of visitors. Respondents were fairly neutral or unsure about how well public agencies communicate about Oregon ocean issues, and about the ease of accessibility to information on those issues, indicating there is room for improvement in agency communications.

On average, respondents felt that they understood seven of the nine potential global ocean issues, with water pollution best understood, and ocean acidification and hypoxia, and wave energy/power development least understood. The average score for perceived understanding of global ocean issues was 38.73 (61%), while the average score for perceived threats those issues pose to Oregon was 42.38 (67%). These averages indicate that Oregon coastal visitors feel that the ocean issues are threats to Oregon marine areas, even though they may not understand those issues very well. A study conducted by Steel, et al., (2005a) found similar results; respondents with greater self-assessed knowledge of the ocean were more likely to indicate that ocean fisheries are in decline. This conclusion suggests that visitors perceive that Oregon marine areas may be vulnerable to a variety of threats, but agencies could provide more information to the public about the nature of these threats.

The majority of respondents correctly answered the factual questions regarding marine debris, oil spills, ocean acidification, wave energy, and harmful algal blooms. Less than one-quarter of respondents correctly answered the question on fisheries decline. While these results are useful in understanding how well Oregon coastal visitors understand broad constructs, as well as for comparing respondents' perceived knowledge with factual knowledge, this pilot research is not sufficient to tailor messages about specific threats to Oregon marine resources.

Respondents indicated they understood ocean issues somewhat well and thought these issues were threats to Oregon marine areas. The Ocean Quiz was included to assess the factual accuracy of the subjects' perceived knowledge responses. Higher perceived understanding of ocean issues was indeed positively correlated with Ocean Quiz scores. There was also a positive correlation between education and both perceived knowledge and factual knowledge.

The more frequently an individual visits the Oregon coast, the more likely they are to feel that they understand issues associated with Oregon's ocean. The positive correlation between frequency of coastal visitation and level of knowledge about the coast has been observed in other studies (Steel, et al., 2005a). Coastal residents indicated that they understood the potential global ocean issues best, considered themselves well informed about Oregon ocean issues, and they ranked the perceived threats to Oregon marine areas greatest. Interestingly, there was not a statistically significant difference between local and nonlocal respondents by factual knowledge (Ocean Quiz scores).

With completion of this study, baseline data collection on the coastal visitor population has been extensive. This study, complemented by the 2012, 2013, 2014, and 2015 visitor intercept surveys at marine reserve sites, provides a description of the visitor population during the time period of marine reserve implementation. The visitor intercept studies will be replicated in future years, and that data will be compared to this baseline data to determine if there has been any change among the visitor population since marine reserve implementation.

INTRODUCTION

In 2008, the state of Oregon began a process to establish a limited system of marine reserves within state waters. Marine reserves are areas in Oregon coastal waters that have been designated for conservation and scientific research. All removal of marine life is prohibited, as is ocean development. Some of the sites also include Marine Protected Areas (MPAs) adjacent to the reserves. In the MPAs, ocean development is still prohibited, but some fishing activities are allowed. State mandates and guidelines for the Oregon marine reserves are provided in Executive Order 08-07 (2008), House Bill 3013 (2009), Senate Bill 1510 (2012), administrative rules adopted by state agencies (OAR 635-012, OAR 141-142, and OAR 736-029), and in the *Oregon Marine Reserve Policy Recommendations* adopted by the Oregon Ocean Policy Advisory Council (OPAC) in 2008. The Oregon Department of Fish and Wildlife (ODFW) was designated the lead agency responsible for implementing and managing the Oregon Marine Reserve System. The OPAC policy recommendations provided the foundation for monitoring of the marine reserves.

During an extensive public engagement process, local communities worked with state officials to site the reserves in areas that would provide ecological benefits, and also avoid significant negative impacts to ocean users and coastal communities, in accordance with Executive Order 08-07. The reserves were to be phased in over several years. With the addition of Cape Falcon Marine Reserve on January 1, 2016, Oregon completed implementation of five marine reserve sites off the Oregon coast, all within 3 nautical miles from shore. The marine reserve sites are named after local natural landmarks, and are located at Cape Falcon, Cascade Head, Otter Rock, Cape Perpetua, and Redfish Rocks.

OREGON MARINE RESERVE GOALS

Based on the OPAC policy recommendations (OPAC 2008), the goals of the Oregon Marine Reserve System are:

Conservation Conserve marine habitats and biodiversity.

Research Serve as scientific reference sites to investigate marine reserve protections and the Oregon territorial seas, to inform nearshore ocean management.

Communities Avoid significant adverse impacts to ocean users and coastal communities.

PROGRAM EVALUATION IN 2023

The Oregon marine reserve legislation included a mandate for an evaluation of the Oregon Marine Reserves Program in 2023. The evaluation will cover all aspects of marine reserve implementation including site management, scientific monitoring, outreach, community engagement, compliance, and enforcement. The Legislature will then consider if and how marine reserves will continue to be used as a management tool in the future.

Each of the five Oregon marine reserves is a unique case study with different configurations, site characteristics, and demographics. The 2023 evaluation will provide an opportunity to learn from these five case studies. Comparative examination of research across the five sites should help determine what has or has not worked well, and what has been learned with this research.

There is general agreement among the scientific community that this timeframe is too brief for detection of substantive ecological changes due to marine reserve protections. In the Oregon temperate marine ecosystem, scientists project a minimum of 10-15 years after extractive activities have ceased before scientific detection of ecological changes is practical. However, this duration does provide sufficient time for constructive ecological and human dimensions research that will provide information for marine reserve site evaluation and inform nearshore resource management and policy.

To achieve these goals, ODFW established a program in 2009 for marine reserves implementation and monitoring. In this context, the Human Dimensions Monitoring Program was developed by ODFW staff with collaboration and assistance from external scientists and marine reserve community members. The Oregon Marine Reserves Human Dimension Monitoring and Research Plan (Murphy, et al., 2012) documents the monitoring program objectives and research purposes. Research results are presented in interim project and summary biennial reports.

To contribute to the evaluation of the marine reserve system, the studies conducted by the ODFW Marine Reserves Program Human Dimensions Project are designed to address the following:

- Determine if marine reserves increase our knowledge of the Oregon nearshore environment, resources, and uses. Ascertain if this information is useful to support nearshore resource management.
- Determine if the marine reserves and associated marine protected areas, and the system as a whole, avoid significant adverse social and economic impacts to ocean users and coastal communities.

Human dimensions research pertaining to the Oregon Marine Reserve System is designed to determine the direct and indirect social, cultural, and economic impacts which result from reserve site implementation. Study subjects include related ocean users, communities of interest, and communities of place. The information collected through this process should be relevant to other marine and coastal natural resource policy issues in Oregon. Thus, the intention is to design a monitoring program that provides area specific data, but also addresses a sufficiently broad scope of research to inform state-wide coastal resource management and policy.

RESEARCH DESIGN

RESEARCH OBJECTIVES

As one aspect of the related human dimensions research, ODFW initiated a study to determine coastal visitors' awareness and knowledge of marine natural resource issues. The primary objective of this research was to collect data about coastal Oregon visitor attitudes about and knowledge of ocean threats, visitors' primary coastal activities, their frequency of visitation, preferred sources of information about ocean issues, and visitor demographics. This baseline data is important to determine if coastal visitors understand ocean and coastal management issues in Oregon. The information derived from the study will also inform related marine reserves outreach efforts. Subsequent replication of this research can then provide the data for assessment of how visitors' knowledge may or may not change over time.

Data were collected during in-person interviews of a random sample of coastal visitors across a wide geographic area along the Oregon coast. The sampling procedure for intercepting ocean visitors was designed to assure a random sample. Visitor contacts occurred for a set period of time across various coastal sample sites. A random rotation of sampling site by time of day and day of week was employed to achieve this random sample.

An in-person ocean user contact procedure can provide more detailed individual data than might be obtained by simple observations. The purpose of the visitor intercept interviews was to gather information about:

- Frequency of coastal visitation to determine individual familiarity with Oregon marine areas and potential associated knowledge about ocean issues;
- Primary activity that visitors participate in on the Oregon coast;
- Visitor attitudes, perceptions, perceived and actual knowledge about global ocean issues and Oregon-specific threats;
- Visitor demographic characteristics; and
- Coastal Oregon visitors' individual attachment to nature.

INTERVIEW INSTRUMENT DESIGN

A literature review was conducted prior to designing and implementing the survey instrument for this study. Following the literature review, several related questions from prior studies were adapted to reflect the context of an Oregon coast visitor survey. All survey items were thus unique to this study, with the exception of a standardized set of questions from the Connectedness to Nature Scale (CNS; Appendix A: Q9), which has been used in numerous prior studies (Mayer and Frantz, 2004). There were four major sections to the survey instrument: section 1 contained questions related to demographics, frequency of visitation, and the CNS (Appendix A: Q1-2, Q9, Q16-19); section 2 contained questions to identify sources visitors used to obtain information about ocean issues as well as an evaluation of communication by public agencies and easy of accessibility to this information (Appendix A: Q6-8); section 3 contained questions about visitor attitudes and perceptions to determine self-assessed ocean awareness (Appendix A: Q3-5); and section 4 contained a six question test of factual knowledge of ocean threats (Appendix A: Q10-15).

One of the primary research objectives of this study was to assess coastal visitors' understanding of ocean resource management issues. Previous studies have demonstrated that there is a current lack of knowledge about ocean issues among the general public. Other research has found a significant relationship between knowledge of marine areas and support for marine conservation (Cudaback, 2008). ODFW funded a related Oregon State University (OSU) study of coastal Oregon residents (Needham, et al., 2013; Perry, et al., 2014) that focused on respondents' perceived and factual knowledge of marine reserves. In that study, indicators of the subjects' knowledge of marine reserves included (1) a self-assessment of the degree the respondent perceived themselves to be informed on the topic of marine reserves, (2) a scale consisting of several items designed to assess respondents' subjective (i.e., perceived) knowledge of marine reserves, and (3) another similar multiple-item scale to assess respondents' objective (i.e. factual) knowledge of marine reserves.

A similar approach was used in this study. ODFW Marine Reserves staff agreed upon nine timely ocean policy and coastal management topics. In the questionnaire (Appendix A), these topics were listed in a table as potential ocean issues (Q3). The interviewees were asked to indicate on a 7-point Likert scale how well they felt that they understood the global issue, with the additional option to state that they don't know (i.e., were not familiar with) the issue. The same set of ocean issues was then used to assess the degree to which the subjects perceived the issues to be threats to Oregon marine areas (Q5). Thus a multiple item scale was designed to first elicit respondents' self-assessment of their understanding of global ocean issues. Thereafter, another question concerned how well informed respondents thought they were concerning the same ocean issues in Oregon (Q4). Finally, respondents were asked to rate the degree of threat they perceived the global ocean issues represent for Oregon marine areas (Q5). The actual format of the self-assessed knowledge questions was adapted from the related prior ODFW funded study (Needham, et al., 2013).

In an OSU study that assessed public knowledge of ocean policy (Steel, et al. 2005), ocean literacy questions were developed based in part on information from NOAA websites. For the current study, a similar approach was taken to develop a series of questions, which were designed to compare the subjects' perceived knowledge (Q3, Q4) and perceived threats (Q5) to their factual knowledge of ocean issues (Q10-15). The sites used to develop these questions included, but were not limited to, the National Oceanic and Atmospheric Administration (NOAA) and National Geographic (Appendix B). Six multiple choice factual questions (the "Ocean Quiz") were used to assess objective knowledge among survey respondents. Correct answers to these multiple choice questions were all facts related to ocean issues and threats presented in the prior questions (Q3, Q5). Respondents' objective knowledge scores derived from these items would allow comparisons between subjects' perceived knowledge and factual knowledge of ocean issues.

Following the knowledge related questions, demographic questions, such as age, gender, residency and educational attainment (Q17–19), were included in the instrument to determine if these variables may be related to perceived and factual knowledge of ocean issues. Respondents were also asked to indicate all sources where they currently obtain information about ocean related issues (Q6). Immediately following this, they were asked to indicate the single best source from which they would prefer to obtain information about ocean related issues (Q7). The questionnaire included questions related to the perceived efficacy of current public agency communications about Oregon ocean issues (Q8). The responses to these demographic and communications questions should help inform and improve education and outreach efforts to enhance the public's ocean knowledge and awareness of marine resource management issues.

One might expect that concern for the environment would be correlated to an individual's degree of awareness and knowledge of ocean issues. To test this hypothesis, individual concern for the environment was assessed in the questionnaire with the Connectedness to Nature Scale (Mayer and Frantz, 2004). A short version of that scale, which had been used in a prior study of Oregon coastal residents (Lindberg, et al., 2016), was included in the questionnaire. Respondents indicate their level of agreement with several statements related to environmental perspectives. These items have been used to assess the correlation between ecological behaviors and values based on agreement or disagreement with statements about an individual's sense of belonging within the broader ecological community (Mayer and Frantz, 2004). A measure of frequency of visitation to the Oregon coast was also included in the research instrument to determine if the amount of time a respondent had spent on the Oregon coast was correlated with perceived and actual knowledge about ocean issues.

