Citizen Science, Communication, and Expertise: An Examination of the Port Townsend
Marine Science Center's Plastics Project

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A thesis
submitted in partial fulfillment of the
requirements for the degree of

Master of Marine Affairs

University of Washington

2011

Program Authorized to Offer Degree:
School of Marine and Environmental Affairs

University of Washington
Graduate School

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Abstract

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Citizen science projects have the opportunity to educate participants about environmental issues being studied first-hand and often in the field. The Port Townsend Marine Science Center's Plastics Project utilized volunteers to collect and sort through samples of sand on beaches to estimate the abundance of plastic marine debris on beaches throughout the Puget Sound of Washington State. Volunteers were surveyed to determine if educational benefits were evident, if participants were educating others and with what frequency, what communication media were used and preferred, and who participants identified as experts. All participants reported being better educated about plastic marine and most reported changes in their consumer behavior. Participants who educated others on a regular basis also attended environmental and plastic marine debris-focused events, and interacted with experts regularly. No other demographic variables examined were able to distinguish more active educators from less active. Participants used and preferred email and in-person communication media while social media and postal mail were among the least utilized. Participants identified a wide array of experts, including university scientists and Plastics Project staff. Citizen science projects may be beneficial at inducing consumer behavior changes and educating participants, and should take care to explore lectures and other in-person communication approaches to increase opportunities for learning. Participants' wide perception of expertise should be taken advantage of to increase opportunities for participant-expert interaction and address participant questions and concerns.

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ACKNOWLEDGEMENTS

I would first like to thank my advisor, Tom Leschine, for his help chopping down a multi-headed hydra of a thesis into something I could actually tackle in a year. Another big thank you to Kate Litle for agreeing to be on my committee in the first place and all her help with the survey and thesis drafts. You both deserve a huge pat on the back! Special thanks to Kate Hoffman and random Coastal Starlight train riders for their help writing survey questions. I could not have done any analysis without the help of Allie Stanko, Tatiana Maravina, and the Center for Social Science Computation and Research who are geniuses with statistical software packages. Thanks to Dr. Dave Fluharty for keeping a steady stream of plastic marine debris-related literature coming my way. I'm also indebted to my partner, Mike, my mother, the SMEA staff, and my friends for all their help along the way, and to my pet rabbit, Mickey, for providing cuddly distractions. Lastly, thanks to Anne Murphy, Jen Kingfisher, Dr. Joel Baker and the rest of the Port Townsend Marine Science Center staff and volunteers for putting on such a fantastic and unique citizen science project that has energized so many participants throughout the years!

Introduction

Public participation in scientific research, commonly referred to as *citizen science*, engages community volunteers to advance scientific understanding (Bonney, Ballard, et al., 2009). Citizen scientists may be employed in a variety of ways such as identifying bird species, playing online games to fold protein structures, or sharing computer processing power (Kostadinova, 2011). Citizen science does not require participants to have a scientific background as citizen scientists are generally trained to perform specific necessary tasks such as sample collection (Trumbull, Bonney, Bascom, & Cabral, 2000). Often citizen scientists are college educated, though participants may range in age from childhood to retirement (Bonney, Cooper, et al., 2009; Evans et al., 2005). Citizen science projects traditionally involved a one-way flow of information with volunteers collecting large amounts of data for a scientist. A two-way learning process, in which scientists learn of public values (Devictor, Whittaker, & Beltrame, 2010) and volunteers are educated about the scientific process, project goals, etc. (Bonney, Cooper, et al., 2009), is now supplementing older methods however. Hypotheses on public education suggest actively engaging in the citizen science data collection process enhances learning (Brossard, Lewenstein, & Bonney, 2005).

Citizen Science and Communication

Comprehension of project subject matter by citizen scientists may be increased by communicating through appropriate media. Studies show that cultural values (Leonard, Van Scotter, & Pakdil, 2009) and experience using media (King & Xia, 1997) influence preferences and acceptance of communication media, especially in regards to emerging

internet technologies. Furthermore, different methods of communication may be necessary for communicating with specific social groups (Burns, O'Connor, & Stocklmayer, 2003; Osborne, Simon, & Collins, 2003). Communicating science to the public encompasses a variety of topics including the understanding of scientific processes, enjoyment of science as entertainment or art, formation of opinions and attitudes, etc. (Burns et al., 2003).

Citizen science projects have utilized the Internet to link scientists with participants (Evans et al., 2005) but not all participants may have access to these technologies or find such media useful. Certain societal groups, for example older participants, may not have experience using new media technologies (e.g. email, social media, blogs, etc.) and thus not accept these media as relevant (Thayer & Ray, 2006). Educational material in a citizen science project should be delivered through media participants will consume; while Americans primarily receive science and technology information via television and the Internet (National Science Board, 2010), the average citizen scientist may prefer other media. Information about the project and results should be communicated regularly to further increase comprehension (Devictor et al., 2010).