SAMPLE DESIGN

Data for this study were collected at 23 samples sites along a 258-mile stretch of the Oregon coast. Since the purpose of this study was to assess public ocean awareness on the broader coast of Oregon, not all of the sample sites fell within marine reserves. Rather, sample locations were categorized into three broad zones: north coast, central coast and south coast. Specific sampling sites within these zones were selected based on visitation frequency and access criteria. These sample sites include frequently visited pull-outs, scenic attractions, and parking areas with beach access in order to intercept visitors engaged in a broad range of activities along the coast. A list of the exact sampling sites, with latitude and longitude, can be found in Table 1.

Table 1. Visitor Intercept Sample Locations

Sampling Location	Sample Site	Latitude	Longitude
North Coast	1. North Cannon Beach	45.898325	-123.962753
North Coast	2. Tolovana Beach State Park	45.872881	-123.961810
North Coast	3. Oswald West State Park	45.761879	-123.957446
North Coast	4. Manzanita Beach	45.718546	-123.940711
North Coast	5. Rockaway Beach	45.612780	-123.945086
North Coast	6. Cape Kiwanda	45.215869	-123.971610
North Coast	7. Bob Straub State Park	45.192545	-123.968240
Central Coast	8. Road's End State Park	45.008310	-124.008715
Central Coast	9. Canyon Drive Park	44.959552	-124.020212
Central Coast	10. Boiler Bay State Scenic Viewpoint	44.830109	-124.065461
Central Coast	11. Devil's Punchbowl State Park	44.747182	-124.064875
Central Coast	12. Don Davis Park	44.636662	-124.063374
Central Coast	13. South Beach State Park	44.601196	-124.066134
Central Coast	14. Seal Rock State Recreation Site	44.495950	-124.083943
Central Coast	15. Governor Patterson Memorial State Recreation Site	44.413937	-124.084312
Central Coast	16. Yachats State Recreation Site	44.310364	-124.107560
South Coast	17. Cape Perpetua	44.253924	-124.111943
South Coast	18. Heceta Beach	44.034975	-124.132606
South Coast	19. Ziolkouski Beach Park	43.664199	-124.204806
South Coast	20. John Dellenback Dunes Trailhead	43.584352	-124.185026
South Coast	21. Bastendorff Beach Park	43.345049	-124.347783
South Coast	22. Bandon Beach	43.113430	-124.433955
South Coast	23. Port Orford (Battle Rock)	42.740935	-124.499065

These sample sites were divided into their respective zones based on county. The north coast sample location encompassed Clatsop and Tillamook Counties, the central coast included all of Lincoln County, and the south coast consisted of Lane, Douglas, Coos and Curry Counties (Figure 1).

Figure 1. Twenty-three Sample Sites along the Oregon Coast

Note: A white border delineates county boundaries.

A total of three days per week were designated as sample days for each of these three sample zones over a six-week period. Each zone was thus sampled twice during the six-week data collection timeframe. (For example, the north coast was sampled at the beginning of week 1 and at the end of week 4.) To achieve a random sample, interviews would start at the same time but at a different sample site each sample day. For this purpose, the sampling protocol was designed with the sample sites numbered according to their sequential location along the highway from one end of the coast to the other. The sample design required the individual conducting the survey to start at a different site on the numerical list each day at the same start time, so the data collection start time was systematically rotated among sampling locations on each sampling day. Thus, a systematic rotation by time of day and day of week by sample site was designed to control for any variances in visitor characteristics related to time of day, day of week, and sample site location on a given sampling day on the coast.[1]

DATA COLLECTION PROTOCOL

The ODFW employee would make contacts with proximate visitors immediately present along the points of access to the location (i.e., in the parking lot, on beaches or shorelines, and/or on the trails). Since the sample location, date, and time were already randomized, this contact procedure should not introduce any discernable bias to the sample.[2] When the target sample time of thirty minutes per sample site was achieved, the interviewer would move on to the next sample site, and begin the process of intercept interviews again.

The ODFW employees conducting the visitor contacts were one seasonal male employee and one temporary female employee, both wearing ODFW hats. After the employee explained the purpose of the study, the contacted visitors were handed a clipboard, with the 2016 ocean visitor survey instrument attached, for their completion. In addition to the location, weather and day of week had an influence on the number of survey respondents. Poor weather conditions (rain, wind, cold, etc.) often resulted in a lower number of survey respondents due to the lack of visitors at the coast during these times. Tourism on the coast is largely seasonal with a steady flow of visitors throughout the week in summer. However, beaches were much more active around weekends.

[1] Due to road construction blocking the entrance to one of the pull-out sample sites at Cape Perpetua, the employee had to adjust the sample plan accordingly and thus moved about a mile south during one of the sample dates. All other sample sites were kept consistent.

[2] Although there was no numeric measure of refusal rate, refusals to participate in the study were exceedingly rare.

RESEARCH RESULTS

2016 OCEAN VISITOR INTERCEPT RESULTS

Data were collected for a total of 138 sampling periods between July 6th, 2016 and August 17th, 2016 (Table 2). A total of 629 interviews were conducted.[3] Table 2 illustrates the distribution of survey respondents by sample region. A total of 293 surveys were completed within the north coast sampling range, 237 on the central coast, and 99 on the south coast.

Table 2. Sampling Frequency by Location

Location	Frequency	Percent	Sampling periods	Avg/sampling period
North Coast	293	46.6%	42	6.98
Central Coast	237	37.7%	54	4.39
South Coast	99	15.7%	42	2.36
Total	629	100.0%	138	4.56

N = 629

As previously described, the survey instrument contained questions pertaining to basic demographics, coastal visitation, CNS (Q1-2; 9; 16-19), communication sources and preferences (Q6-8), perceived knowledge of ocean issues and threats to Oregon's ocean (Q3-5), and actual knowledge of ocean issues (Q10-15). The results from this survey will be discussed in that order.

SECTION 1 – DEMOGRAPHICS, VISITATION, AND CONNECTEDNESS TO NATURE

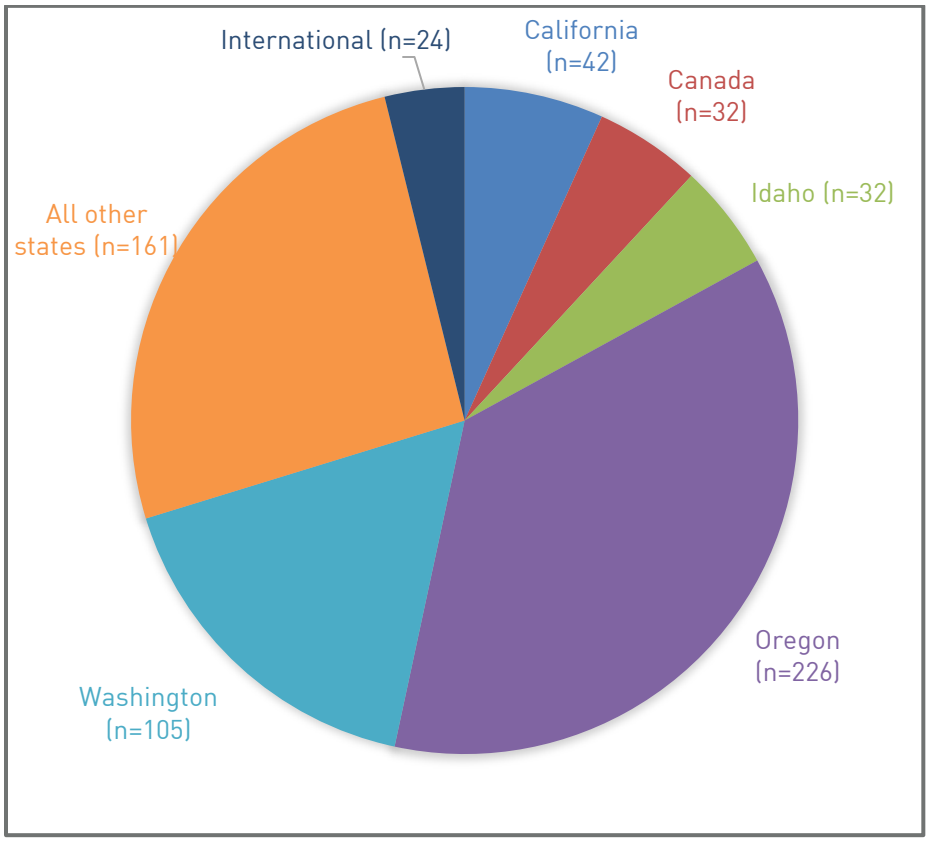
This first section of the current report includes visitor response data for the demographic variables: place of residence, age, gender, and level of formal education. Included in this section are also results of responses to questions pertaining to the respondent's visitation rate and activities while visiting the coast. Data on responses to the CNS, which reveals an individual's concern for the environment (Mayer and Frantz, 2004), are also discussed in this section.

Slightly more than one third (36%) of all respondents contacted during their visit to the Oregon coast were Oregon residents (Figure 2). The next most common states of residence were the adjoining coastal states of Washington (16.9%) and California (6.8%). An equal proportion of visitors (5.1%) came from Canada and Idaho. Approximately one-quarter of respondents reside in numerous other states, while 3.9% of respondents were international visitors.

[3] With a random sample of 629 visitors, the margin of error for this sample is ±1.99% at the 95% confidence interval.

Figure 2. Residence of Coastal Visitors

Q16. Please list your state or country of residence and zip code below:



N = 622; Missing = 7

The majority (58.8%) of respondents were at least 46 years old, with an average age of 48 years (Table 3). The fewest number of respondents were those visitors between 18 to 30 years of age. There were slightly more (52%) female respondents than male respondents (Table 4).

Table 3. Age of Respondents

Q17. What is your age?

Age Category	Frequency	Percent
18-30 years	110	18.0%
31-45 years	142	23.2%
46-60 years	208	34.0%
61+ years	152	24.8%
Total	612	100.0%

N = 612; Missing = 17

Table 4. Gender of Respondents
Q18. What is your gender?

Gender	Frequency	Percent
Male	298	48.0%
Female	322	52.0%
Total	620	100.0%

N = 620; Missing = 9

The respondents generally had attained a high level of education, with an average of 16 years of formal education, equivalent to an undergraduate degree. Over one-third (36.0%) of respondents achieved some level of graduate education (Table 5). Only 13.9% of respondents had not pursued education past the high school level.

Table 5. Education Level of Respondents
Q19. What is the highest year of formal education you have completed?

Education Category	Frequency	Percent
1-12 years (high school)	86	13.9%
13-15 years (some college)	141	22.8%
16 years (Bachelor's degree)	169	27.3%
17+ years (Graduate education)	223	36.0%
Total	619	100.0%

N = 619; Missing = 10

Respondents were asked to estimate how many times they had previously visited the Oregon coast. The most common response (27.0%) was between one and 10 visits (Table 6). Over 20% of respondents were visiting the coast for the first time, while 17.5% reported over fifty visits. Coastal residents comprised 11.6% of the total respondents.

Table 6. Frequency of Visitation
Q1. How many times have you visited the Oregon coast?

Visitation	Frequency	Percent
First visit	140	22.5%
1-10 visits	168	27.0%
10-50 visits	134	21.5%
50+ visits	109	17.5%
Coastal resident	72	11.6%
Total	623	100.1%

N = 623; Missing = 6

Respondents were asked to identify their primary activity during their visit among five options provided: fishing, water recreation (e.g., surfing, scuba, etc.), beach recreation (e.g. tide pooling, walking, etc.), wildlife viewing (e.g. birds, whales, sea lions, etc.), and an option to write in a response if their activity did not fall within the previously listed activities. Since they were not visiting, coastal residents did not respond to this question. The majority (73.3%) of respondents indicated that beach recreation was their primary activity on the Oregon coast (Table 7). The second most common response was wildlife viewing (10.7%), followed by the "other" category (9.6%). Responses to the latter included visiting family and friends, touring coastal towns, and escaping high temperatures.

Table 7. Primary Activity on Oregon Coast

Q2. When you visit the Oregon coast, what is the primary activity you participate in?

Activity	Frequency	Percent
Beach Recreation	403	73.4%
Wildlife Viewing	59	10.8%
Water Recreation	18	3.3%
Fishing	16	2.9%
Other	53	9.7%
Total	549	100.1%

N = 549; Missing = 2

In responding to the CNS (Q9), visitors were asked to rate their degree of agreement with five statements regarding their sense of identification and belonging within the natural world. Each CNS item is rated on a 7-point Likert scale, with the higher values indicating a greater degree of agreement with the statement. Thus, the maximum score one could achieve was 35, while the minimum potential score was five[4]. The average score across all questions was 26.85, roughly equivalent to a rating of five to six on each statement (Table 8). Note that the mode is 35 (n = 77), which means the most common response to the CNS among this sample of visitors was a score of seven, the highest level of agreement, for all items comprising the scale. The distribution of all scores was skewed left (Figure 3).

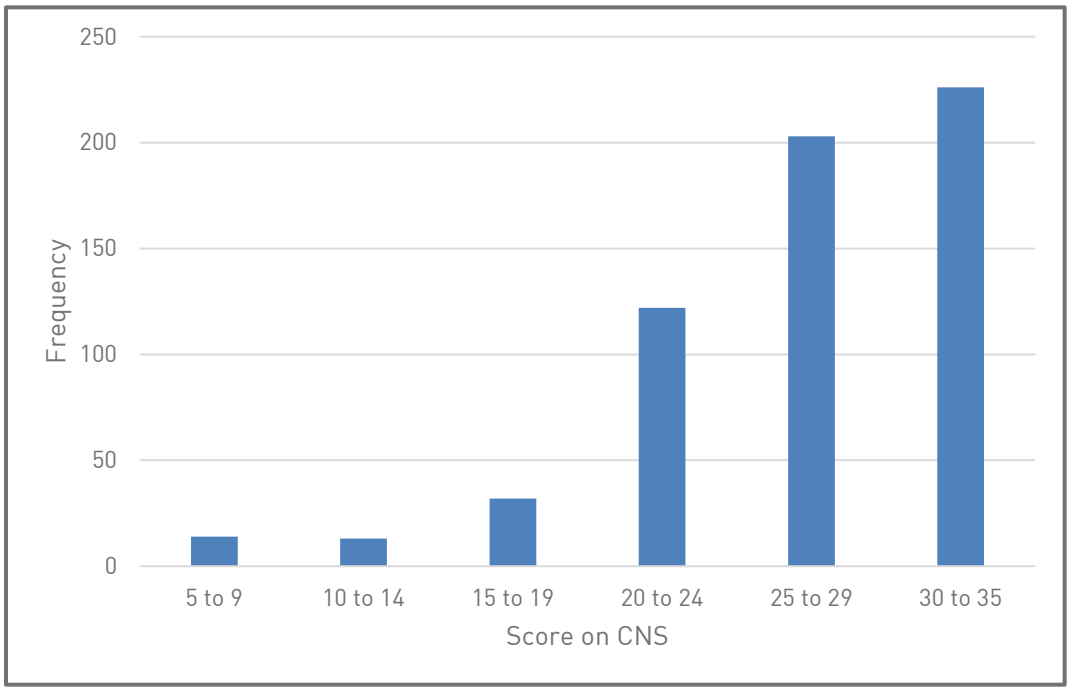
Table 8. Connectedness to Nature Scale (Q9)

Mean	26.85
Median	28.00
Mode	35.00
Range	30.00
Minimum	5.00
Maximum	35.00

N = 610; Missing = 19

[4] Both maximum and minimum potential scores were observed in survey responses.

Figure 3. Connectedness to Nature Scale Distribution



N = 610; Missing = 19

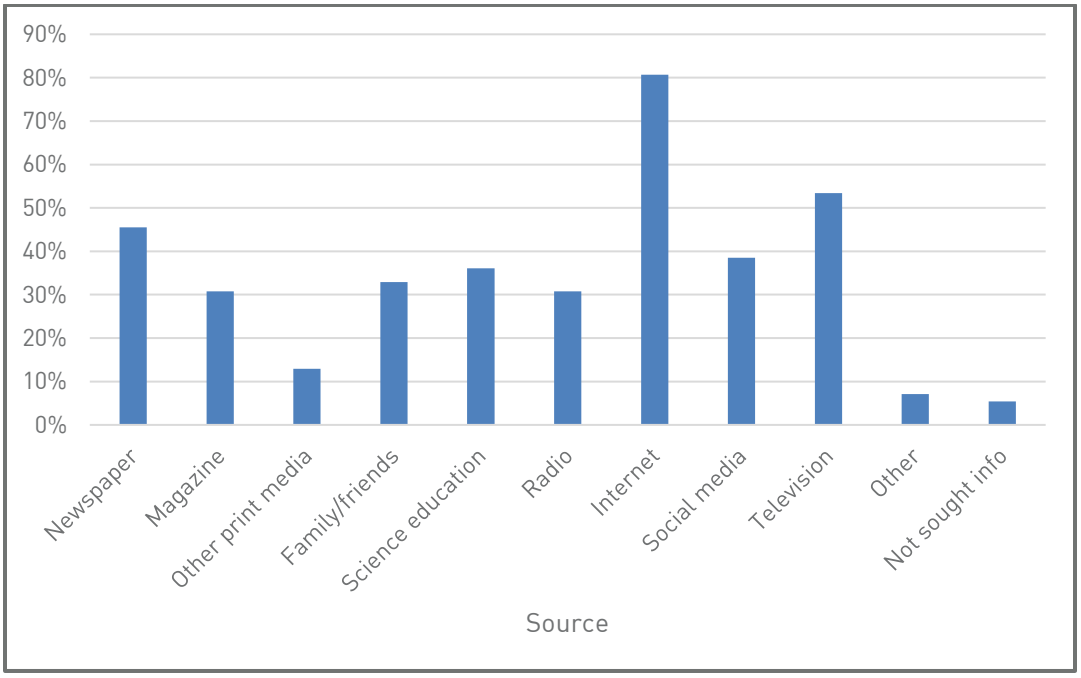
SECTION 2 – COMMUNICATION

The communication section of the visitor intercept survey focused on sources visitors currently use to obtain information about the oceans, as well as their preferred source. The questionnaire also contained items about the efficacy of public agency communications about ocean issues, and the accessibility of information specifically about Oregon ocean issues.

Respondents reported utilizing a wide range of sources to obtain information about ocean related issues (Figure 4). The most common source used was the internet (80.7%), followed by television (53.4%), and then newspapers (45.5%). Only 34 respondents (5.4%) stated that they did not seek information on this topic.

Figure 4. Sources for Acquiring Information on Ocean Issues

Q6. In what ways do you currently obtain information about ocean related issues?



N = 629; Missing = 0

Note: Respondents could select more than one source; therefore, percentages do not sum to 100%.

After identifying all information sources they currently use (Q6), visitors were then asked to select their most preferred single source for obtaining information on ocean issues (Q7). Respondents identified the internet as the most commonly preferred information source (43.4%; Table 9). The second most preferred information source was television (16.6%). All other sources were preferred by fewer than 10% of the respondents.

Table 9. Preferred Source for Information on Ocean Issues

Q7. From the list in Question 6 (above), please write the letter of ONE source from which you would prefer to obtain information about ocean related issues.

Source	Frequency	Percent
Newspaper	56	9.3%
Magazine	24	4.0%
Other print media	11	1.8%
Family/friends	8	1.3%
Science education	53	8.8%
Radio	33	5.5%
Internet	261	43.4%
Social media	48	8.0%
Television	100	16.6%
Other	8	1.3%
Total	602	100.0%

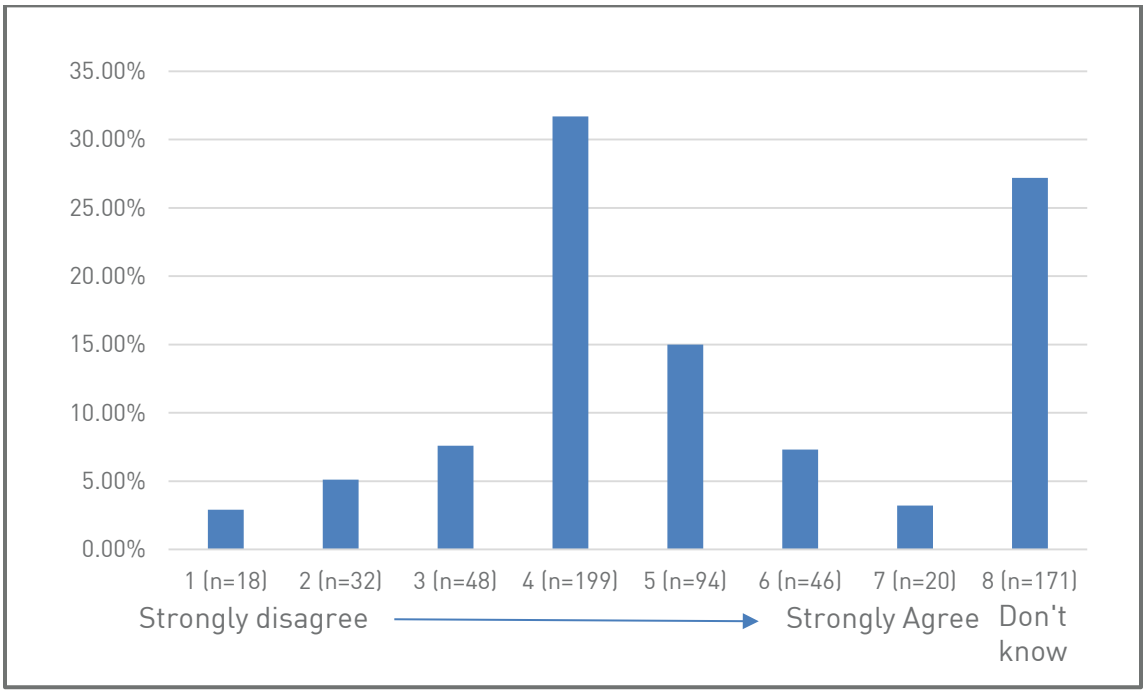
N = 602, Missing = 27

Note: Respondents could only select one source.

Respondents were asked the extent to which they agreed with the statement, 'public agencies have done a good job communicating about Oregon ocean issues'. The majority (59%) of the respondents either felt neutral (31.7%) or unsure (27.2%) about how well public agencies have accomplished this task (Figure 5). Only 15.6% of respondents felt agencies were not fulfilling this role, while 25.5% of respondents felt agencies were communicating well. The average level of agreement among respondents was 4.18 out of a possible score of 7 (60%), which is slightly above neutral.

Figure 5. Efficacy of Public Agency Communication

Q8a. To what extent do you agree or disagree with each of the following statements? Public agencies have done a good job communicating about Oregon ocean issues.



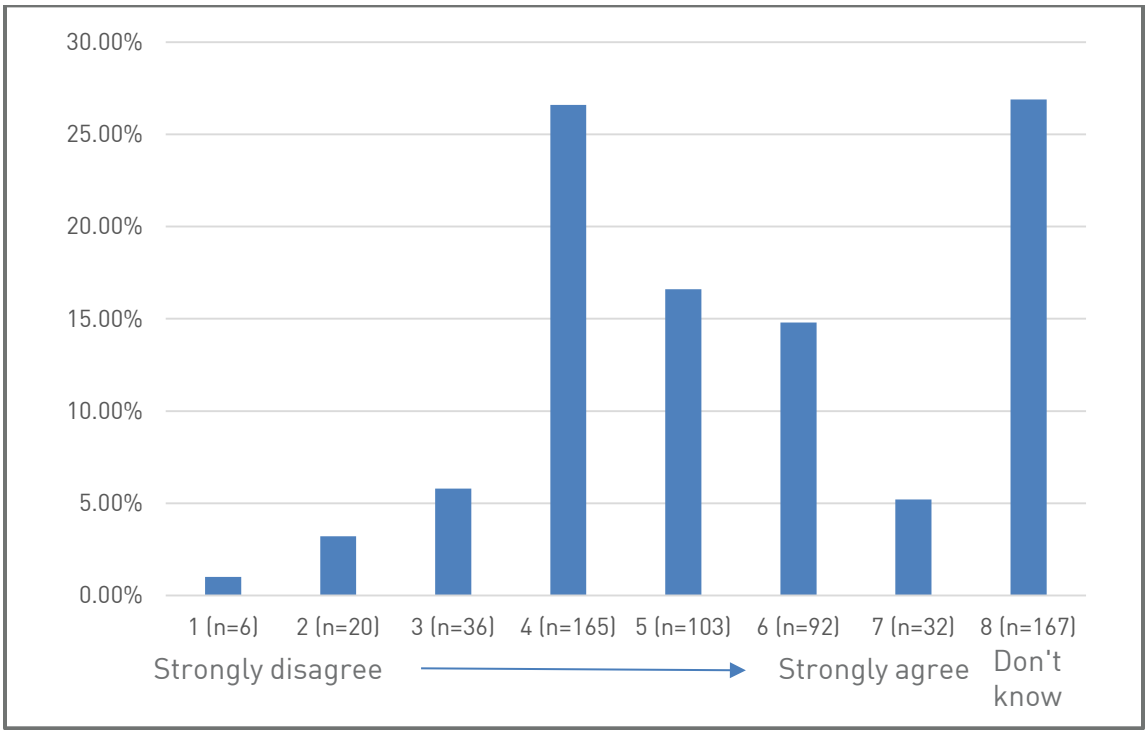
N = 628; Missing = 1

Responses ranged from 1 (strongly disagree) to 7 (strongly agree) and 8 was "don't know".

Visitor response patterns concerning ease of information access resembled their perceptions of efficacy of agency communications. Most respondents (54%) felt either neutral (26.6%) or unsure (26.9%) about how easy it is to obtain information about Oregon ocean issues (Figure 6). Only 10% believed it is difficult to find this information, while 36.6% responded affirmatively to some degree to the statement. The large proportion of respondents who chose the "Don't Know" response (26.9%) may be at least partially explained by the number of nonresident respondents who have little prior experience visiting the Oregon Coast.

Figure 6. Accessibility of Information on Oregon Ocean Issues

Q8b. To what extent do you agree or disagree with each of the following statements?
It is easy to obtain information about Oregon ocean issues.



N = 621; Missing = 8
Responses ranged from 1 (strongly disagree) to 7 (strongly agree) and 8 was "don't know".

SECTION 3 – PERCEIVED KNOWLEDGE AND THREATS OF POTENTIAL OCEAN ISSUES

The following section of this report reviews the respondents' self-assessed (perceived) knowledge of ocean issues and threats to Oregon marine resources. Respondents were asked to rate their understanding of several potential global ocean issues. A second related question then focused on their opinion of the degree of threat which those issues pose specifically to the Oregon marine environment.