While citizen science projects have found various ways to bring volunteers and scientists together, a definition of *scientist* or *expert* has not been formulated in the literature for these projects. Evans et al. showed interactions with research staff provided increased scientific knowledge for participants (2005) but did not allude to whom such research staff were (i.e. principal investigators, graduate or undergraduate students, lab techs, etc.). Statistically speaking, an expert can be defined as “one whose opinion adds information over and above what is provided by the observed data” (Lele & Allen, 2006, p. 683). In the

courtroom, experts are generally determined by education and training, although judges provide the final say (Thornton, 2009). But what characteristics determine an expert to the lay public: formal education, career history, fame, *je ne sais quoi*? A narrow definition might limit the ability of participants to interact with experts, while a broader definition could provide increased opportunities for interaction.

The Plastics Project

It is estimated that plastics account for 60-80% of all marine debris (Moore, 2008). Plastic marine debris (PMD) poses concern for wildlife as plastics are often mistaken for food (Gregory, 2009) and can accumulate in food webs (Eriksson, 2003). Larger plastics degrade in the marine environment to form microplastics, generally 1-5 mm in circumference (Barnes, Galgani, Thompson, & Barlaz, 2009). Plastic resin pellets (also referred to as *nurdles*), preproduction plastic pieces which are melted to form end-use products are a source of intentionally-created microplastics (Mato et al., 2001). Microplastics are common in consumer products such as facial cleansers to act as exfoliants (Fendall & Sewell, 2009). Microplastics can act as surfaces for attachment of environmental contaminants (Endo et al., 2005), namely polychlorinated biphenyls (PCBs), increasing the threat of PMD.

The Port Townsend Marine Science Center (PTMSC) started the Plastics Project in 2006 (Port Townsend Marine Science Center, 2011). The project recruited volunteers from local environmental organizations to collect and sieve sand on beaches at the highest wrack line throughout the Puget Sound region in Washington State. Three 1² m quadrats were sampled at each site. The participants then sorted and counted debris into eight categories. The goal of the project was to estimate the abundance of manmade debris, specifically PMD

and microplastics, accumulating on beaches and to determine plausible causations for variability. Sampling began in autumn 2008 and ended in spring 2011, with sampling occurring at each site once per autumn and spring season. An estimated 150 volunteers participated in beach sampling encompassing over 30 sites in 12 counties. Participants usually volunteered for one sampling season, contributing to turnover from year-to-year (A. Murphy, personal communication, April 28, 2010).

PTMSC held Plastics Summit 2010 (PS2010) in May of 2010 to familiarize Plastics Project participants with the environmental implications of PMD, project methods and goals, and preliminary results. The summit featured guest lectures from University of Washington and National Oceanic and Atmospheric Administration (NOAA) scientists. Approximately 80 participants attended the summit. Feedback from participants during the Summit inspired this study.

The DPSIR Framework

The European Environment Agency's DPSIR framework (Kristensen, 2004) is designed to aid systematic consideration of how Drivers, Pressures and State changes associated with an ecosystem Impact can be addressed through policy Responses that in turn address the aforementioned D, P, S and I. The framework is commonly used to illustrate the flow of information between scientists and policymakers and the human dimensions of environmental pollution. The Plastics Project is primarily a study of the *State* of the Puget Sound ecosystem, specifically the abundance of PMD on beaches.

Research Questions and Hypotheses

Participant Preferences for Communication Media

Determining the optimum strategy to communicate with participants in the Plastics Project and similar citizen science projects is a primary interest of this study. Communicating effectively such that participants receive information via participant-preferred media likely ensures that participants will acquaint themselves with the information rather than disregard educational and project-sensitive material (King & Xia, 1997; Leonard et al., 2009).

Research Question 1: What are the best media to convey information to participants?

Research Question 1a: Through which media do participants receive information about PMD most often?

Research Question 1b: Through which media do participants most prefer to receive environmentally-focused information?

As Americans primarily receive science and technology information via television and the Internet (*National Science Board, 2010*), it was hypothesized that environmentally-focused information would follow the same pattern.

Hypothesis 1: Television and Internet Media (including websites, blogs, and social media) will be used and preferred the most.

Literature reviewed suggests varying gender, educational, occupational and other demographic dissimilarities among participants may warrant specific communication strategies for different groups (Steel, Warner, & Lach, 2010; Trankina, 1993). Gender and education level were among the demographics asked of participants in this study.

Research Question 2: Do certain groups of participants prefer and/or utilize media differently than others in regards to receiving environmentally-focused information?

Participants themselves may utilize numerous media to convey information learned about PMD to others not involved with the Plastics Project. Younger people have been shown to be significantly more likely to use social networking sites than older adults (Zickuhr, 2010). Assuming both groups communicate with others the same amount, older individuals must use other media which may not utilize the Internet at all.

Research Question 3a: Through which media do participants convey information about PMD most often?