For the scale of perceived understanding of ocean issues, a total of nine potential ocean issues were rated on a 7-point Likert scale, where a higher score on the scale indicated a greater degree of perceived understanding of the ocean issue. Thus, the highest combined score a respondent could achieve on the perceived global ocean issue scale was 63 (9 issue items x 7 points each), representing the greatest degree of self-assessed (perceived) understanding of all of the issues. Conversely, the lowest potential score was nine, indicating the lowest degree of self-assessed understanding of the ocean issues. The average score on the scale of perceived understanding of ocean issues for all respondents was 38.73 (Table 10).

Table 10. Perceived Understanding of Global Ocean Issues

Q4. Please indicate how well you feel you understand each of the following potential **global** ocean issues.

Mean	38.73
Median	40.00
Mode	42.00
Range	54.00
Minimum	9.00
Maximum	63.00

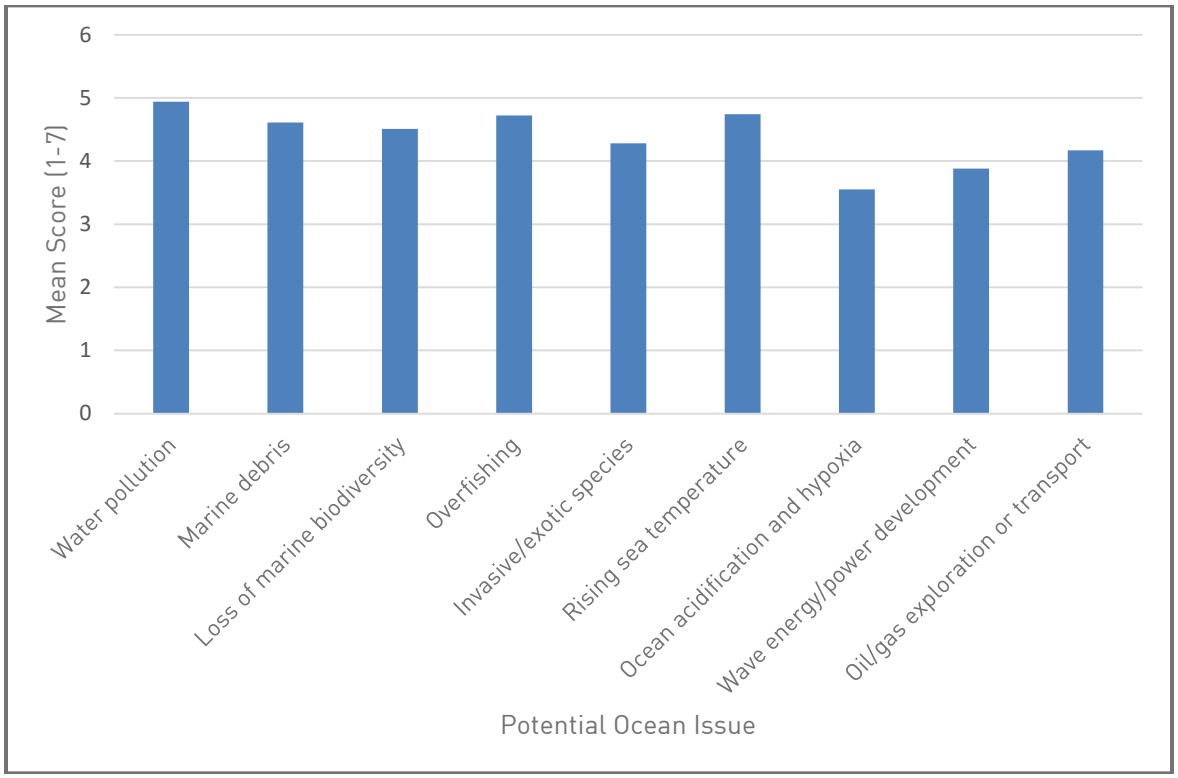
N = 617; Excludes respondents with incomplete answers
Missing = 12
95% confidence interval of ±0.91
Range 37.82 to 39.64

Respondents generally ranked their understanding of the potential ocean issues between a four and five on the Likert scale, indicating respondents felt that they understood the topic from somewhat to somewhat well (Figure 7). The mean, median, and mode for perceived understanding of each ocean issue were relatively similar; within ±1 point. The only ocean issue that did not follow that pattern was ocean acidification and hypoxia (more information in Appendix D). The highest average perceived understanding among the respondents was for water pollution, with a mean score of 4.94[5]. The two ocean issues that were the most poorly understood were ocean acidification and hypoxia and wave energy/power development. The average rating of respondents' understanding of ocean acidification and hypoxia was a score of 3.55, while their average rating of their understanding of wave energy/power development was a score of 3.88. Both of these mean rankings are below the "understand somewhat" rating level (4), indicating that respondents felt that they did not understand these issues.

[5] Since responses to these individual questions are ordinal data, the mean or average score is not a measure with definitive meaning. The inclusion of means with ordinal data in this report is to help general understanding of response distributions. Interpretation of the mean for a single item Likert scale is tenuous and should be approached with caution. Interpretation of the mean for a multiple item composite scale scores is less problematic, as these scale scores are frequently treated as interval level measures (e.g. academic test grades).

Figure 7. Mean Score of Understanding of Potential Global Ocean Issues

Q3. Please indicate how well you feel you understand each of the following potential global ocean issues.



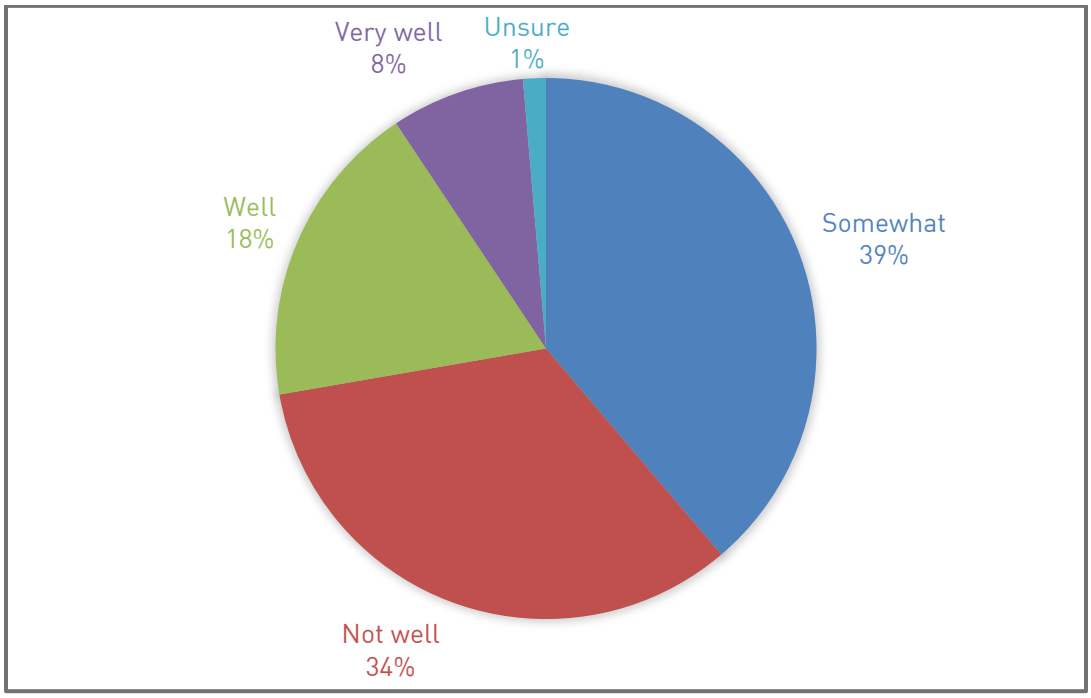
Note: Respondents who selected the response "Don't Know" were omitted when calculating the mean scores for each item. Thus each item could have a different number of valid responses (i.e., those who actually rated their understanding of the issue).

Water pollution n = 621; Marine debris n = 610; Loss of marine biodiversity n = 610; Overfishing n = 605; Invasive/exotic species n = 613; Rising sea temperature n = 607; Ocean acidification and hypoxia n = 598; Wave energy and power development n = 609; Oil gas exploration or transport n = 606.

The visitors were next asked to assess how well informed they were about Oregon ocean issues (Figure 8). The majority of respondents (72%) felt that they were informed about Oregon ocean issues either not well (33.5%) or somewhat well (38.8%). Only 18% of respondents indicated they were well informed about ocean issues in Oregon, and an even smaller proportion (8%) of the visitors thought they were very well informed about Oregon ocean issues. Eight people (1.4%) responded that they were unsure how informed they were considering Oregon ocean issues.

Figure 8. Degree Respondents Informed about Oregon Ocean Issues

Q4. How informed do you consider yourself to be concerning ocean issues in Oregon?



N = 588; Missing = 41

Respondents were asked to indicate the degree of threat that they thought each of the nine potential ocean issues posed to Oregon marine areas. As with the prior scale of understanding of ocean issues, the highest combined score a respondent could achieve on the scale to assess perceived threats to Oregon marine areas was 63, representing the greatest degree of perceived threats. Conversely, the lowest potential score was nine, indicating the lowest degree of perceived threats. The average score on the scale of perceived threats to Oregon ocean areas for all respondents was 42.38 (Table 11).

Table 11. Perceived Threats to Oregon Ocean Areas

Q5. Please indicate if you agree that each of the following is a threat to **Oregon's** marine areas.

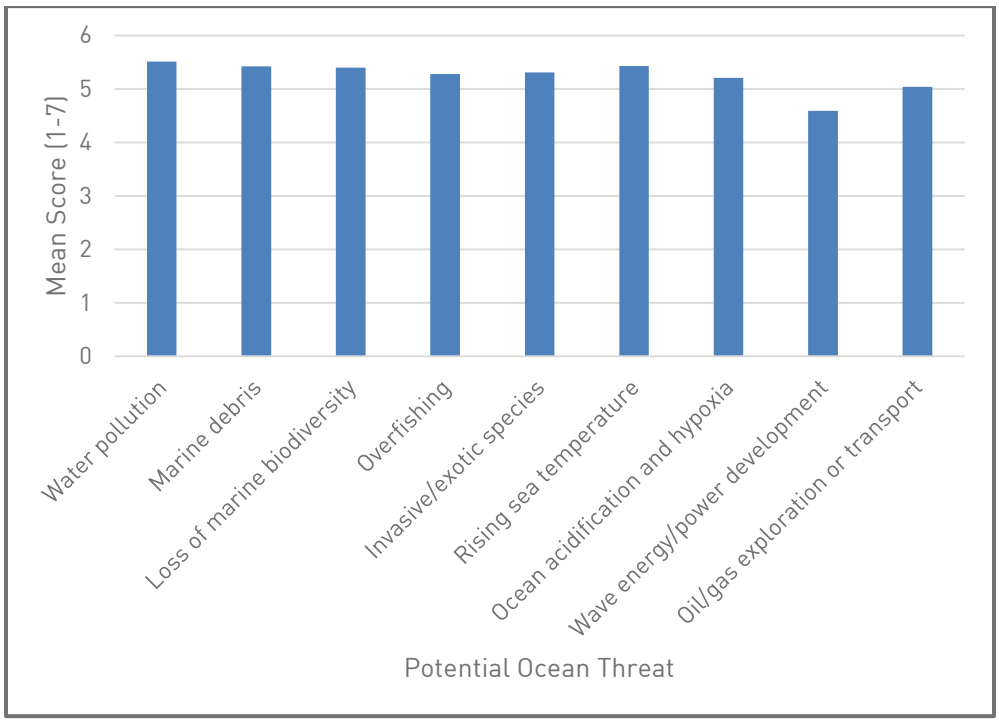
Mean	42.38
Median	44.00
Mode	54.00
Range	54.00
Minimum	9.00
Maximum	63.00

N = 557; excludes incomplete answers. Many visitors felt they could not answer this question.
Missing = 72 (Includes "Don't Know" responses); 95% confidence interval of ±1.02
Range = 41.36 to 43.4

The average ranking for each of the potential ocean issues was above a neutral score of four, indicating that respondents felt that all of the issues represented threats to Oregon marine areas (Figure 9). The mean, median, and mode for perceived threat of each ocean issue were relatively similar, within ±1 point. The issue considered to be the highest threat to Oregon was water pollution, with a mean score of 5.51. The average rating of perceived degree of threat for most of the ocean issues was between five and six. The one exception was for wave energy/power development, with an average rating of 4.59, indicating respondents believed wave energy/power development was less of a threat to Oregon marine areas.

Figure 9. Mean Score of Perceived Ocean Threats to Oregon

Q5: Please indicate if you agree that each of the following is a threat to Oregon's marine areas.



Note: Respondents who selected the response "Don't Know" were omitted when calculating the mean scores for each item. Thus each item could have a different number of valid responses (i.e., those who actually rated their opinion of the perceived threat of the issue).

Water pollution n = 551, Marine debris n = 540, Loss of marine biodiversity n = 517, Overfishing n = 519, Invasive/exotic species n = 498, Rising sea temperature n = 522, Ocean acidification and hypoxia n = 443, Wave energy and power development n = 436, Oil gas exploration or transport n = 475.

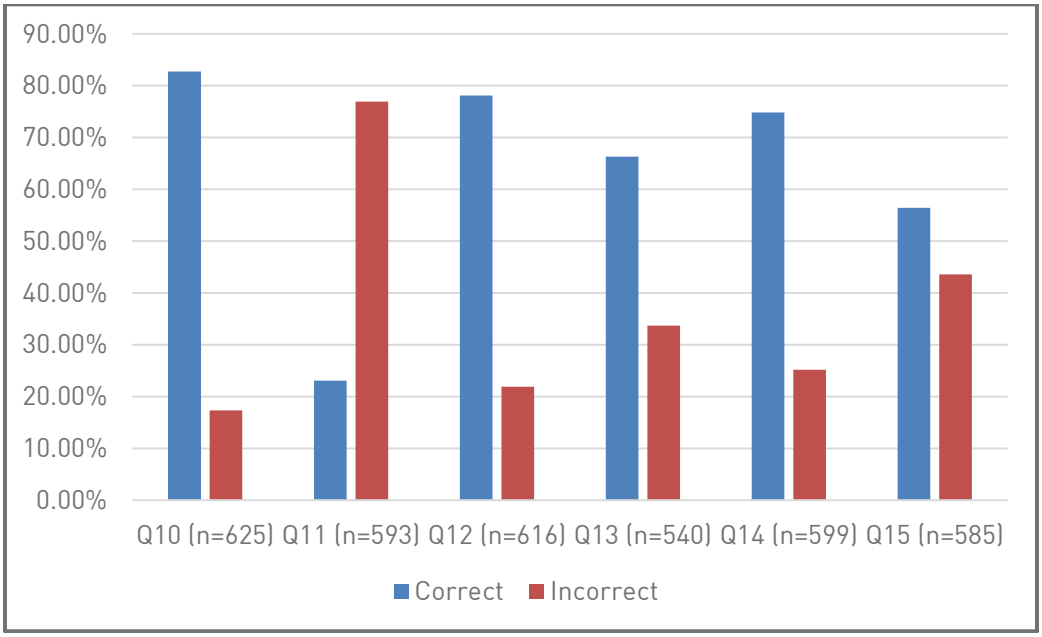
SECTION 4 – OCEAN QUIZ FACTUAL KNOWLEDGE

A series of questions were included in the questionnaire to assess the respondents' factual knowledge of ocean issues (the Ocean Quiz – OQ). This six question, multiple choice test consisted of questions (Q10 to Q15) relating to the previous ocean issues contained in the perceived knowledge and perceived threat section of the questionnaire. While respondents had previously reported their self-assessed understanding of certain ocean issues, this series of questions was designed to determine the respondents' objective, factual knowledge of the same ocean issues.

Of the six Ocean Quiz questions, five questions were correctly answered by the majority of respondents (Figure 10). The question with the highest correct response rate was Q10, which asked respondents to identify the most common type of harmful marine debris accumulating in the ocean. Over 80% of the respondents correctly chose plastics as their answer. The second question with the highest proportion of correct answers was Q12; 78% of respondents knew that nearshore, estuaries, and coral reefs are the marine habitats most impacted long-term by oil spills. Roughly 75% of respondents accurately answered that shellfish and corals are more directly at risk from ocean acidification than the other

organisms listed (Q14). Approximately two-thirds of respondents (66%) correctly answered that the greatest potential for wave energy resources is between 30° and 60° latitude along western coasts (Q13). Just over half of the respondents (56.4%) understood that harmful algal blooms (HABs) in the ocean can lead to harmful health effects from the consumption of fish and shellfish (Q15). A large proportion of subjects (29.1%) responded that harmful algal blooms can lead to large-scale die-offs of kelp forests. The only question that the majority of respondents (76.9%) answered incorrectly was Q11 which pertained to the proportion of the world's fisheries estimated to be overexploited. Only 23.1% of respondents correctly answered 25%, while the most common response (43%) to this question was 50% of the world's fisheries.[6]

Figure 10. Factual Knowledge Scores by Question (Q10-15)



Note: There were varying valid responses for each question, as some respondents chose not to answer certain questions. Other respondents selected more than one choice for a question, and their response for that particular question was excluded from these results.

A total of 517 visitors answered all of the OQ test questions, and a composite score was created for these respondents. The average composite score was 3.84 (64% correct; Table 12). The minimum score was one, which indicates that every respondent correctly answered at least one of the OQ questions. The most common score was 4 (n = 186). The maximum score was six, which indicates that some respondents (n = 20) correctly answered every question. The range of composite test scores was an approximately normal distribution (a "bell curve", slightly skewed to the left, Figure 11).

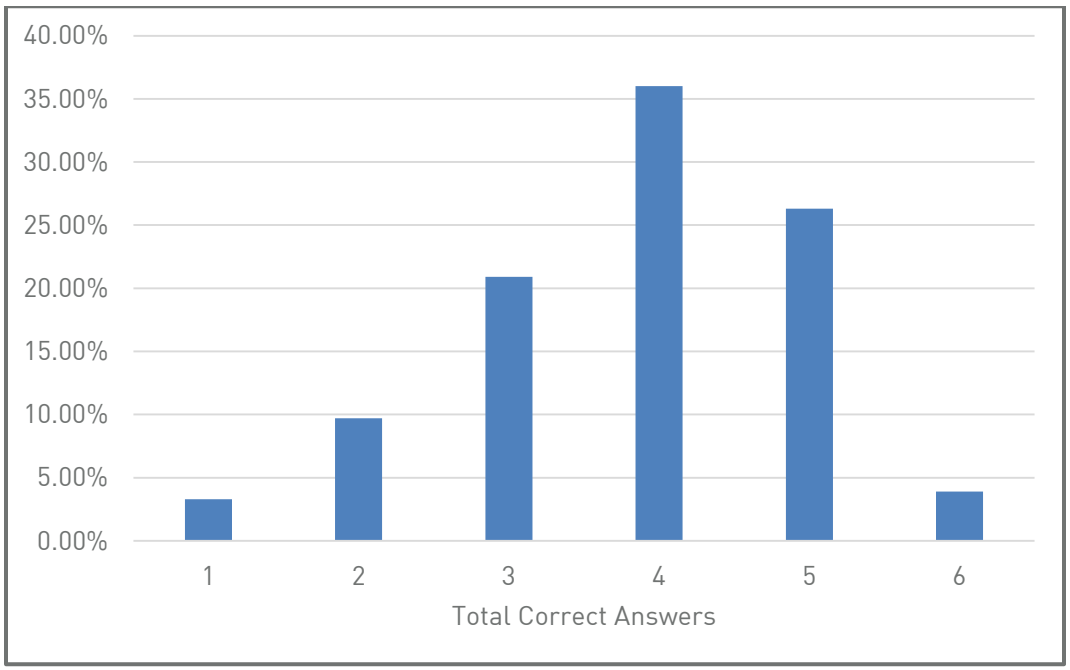
[6] Since there is limited consensus among the scientific community on this topic, additional analyses were performed to investigate the impact of Q11 on respondent scores and correlations with other variables. See Appendix C for further discussion.

Table 12. Total Factual Knowledge Scores Statistics (Q10-15)

Mean	3.84
Median	4
Mode	4
Minimum	1
Maximum	6

N = 517; Missing = 112
Note: Only respondents who answered all six questions are included in this table.
95% Confidence Interval ± 0.1; Range = 3.74 to 3.94

Figure 11. Distribution of Total Factual Knowledge Scores (Q10-15)



N = 517; Missing = 112
Note: Only respondents who answered all six questions are included in this figure.

SECTION 5 – ADDITIONAL ANALYSES

The following discussion reviews a series of analyses that were conducted to investigate the relationships between several of the variables related to the visitors' knowledge and attitudes. Analyses that were found to be statistically significant are discussed herein. Additional tests that were not found to be statistically significant are also noted, when that outcome may be instructive.[7]

The first analyses compared years of education (Q19) to a range of relevant variables (Table 13). The respondents' level of education was positively correlated to their scores on the CNS scale (Q9). Thus, respondents with higher education levels were more likely to score higher on the CNS. Perceived understanding of global ocean issues (Q3) was also positively correlated with years of education. As might be expected, more highly educated respondents were more likely to indicate that they understood the ocean issues well. In addition, the respondent's score on the Ocean Quiz (Q10-Q15) was also positively correlated with a respondent's education level. Respondents with higher education tended to have higher factual knowledge scores. However, education was not significantly related to the degree to which the respondents perceived the ocean issues to be threats to Oregon (Q5), or to the degree to which the respondents considered themselves well informed about ocean issues in Oregon (Q4).

Table 13. Statistical Comparisons by Education

Comparison	Statistic	P value
Education x CNS	R = .138	.001
Education x Perceived Understanding	R = .195	.000
Education x Ocean Quiz	R = .087	.049
Education x Perceived Threats	R = -.005	.893
Education x Degree Informed	F = .877	.453

The age of the respondent was positively correlated with perceived understanding of ocean issues (Table 14). Respondent age was also correlated with the degree to which the respondents perceived the ocean issues to be threats to Oregon, and the degree to which the respondents considered themselves well informed about ocean issues in Oregon. Less well informed respondents tended to be younger (44.12 years) compared to respondents who considered themselves to be somewhat to well informed (49 years), and very well informed (53 years). However, age was not significantly correlated with the average respondent's CNS score or to their factual knowledge (OQ) scores.

Table 14. Statistical Comparisons by Age

Comparison	Statistic	P value
Age x Perceived Understanding	R = .164	.000
Age x Perceived Threat	R = .104	.010
Age x Degree Informed	F = 5.744	.001
Age x Ocean Quiz	R = .039	.384
Age x CNS	R = .017	.678

[7] Additional multivariate analyses of these data will be covered in a supplemental paper at a later date.

Gender was significantly correlated with perceived understanding of ocean issues, the Ocean Quiz, and CNS scores (Table 15). On average, male respondents indicated that they understood ocean issues better than females, and they scored higher on the factual knowledge questions. Females scored significantly higher on the CNS scale. Gender was not significantly related to the degree to which the respondents perceived the ocean issues to be threats to Oregon or to the degree to which the respondents considered themselves well informed about ocean issues in Oregon.

Table 15. Statistical Comparisons by Gender

Comparison	Statistic	P value
Gender x Perceived Understanding	F = 5.890	.016
Gender x CNS	F = 24.533	.000
Gender x Ocean Quiz	F = 5.948	.015
Gender x Perceived Threat	F = 1.172	.279
Gender x Degree Informed	X^2 = 3.763	.709

Respondents who were local residents were significantly more likely than nonlocal respondents to select higher ratings for perceived understanding and perceived threats (Table 16). As would be expected, local respondents were also far more likely to consider themselves well or very well informed about Oregon ocean issues (57%) compared to nonlocal respondents (22%). However, the comparisons between local and nonlocal respondents were not significant for either the CNS or factual knowledge (OQ) scores.

Table 16. Statistical Comparisons by Local Residence

Comparison	Statistic	P value	Eta^2
Local x Perceived Threat	F = 4.604	.032	.008
Local x Perceived Understanding	F = 11.550	.001	.019
Local x Degree Informed	X^2 = 50.151	.000	.293*
Local x CNS	F = 2.094	.148	.003
Local x Ocean Quiz	F = .309	.578	.001

*Cramer's V

Perceived understanding of global ocean issues was positively correlated with CNS scores (Table 17). Higher respondent CNS scores were related to higher degrees that respondents thought they understood ocean issues. In addition, respondents' perceptions that the issues represented threats to Oregon ocean resources was positively correlated with their CNS score. Respondents that had higher CNS scores were more likely to indicate that the ocean issues were threats to Oregon marine areas. Although CNS scores were related to perceived understanding of marine issues (subjective knowledge), CNS scores were not related to factual knowledge about the same topics (objective knowledge, OQ scores) or to the self-assessed degree to which one is informed about Oregon ocean issues.

Table 17. Correlates of CNS Scores

Comparison	Statistic	P value
CNS x Perceived Understanding	R = .252	.000
CNS x Perceived Threats	R = .193	.000
CNS x Degree Informed	F = 1.628	.137
CNS x Ocean Quiz	R = .020	.660

The respondents' factual knowledge scores were positively correlated with their perceived understanding of global ocean issues (Table 18). A respondent who indicated they understood the ocean issues well was more likely to score higher on the test of objective factual knowledge, an intuitive outcome. Factual knowledge was not correlated with perceived threats or the degree one considers themselves to be well informed about Oregon ocean issues. Perceived understanding of global ocean issues was correlated with perceived threats those issue might represent for Oregon ocean areas. Intuitively, perceived understanding was correlated with perceived degree one is informed about Oregon ocean issues. Finally, the perceived degree one is informed was correlated to perceived threats to Oregon's ocean areas.

Table 18. Additional Correlations

Comparison	Statistic	P value
Ocean Quiz x Perceived Understanding	R = .180	.000
Ocean Quiz x Perceived Threats	R = .074	.091
Ocean Quiz x Degree Informed	F = .341	.888
Perceived Understanding x Perceived Threats	R = .361	.000
Perceived Understanding x Degree Informed	F = 32.986	.000
Perceived Threat x Degree Informed	F = 17.541	.000

The preferred source of information about ocean issues was significantly correlated with the respondents' perceived understanding of ocean issues (Table 19). Respondents that selected newspapers or science education indicated the highest average levels of perceived understanding of ocean issues, while those that selected television, other print media, and family/friends had the lowest averages. There were not statistically significant differences between CNS scores or degree of perceived threats by preferred information sources.

Table 19. Knowledge, Perceptions and Information Sources

Comparison	Statistic	P value	Eta^2
Preferred Source x Perceived Understanding	F = 2.300	.012	.038
Preferred Source x Ocean Quiz	F = 1.723	.073	.034
Preferred Source x Perceived Threats	F = 1.128	.338	.019
Preferred Source x CNS	F = 1.178	.303	.020

Note: The relationship between preferred source and perceived degree one is informed was not statistically significant. However, the low cell counts for many (50%) of the cells in this crosstabulation make this analysis invalid.

The preferred source of information about ocean issues was weakly correlated with factual knowledge (OQ, Table 19). Respondents who preferred radio, newspaper, internet, and the "other" option tended to have higher factual knowledge scores. With so many information sources in this analysis, there would be an attenuation of this statistical effect, so preferred information sources were recoded, based on rank order of factual knowledge scores, into radio, internet, newspaper, and all other sources (Table 20). This relationship between preferred information source and Ocean Quiz score was statistically significant (p = .034). Respondents who preferred radio (OQ = 4.16, 69% correct), internet (OQ = 3.94, 66% correct), and newspaper (OQ = 3.92, 65% correct) had higher average factual knowledge scores in comparison to the respondents who preferred all other information sources (OQ = 3.67; 61% correct).

Table 20. Factual Knowledge and Preferred Information Source (Recoded)

Preferred Info Source	Mean OQ Score	Frequency (%)
Radio	4.16	31 (6.28%)
Internet	3.94	220 (44.53%)
Newspaper	3.92	50 (10.12%)
All Other Sources	3.67	193 (39.07%)
Total	3.84	494 (100%)

$F = 2.915$; $p = .034$; $Eta^2 = .034$

Perceived understanding of ocean issues and perceived threats to Oregon ocean areas were both significantly correlated to visitation (Table 21). Respondents who had visited Oregon coasts more frequently tended to feel they had a better understanding about ocean issues and perceived these issues to be threats to Oregon. The degree to which respondents considered themselves to be well informed about Oregon ocean issues was also correlated with higher rates of visitation. However, higher rates of visitation were not correlated with CNS scores or factual knowledge (OQ).

Table 21. Statistical Comparisons by Repeat Visitation

Comparison	Statistic	P value
Visitation x Perceived Understanding	$F = 4.953$	.001
Visitation x Perceived Threat	$F = 4.703$	.001
Visitation by Ocean Quiz	$F = 1.749$	.156
Visitation x CNS	$F = 1.287$	.278
Visitation x Degree Informed	$X^2 = 159.84$	.000

Note: Local residents generally had higher scores on perceived understanding, perceived threats, CNS and factual knowledge than visitors. However, those respondents are not visitors and are not included in this table.

Table 22 contains the crosstabulation referenced in the last row of table 21, a comparison of rates of visitation with the degree to which respondents considered themselves to be informed about Oregon ocean issues. There was a trend for greater visitation to be associated with the self-assessed degree respondents thought they were informed about Oregon ocean issues.

Table 22. Visitation by Self-Assessed Degree Informed

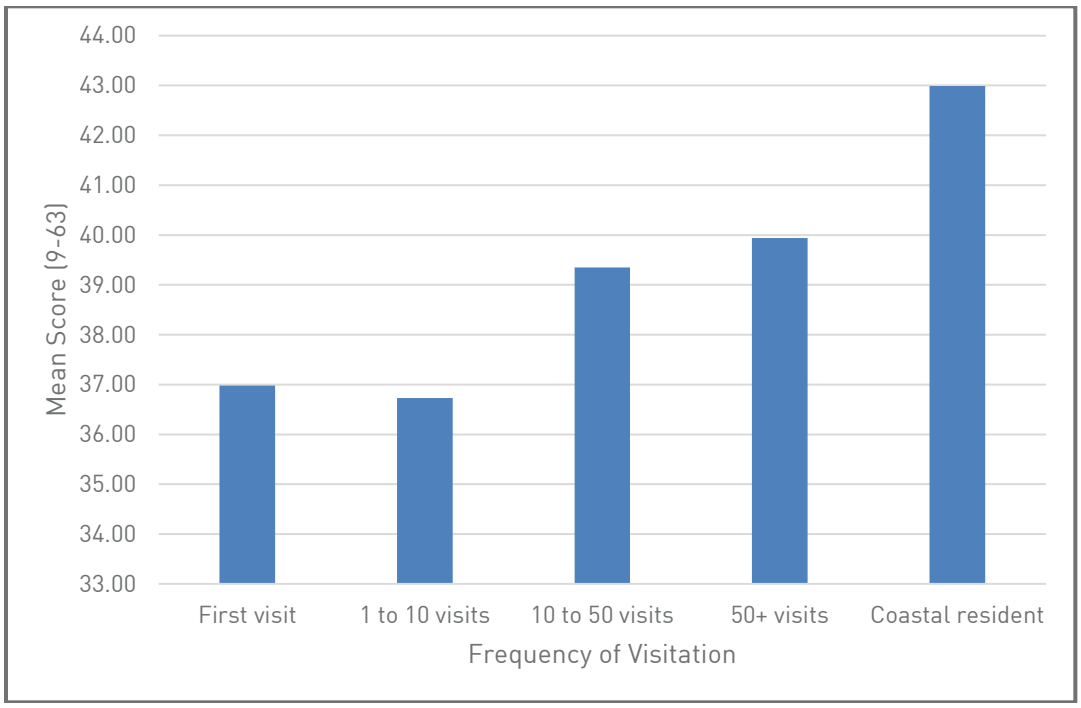
	Rate of Visitation				
Degree Informed	**First Visit N (Row %)**	**1 to 10 Visits N (Row %)**	**10 to 50 Visits N (Row %)**	**50+ Visits N (Row %)**	**Row Total**
Not Well	93 (48%)	69 (36%)	23 (12%)	7 (4%)	192 (100%)
Somewhat	28 (14%)	69 (34%)	60 (30%)	45 (22%)	202 (100%)
Well	5 (6%)	21 (26%)	32 (39%)	24 (29%)	82 (100%)
Very Well	0 (0%)	3 (9%)	10 (31%)	19 (59%)	32 (99%*)
Column Total	126 (25%)	162 (32%)	125 (25%)	95 (19%)	508 (101%*)

X^2 =159.84; p ≤ .000; Phi = .561; Cramer's V = .324
* Rounding Error
Local residents are not visitors and therefore are excluded from this table.

The following figures also illustrate some of these relationships with coastal residents included. Figure 12 compares frequency of visitation to the Oregon coast with perceived understanding of global ocean issues. Figure 13 compares visitation with perceived threats to Oregon marine areas. When coastal residents were removed from the sample, and statistics were recalculated, all correlations remained statistically significant. This outcome indicates that the results were not skewed by coastal residents' perceptions of the ocean issues, and that perceived understanding of ocean issues and perceived threats to Oregon marine resources increase with higher frequency of visitation.

The average score for perceived understanding of ocean issues was approximately 37 for first time visitors and visitors that have been to the Oregon coast between one and ten times (Figure 12). This score increased to about 39 for respondents that have visited the Oregon coast more often. The respondents that reported the highest degree of understanding of global ocean issues were coastal residents, with an average score of 43.

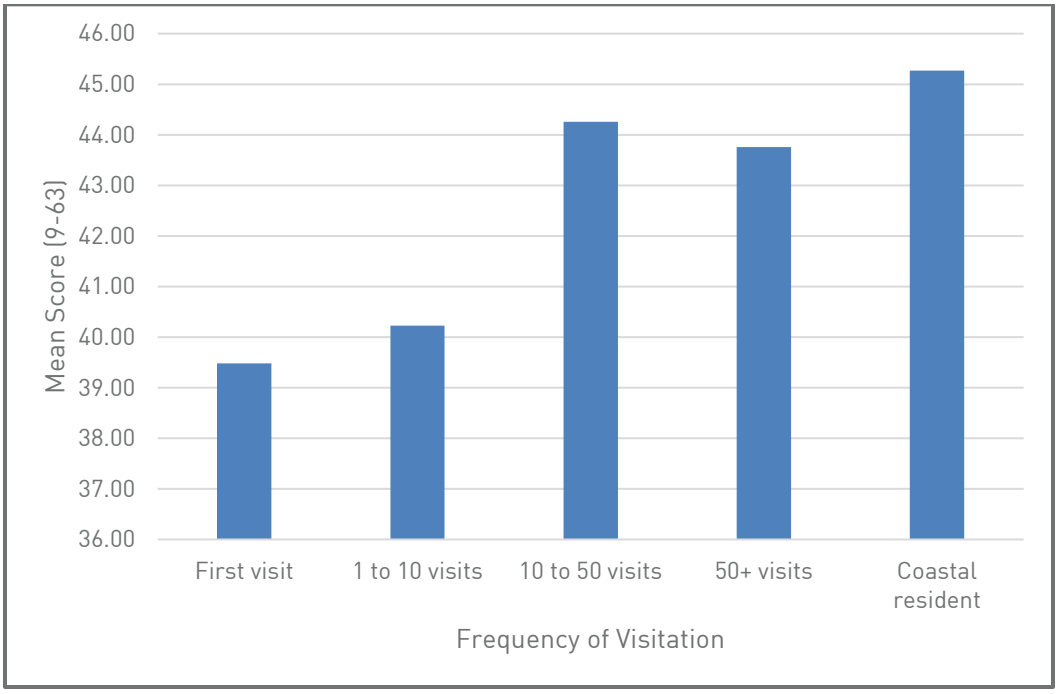
Figure 12. Perceived Understanding of Global Ocean Issues by Frequency of Visitation



N = 561; Missing = 68;
F = 3.424; p = .017

The average score for perceived threats from ocean issues to Oregon marine areas was approximately 40 for first time visitors and visitors that have been to the Oregon coast between one and ten times (Figure 13). This score increased to about 44 for respondents that have visited the Oregon coast more often. The respondents that reported the highest degree of threat to Oregon's ocean were coastal residents, with an average score of 45.

Figure 13. Perceived Threat to Oregon's Marine Areas by Frequency of Visitation



N = 372; Missing = 257
F = 20.304; p ≤ .000

The following table is provided to summarize the previous discussion (Tables 13-21).

Table 23. Summary of Comparative Statistics

Correlate	Understanding	Threats	Degree Informed	CNS Score	Fact Knowledge
Education	+	X	X	+	+
Age	+	+	+	X	X
Gender	+	X	X	+	+
Local	+	+	+	X	X
CNS	+	+	X	NA	X
Factual (OQ)	+	X	X	X	NA
Per. Understand	NA	+	+	+	+
Per. Threat	+	NA	+	+	X
Degree Informed	+	+	NA	X	X
Visitation	+	+	+	X	X

+ = Statistically Significant; X = Not Significant; NA = Not Applicable, Same Variable
Note: The primary activity that the respondent indicated was their main reason for coming to the Oregon coast was not significantly correlated with any of the variables of interest.

CONCLUSIONS

The majority of the questionnaires were completed by visitors at the north and central coast sites, and only 16% of all contacts occurred along the south coast. This distribution of respondents reflects the distribution of visitors on the Oregon coast. Fewer tourists visit the southern coastal towns in Oregon, while the majority are found in central and northern communities such as Newport, Lincoln City, Pacific City and Cannon Beach. The economic base of many of these central and northern communities includes a significant tourism sector. From 2013 to 2015, visitors stayed on the north and central coast regions around 6.2 to 6.5 million nights, respectively (Dean Runyan Associates, 2016), and visitors stayed on the south coast only about 4.2 million nights during the same time frame. The northern coastal communities are in close proximity to Washington State, which likely accounts for the large proportion of Washington residents encountered during the study. Although Oregonians constituted the largest proportion of respondents (36%), a significantly larger proportion of the respondents were Washington residents (17%) than were California residents (7%). Beyond the states on the Oregon border, respondents were residents of states throughout the country.[8] Many were international visitors, particularly residents of Canada.

One-quarter of the respondent population was over 60 years old. The proportion of respondents over the age of 60 was disproportionately higher than the proportion of the population over the age of 60 in the state of Oregon and in the United States (U.S. Census). The level of education among respondents was high. The majority of respondents were college graduates, and over one-third of visitors had attained some level of graduate education. Typically such visitors are more affluent and have more discretionary income for travel (Hartog and Oosterbeek, 1998).

There was a fairly equal distribution in visitation rates among the respondents. Four categories were used to indicate frequency of visitation (first visit, 1-10 visits, 10-50 visits, 50+ visits, with an additional response option to identify coastal residents). Coastal residents were 12% of respondents, and approximately 18% to 27% of respondents were in each of the four visitation categories. Certain sample sites hosted many first time visitors, while other sites were popular local destinations.

The average total score for the CNS was 26.85, from a potential maximum of 35, which indicates that respondents generally expressed a medium to strong sense of identity with nature. In designing outreach and communication, the outcome of responses to the CNS can have important implications. Studies have shown that higher scores on the CNS are correlated with positive ecological behaviors (Mayer and Frantz, 2004). The efficacy of communications to protect natural resources, such as might be directed toward visitors to tidepools and other ecologically sensitive marine settings, can be improved with such information.

Another important contribution to effective communication and outreach is knowledge of the sources of information visitors currently use and prefer to use to obtain information about marine natural resources. The majority of respondents used the internet (43%), television (17%), and newspapers (9%) to obtain information about ocean issues. Over 30% indicated they also use all other information sources. While a broad range of sources are currently used, the preferred source of information is the internet. However, only 43% of the respondents indicated that the internet is their preferred source, suggesting that multiple communication methods must be utilized in order to reach a large audience.

[8] Many of these visitors commented that a significant motivation in their decision to visit the Oregon coast was their desire to escape the summer heat and humidity of their home states.

Earlier research has shown a positive relationship between knowledge and newspaper readership (Brians and Wattenberg, 1996), and a negative relationship between television use and environmental knowledge (Steger et al., 1988). Regardless, visitors increasing dependence on the internet has important implications in designing outreach strategies.

In assessing the efficacy of communication from public agencies, the majority of respondents were neutral (32%) or unsure (27%) about how well public agencies communicate about Oregon ocean issues. More respondents agreed that public agencies were communicating this information well than not well. Similar results were found when respondents were asked how easy it is to obtain information about Oregon ocean issues. The majority of respondents were neutral or unsure (54%), while over one-third agreed that it is easy to find this information.[9]

On average, respondents felt that they understood seven of the nine potential ocean issues at least somewhat well. Water pollution was the potential threat that respondents indicated they understood best. Two ocean issues, ocean acidification/hypoxia and wave energy/power development, were the least understood issues among respondents. While most coastal visitors understand the concept of overfishing or water pollution, ocean acidification and hypoxia are more technical scientific terms that have emerged more recently as ocean risks, of which a larger portion of the public may not be familiar (Frisch et al., 2015). Furthermore, while most respondents are familiar with the term wave energy, many are unaware of further information on this subject (Conway, et al., 2010).

When assessing understanding of ocean issues, the average response for most ocean issues (Q3) was a perceived agreement rank of between five and six on a 7-point Likert scale. The sole exception was the statement about wave energy/power development, which had an average score of 4.59 (66%). The average combined score for the respondents' perceived understanding of global ocean issues was 38.73 (61%) of a maximum possible score of 63. The majority (72%) of visitors indicated that they understood Oregon ocean issues either not well or just somewhat well (Q4). The majority of visitors also understood there are a wide range of threats to Oregon marine areas (Q5). The average combined score for the respondents' perception of threats posed to Oregon was 42.38 (67%). These results indicate that visitors feel that the provided ocean issues are threats to Oregon marine areas, even though they may not understand those issues very well. Previous studies with similar results have revealed that the public understands there are serious threats facing the ocean, but they lack knowledge about ocean processes and functions (Steel et al., 2005b). This outcome indicates that visitors perceive Oregon marine areas as being threatened by a variety of sources, but visitors need more information to understand the nature of these threats.

Following the questions about perceptions of ocean issues/threats (Q3–5), communication efficacy (Q6-8), and the CNS (Q9), the respondents were asked to answer six factual multiple choice questions designed to gauge their objective knowledge of ocean topics (Q10-15). The Ocean Quiz section of the survey instrument occurred after the attitudinal section to avoid potential influence on responses to the latter. The average score on the Ocean Quiz was 3.84 (64%) out of a possible score of six. The distribution of correct responses was an approximately normal distribution (i.e., a bell curve). Over three-quarters of respondents correctly answered the questions regarding marine debris, effects from oil spills, and effects from ocean acidification. Two-thirds of respondents correctly answered the

[9] During the interviews, many respondents commented while completing these questions that they were unsure how to respond because they were not Oregon residents. Similarly, others stated that there might be a wealth of information on Oregon ocean issues available, but they have never sought out this information.

question related to wave energy, just over half correctly answered a question about harmful algal blooms, and less than one-fourth of respondents correctly answered the question on fisheries decline.[10] These results are useful both in illustrating how well Oregon coastal visitors' understand specific ocean issues and in comparing respondents' perceived knowledge rankings with factual knowledge scores. However, since there is only one question regarding each ocean issue, this quiz is not a strong assessment of awareness of each specific ocean issue. The utility to direct communication and outreach efforts is limited by this brevity and the exploratory nature of this research.

A series of statistical analyses was performed comparing the bivariate relationships between many of the variables. The purpose of these comparisons was to investigate: (1) how perceptions are related to the attributes of respondents, and (2) how attitudes and perceptions are related to factual knowledge among the respondents.

Perceived understanding of ocean issues (Q3) was positively correlated with most of the variables, including age (Q17), education (Q19), gender (Q18, higher among males), local residence (Q16), visitation (Q1), perceived degree informed about Oregon ocean issues (Q4), perceived threats to Oregon's ocean (Q5), CNS scores (Q9), and factual knowledge (OQ scores; Q10-15). Respondents who indicated they understood the ocean issues best were more likely to be male, better educated, older, local residents or more frequent visitors, who considered themselves better informed about Oregon ocean issues, and had a higher level of identity with nature. These respondents also thought the ocean issues represent threats to Oregon ocean areas. A study conducted by Steel et al. (2005a) similarly found that respondents with greater self-assessed knowledge of the ocean were more likely to perceive problems in ocean fisheries.

The respondents' ratings of perceived threats to Oregon ocean areas were not correlated with as many variables as perceived understanding of ocean issues. This outcome could be expected since fewer of the respondents would be familiar with issues specific to Oregon. There were statistically significant relationships between perceived threats and age, local residence or more frequent visitation, identity with nature, perceived understanding, and perceived degree one is informed about Oregon ocean issues. Those respondents who considered themselves to be well informed about Oregon ocean issues also tended to be older, local or more frequent visitors with higher degrees of agreement that the ocean issues were threats to Oregon. As one would expect, these respondents also had a higher degree of perceived understanding of global ocean issues.

Respondents identity with nature (CNS scores) was positively correlated with education, gender (females scored higher), perceived understanding of global ocean issues, and the degree that the ocean issues were perceived as threats to Oregon marine areas. These results indicate that respondents who had higher CNS scores were more likely to have a higher level of education, and think that they understand ocean issues. These respondents also tended to indicate those issues represent threats to Oregon marine resources. Other research has found that such individuals are more likely to adopt positive ecological behaviors to conserve natural areas (Schultz, 2000).

As previously related, the Ocean Quiz section of the questionnaire was designed to compare respondents' objective knowledge with a self-assessment of their (perceived) knowledge of ocean issues and perceived degree they are informed about Oregon ocean issues. In assessing perceived knowledge, respondents indicated the degree to which they felt they understood each ocean issues.

[10] The question about fisheries decline and overexploitation is reviewed in a separate analysis (see Appendix C).

Although responses were anonymous, respondents might still tend to indicate they possess more factual knowledge about issues than they actually have (Brückner, 1995). In the current study, however, higher factual knowledge was correlated with gender (males tended to score higher), education, and perceived understanding of ocean issues; the latter an outcome that makes intuitive sense. The positive correlation between years of education and the Ocean Quiz scores was also not surprising because higher socioeconomic status and education are generally correlated with higher levels of knowledge (Genova and Greenberg, 1979).

Local residents and those who more frequently visit the Oregon coast were more likely to feel that they understand issues associated with Oregon's ocean. The positive correlation between frequency of coastal visitation and level of knowledge about the coast has been observed in other studies (Steel, et al., 2005a). This trend can potentially be explained by situation-specific differences, which suggests that those with a greater stake in a topic are motivated to acquire information on that topic quicker than others (Ettema and Kline, 1977). Interestingly, while coastal residents indicated that they understood the global ocean issues best, they were not the respondents who scored the highest on the Ocean Quiz. The visitors in the categories of one to 10 visits and 10 to 50 visits scored the highest on the Ocean Quiz. However, scores for the Ocean Quiz were not significant across visitation frequencies.

With completion of this study, baseline data collection on the coastal visitor population has been extensive. This study, complemented by the 2012, 2013, 2014, and 2015 visitor intercept surveys at marine reserve sites, provides a description of the visitor population during the time period of marine reserve implementation. The visitor intercept studies will be replicated in future years, and that data will be compared to this baseline data to determine if there has been any change among the visitor population since marine reserve implementation.

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APPENDIX A

Visitor Intercept Questionnaire

2016 ODFW Ocean Visitor Survey

1. How many times have you visited the Oregon coast? **(Circle *ONE* letter)**

   A. This is my first visit
   B. 1-10
   C. 10-50
   D. 50+
   E. I live here **(Go to Q3)**

2. When you visit the Oregon coast, what is the **primary** activity you participate in? **(Circle *ONE* letter)**

   A. Fishing
   B. Water recreation (e.g., surfing, scuba, etc.)
   C. Beach recreation (e.g., tide pooling, walking, etc.)
   D. Wildlife viewing (e.g., birds, whales, sea lions, etc.)
   E. Other (write response) _____

3. Please indicate how well you feel you understand each of the following potential **global** ocean issues. **(Circle *ONE* number for *each*)**

Potential Ocean Issue	Not well			Somewhat		Very Well	Don't Know
Water pollution	1	2	3	4	5	6	7	8
Marine debris	1	2	3	4	5	6	7	8
Loss of marine biodiversity	1	2	3	4	5	6	7	8
Overfishing	1	2	3	4	5	6	7	8
Invasive/exotic species	1	2	3	4	5	6	7	8
Rising sea temperature	1	2	3	4	5	6	7	8
Ocean acidification and hypoxia	1	2	3	4	5	6	7	8
Wave energy/power development	1	2	3	4	5	6	7	8
Oil/gas exploration or transport	1	2	3	4	5	6	7	8

4. How informed do you consider yourself to be concerning ocean issues in **Oregon**? **(Circle *ONE*)**

Not Well	Somewhat	Well	Very Well	Unsure

5. Please indicate if you agree that each of the following is a threat to **Oregon's** marine areas.
(Circle *ONE* number for each)

Potential Ocean Issue	Strongly disagree			Neutral		Strongly agree	Don't Know
Water pollution	1	2	3	4	5	6	7	8
Marine debris	1	2	3	4	5	6	7	8
Loss of marine biodiversity	1	2	3	4	5	6	7	8
Overfishing	1	2	3	4	5	6	7	8
Invasive/exotic species	1	2	3	4	5	6	7	8
Rising sea temperature	1	2	3	4	5	6	7	8
Ocean acidification and hypoxia	1	2	3	4	5	6	7	8
Wave energy/power development	1	2	3	4	5	6	7	8
Oil/gas exploration or transport	1	2	3	4	5	6	7	8

6. In what ways do you currently obtain information about ocean related issues? **(Check *ALL THAT APPLY*)**

- ☐ A. Newspaper
- ☐ B. Magazine
- ☐ C. Other print media
- ☐ D. Family / friends
- ☐ E. Science education
- ☐ F. Radio
- ☐ G. Internet
- ☐ H. Social media
- ☐ I. Television
- ☐ J. Other (write response) _____
- ☐ K. I have not sought information on this topic

7. From the list in Question 6 (above), please **write the letter** of ***ONE*** **source** from which you would **prefer** to obtain information about ocean related issues.

Letter for source _____

8. To what extent do you agree or disagree with each of the following statements?
(Circle *ONE* number for each)

Statement	Strongly disagree			Neutral			Strongly agree	Don't Know
Public agencies have done a good job communicating about Oregon ocean issues	1	2	3	4	5	6	7	8
It is easy to obtain information about Oregon ocean issues	1	2	3	4	5	6	7	8

9. To what extent do you agree or disagree with each of the following statements?
(Circle *ONE* number for each)

Statement	Strongly disagree			Neutral			Strongly agree
I often feel a sense of oneness with the world around me	1	2	3	4	5	6	7
I often feel a kinship with animals and plants	1	2	3	4	5	6	7
I feel that all inhabitants of Earth, human and nonhuman, share a common "life force"	1	2	3	4	5	6	7
Like a tree can be part of a forest, I feel embedded within the broader natural world	1	2	3	4	5	6	7
I think of the natural world as a community to which I belong	1	2	3	4	5	6	7

For the following multiple-choice questions, please choose *ONE* response.

10. What is the most common type of harmful marine debris accumulating in the ocean?

A. Lost, abandoned or discarded fishing gear (e.g., ghost nets, lines, pots, etc.)
B. Plastics
C. Metal
D. Wood

11. What percent of the world's fisheries are commonly estimated to be either overexploited, depleted or in a state of collapse?

A. 10%
B. 25%
C. 50%
D. 80%

12. Which of the following marine habitats is most impacted long-term by an oil spill?

A. Deep sea and sea floor
B. Offshore open ocean
C. Nearshore, estuaries, and coral reefs
D. Inland rivers

13. Geographically, where is the greatest potential for wave energy resources?

A. At the poles (90° latitude)
B. At the equator (0° latitude)
C. Between 30° and 60° latitude, along western coasts
D. Between 30° and 60° latitude, along eastern coasts

14. Which of the following groups of marine organisms are most directly at risk from ocean acidification?

A. Deep ocean fish
B. Seabirds
C. Marine mammals
D. Shellfish and corals

15. Harmful Algal Blooms (HABs) in the ocean can lead to which of the following?

A. Harmful health effects from the consumption of fish and shellfish
B. Decreased fertilization of seabird eggs
C. Increased corrosion of marine vessels
D. Large-scale die-off of kelp forests

16. Please list your state or country of residence and zip code below:

A. STATE/COUNTRY_____ B. ZIP CODE_____

17. What is your age? _____ years

18. What is your gender? A. Male B. Female

19. What is the highest year of formal education you have completed? **(Circle ***ONE*** number)**

1 2 3 4 5 6 7 8 9 10 11 12	13 14 15 16	17 18 19 20 21 22 23 24+
(Elementary thru High school)	(College or Technical School)	(Graduate or Professional School)

20. Is there anything else you would like to tell us about your visit to the Oregon coast? Please use this space for your comments. We appreciate your cooperation.

_____

_____

_____

_____

ODFW USE ONLY

1. ID No._____
2. Date_____
3. Time _____
4. Sampling Location: _____

APPENDIX B

Ocean Quiz Answer Key and Sources

OCEAN QUIZ ANSWER KEY

Note: Following each question, the source of the information is cited.

10. What is the most common type of harmful marine debris accumulating in the ocean?
    A. Lost, abandoned or discarded fishing gear (e.g., ghost nets, lines, pots, etc.)
    B. Plastics
    C. Metal
    D. Wood

Sources:
https://marinedebris.noaa.gov/info/patch.html
http://www.unep.org/regionalseas/marinelitter/publications/docs/plastic_ocean_report.pdf

11. What percent of the world's fisheries are commonly estimated to be either overexploited, depleted or in a state of collapse?[11]
    A. 10%
    B. 25%
    C. 50%
    D. 80%

Sources:
http://www.fao.org/3/a-i5555e.pdf
http://science.sciencemag.org/content/314/5800/787.full
http://www.un.org/depts/los/convention_agreements/reviewconf/FishStocks_EN_A.pdf

12. Which of the following marine habitats is most impacted long-term by an oil spill?
    A. Deep sea and sea floor
    B. Offshore open ocean
    C. Nearshore, estuaries, and coral reefs
    D. Inland rivers

Sources:
http://www.noaa.gov/resource-collections/gulf-oil-spill
http://response.restoration.noaa.gov/sites/default/files/Oil_Spill_Coral.pdf

[11] See Appendix C for more information on this question.

13. Geographically, where is the greatest potential for wave energy resources?

A. At the poles (90° latitude)
B. At the equator (0° latitude)
C. Between 30° and 60° latitude, along western coasts
D. Between 30° and 60° latitude, along eastern coasts

Sources:

http://www.rnp.org/node/wave-tidal-energy-technology
http://www.boem.gov/Ocean-Wave-Energy/
http://www.energy.ca.gov/oceanenergy/

14. Which of the following groups of marine organisms are most directly at risk from ocean acidification?

A. Deep ocean fish
B. Seabirds
C. Marine mammals
D. Shellfish and corals

Sources:

http://ocean.nationalgeographic.com/ocean/ocean-issues-quiz/
http://ocean.si.edu/ocean-acidification
http://www.pmel.noaa.gov/co2/story/What+is+Ocean+Acidification%3F

15. Harmful Algal Blooms (HABs) in the ocean can lead to which of the following?

A. Harmful health effects from the consumption of fish and shellfish
B. Decreased fertilization of seabird eggs
C. Increased corrosion of marine vessels
D. Large-scale die-off of kelp forests

Sources:

http://oceanservice.noaa.gov/hazards/hab/
http://hab.ioc-unesco.org/index.php?option=com_content&view=article&id=5&Itemid=16
https://ioos.noaa.gov/project/detecting-harmful-algal-blooms-pacific-northwest/

APPENDIX C

Ocean Quiz Supplemental Analyses

ANALYSIS OF OCEAN QUIZ (OQ) WITH QUESTION 11 INCLUDED AND EXCLUDED

The response options for Q11 required the subjects to choose a specific proportion of world fisheries that are considered overexploited or depleted (10%, 25%, 50%, or 80%). Since there is not an exact answer to this question, a better option would have been to offer the respondent a series of response categories that allow a range (e.g., 0% to 20%; 20% to 40%; 40% to 60%, etc.). Since the question did not allow for that possible response, and since there is not a scientific consensus for this answer, the statistical analyses were run including and excluding Q11 as part of the OQ to ascertain if there was a substantive difference in the results. There was little change in the outcome. In the body of the report, the discussion only considers those results with Q11 included.

For either version of the OQ scale, the statistically significant relationships with factual knowledge were gender (males are higher), perceived understanding, education (years), and preferred information sources (recoded as internet, newspaper, radio, and other sources). For the OQ version without Q11, the relationship between factual knowledge and perceived threats was also statistically significant.

The OQ scale, both with and without Q11, was not related to the original eleven preferred information categories in the questionnaire. However, when the information categories were recoded to investigate evident trends in the data, the relationship was significant for both versions of the OQ scale.

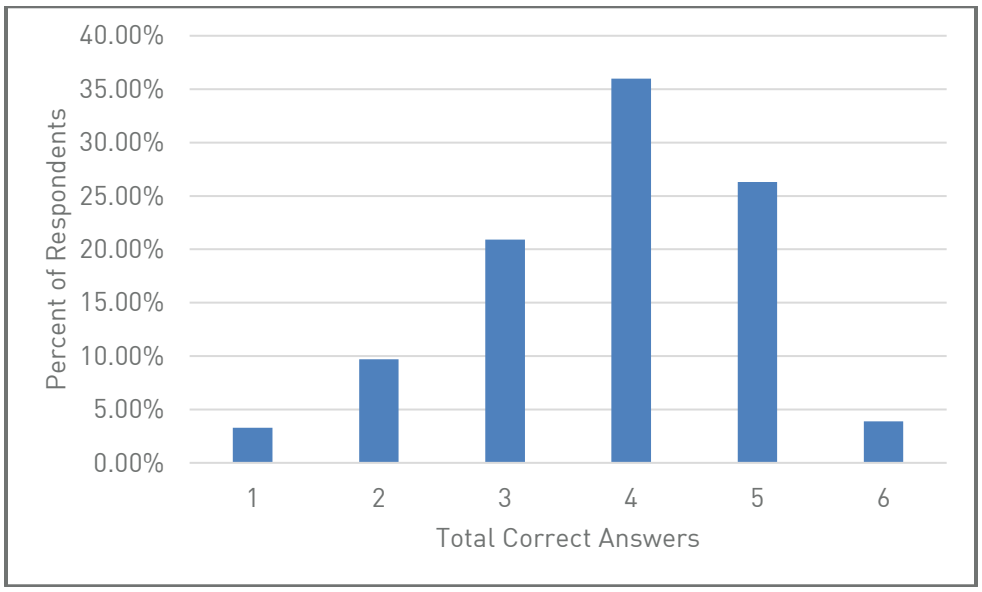
The OQ scale, both with and without Q11, was not related to age, primary activity, visitation, local/nonlocal residence, the degree respondents thought they were informed about Oregon ocean issues, and the CNS scores.

Table 22. Comparisons of OQ summed score with important variables

	P value		
Variables	**With Q11**	**Without Q11**	**Significant?**
Mean OQ score[1]	64%	72%	NA
OQ score distribution skew[2]	-0.446	-0.523	NA
Primary activity and OQ	0.123	0.355	NO
Vistation frequency and OQ	0.267	0.142	NO
Preferred info source and OQ	0.073	0.070	WEAKLY
Gender and OQ	0.015	0.024	YES
Age (years) and OQ	0.384	0.161	NO
Local residence and OQ	0.578	0.603	NO
Perceived threat and OQ	0.221	0.014	CHANGE[3]
Degree informed and OQ	0.707	0.346	NO
Perceived understanding and OQ	0.000	0.000	YES
CNS and OQ	0.660	0.114	NO
Education (in years) and OQ	0.049	0.028	YES
Preferred source recode (newspaper, radio, internet, all other sources) and OQ	0.034	0.045	WEAKLY

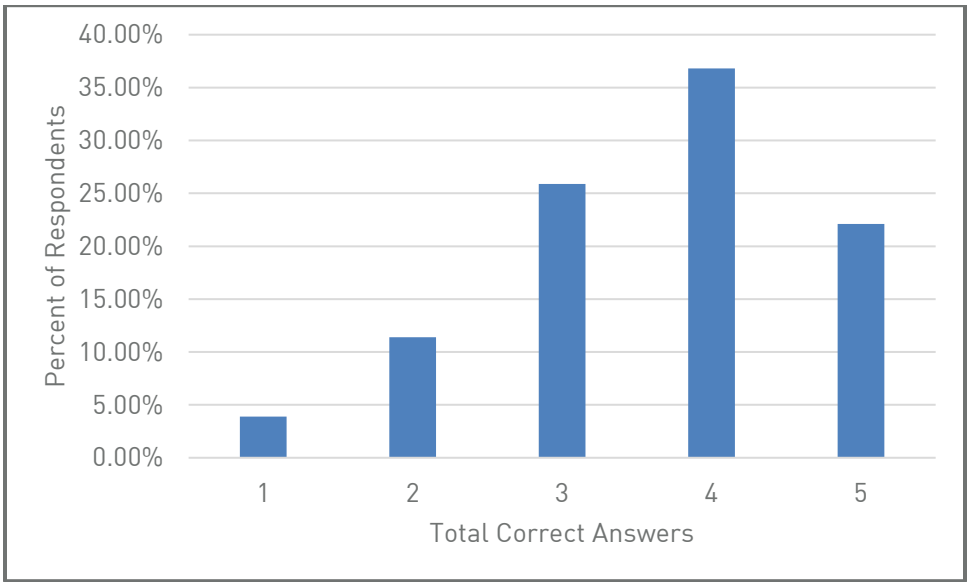
[1]Ocean Quiz score provided as a percentage, not a p value.
[2]Ocean Quiz score distribution skew provided as the amount the curve is skewed to the left, not as a p value.
[3]The only instance that the statistics changes from not significant to significant when removing question 11 is in the relationship between perceived threat and Ocean Quiz score.

Figure 14. Distribution of Total Factual Knowledge Scores with Question 11



N = 517; Missing = 112

Figure 15. Distribution of Total Factual Knowledge Scores without Question 11



N = 517; Missing = 112

APPENDIX D

Discussion of Perceived Understanding of OAH Statistics

DISCUSSION OF PERCEIVED UNDERSTANDING OF OCEAN ACIDIFICATION AND HYPOXIA

A Likert scale was used to collect data on respondents' perceived understanding of nine potential ocean issues. Since responses to these individual questions are ordinal data, the mean score is not a measure with definitive meaning. The inclusion of means with ordinal data in this report is to help general understanding of response distributions. Interpretation of the mean for a single item Likert scale is tenuous and should be approached with caution.

To determine if presenting the ocean issues as mean respondent scores was relevant and applicable, the mean, median, mode, and relative distribution of the scores for each item. For most variables, the mean, median, and mode were all within ±1 point, and the distribution was relatively normal. For the issue item ocean acidification and hypoxia, however, the mean and median were close, but the mode was much lower (Table 23).

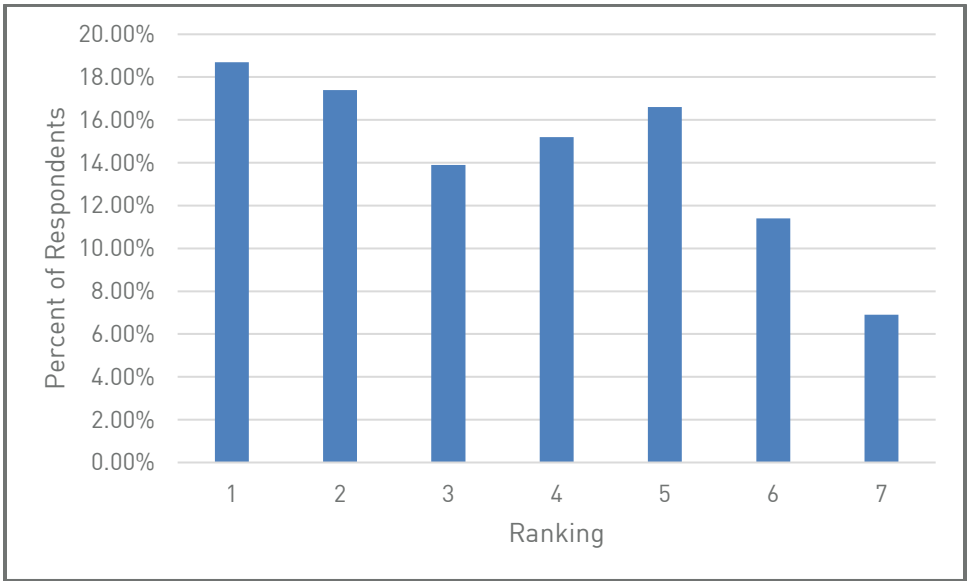
Table 23. Perceived Understanding of Ocean Acidification and Hypoxia

Mean	3.55
Median	3.50
Mode	1

N = 598; Missing = 4
Note: Respondents who selected the response "8 = Don't Know" were omitted.

The distribution of scores for perceived understanding of ocean acidification and hypoxia did not resemble a normal curve (Figure 16). These data suggest that respondents' perceived understanding of ocean acidification and hypoxia are quite varied with no consistent pattern.

Figure 16. Distribution of Scores for Perceived Understanding of Ocean Acidification and Hypoxia



N = 598; Missing = 4
Note: Respondents who selected the response "8 = Don't Know" were omitted.