Research Question 3b: Are certain media used more or less often by different groups of participants based on age, gender, etc. to convey information about PMD?

Hypothesis 2: Gender, age, and education level will affect media participants use and prefer for sending and receiving information.

Participants as Educators

Participants in the citizen science project may have acted as educators, informing their familiars about PMD based on information gained through sampling and educational opportunities provided by the project. Participants may thus provide an expanded network of educational outreach opportunities for a citizen science project (Evans et al., 2005), in this case possibly leading to changes in consumer behavior toward plastic goods or other attitude changes.

Research Question 4: Are there groups of participants who convey information to other people about PMD more often and are there particular patterns of association among these participants (i.e. group identities)?

Across the board, citizen scientists in environmental projects seem to be older individuals with more free-time and a higher level of education. This could be because these types of participants are more scientifically-minded and thus more apt to volunteer their time for research. Preliminary observation of Plastics Project participants identified more vocal volunteers as older individuals whom sampled frequently and often held at least a bachelor's degree in an environmental field (personal observations).

Hypothesis 3: More active conveyors of information will be older, have a degree in an environmentally-related field, and will have sampled a greater number of times.

Anecdotal information from Plastics Project affiliates suggests certain participants were active educators. One project participant, for example, carried a matchbox of microplastic debris from sampling areas which she showed to people she tried to educate about PMD. Participants such as this will be deemed *direct educators*. Other participants employed a passive approach, sending – usually through email – news and journal articles about PMD to others. These passive educators will be deemed *recommenders*.

Research Question 5: What characteristics differentiate direct educators from recommenders?

Participant Interactions with Scientists, Researchers, and Other Experts

Citizen science projects often encourage interactions between participants and lead researchers to facilitate learning. Face-to-face interactions with researchers were of primary importance to participants in the Neighborhood Nestwatch program (Evans et al., 2005).

Research Question 6: How important do participants feel it is to directly interact with experts?

Recognized experts may provide guidance desired by citizen science participants with regards to proper sampling techniques, preliminary results, etc. However, definitions for experts vary greatly depending on context. Determining who participants perceive as experts could enable optimal participant-expert interactions to increase educational opportunities.

Research Question 7: Who do participants recognize as experts?

This study also aims to generate feedback on how citizen science projects may improve relations between experts and participants. It is also important to determine a baseline for how participants perceive interaction between experts and the project itself.

Research Question 8: What do participants sense about the level of assistance the projects receives from experts?

Research Question 9: In what ways do participants believe experts could assist the project and its participants?

Participant Research Interests following the DPSIR Model

Of interest in this study was what aspects of PMD research participants felt were most important. Participants may have preference for certain research questions – in effect

studying D, P, S, I or R – and thus be more likely to be better engaged in projects perceived as focused on addressing more important questions.

Research Question 10: Where do participants' interests for PMD research align on the DPSIR model?

Method

Plastics Project participants were surveyed following the Tailored Design Method for Internet surveys (Dillman, Smyth, & Christian, 2009). Due to Federal regulations, only subjects age 18 and older were surveyed. The survey was created using the University of Washington's Catalyst Web Tools WebQ (University of Washington Information Technology, 2011) and distributed via email. PTMSC did not keep a list of Plastics Project participants, instead relying on Program Coordinators from volunteer organizations such as Washington State University's Beach Watchers to manage participants. Surveys were thus solicited through the Program Coordinators. A few of the Program Coordinators were unsure of the exact number of volunteers who were Plastics Project participants. In these cases, estimations for participants were used. Population size was estimated at 125–140 participants with 53 completed surveys. Estimated response rate was thus 38–42%.

Research Questions 2 and 3b were unable to be examined due to the small sample size: media preference and utilization by certain groups of participants for sending and receiving environmentally or PMD-focused information. With the multitude of media available, distributions were simply too small to analyze statistically. Furthermore, Research Question 9, identifying ways participants believed experts could assist the Plastics Project, could not be fully addressed in this study. Participant responses to the survey question, "In what ways could scientists, researchers, and other experts assist the Plastics Project and/or the Plastics Project participants? Please be as specific as you feel you can," did not yield many concrete suggestions for assistance. Rather, participants often took this opportunity to express frustrations or confusions about the project.

The survey featured 36 closed-ended questions and five open-ended questions; though some closed questions did offer an “other” write-in option (see Appendix A). Responses were coded by the primary author in ATLAS.ti v.6 (“ATLAS.ti,” 2011). For Likert scale-type questions, descriptive statistics were analyzed using SPSS v.19 (“SPSS,” 2011) (see Appendix B). Two-by-two contingency tables were created to discern significant interactions between variables at the 95% confidence level with a one-tailed Fisher’s exact test of independence (FET). In cases of small sample sizes, approximation tests such as chi-square do not provide accurate test statistics. FET is most commonly used when there are two nominal variables arranged in two-by-two contingency tables, as was performed in this analysis, with the null hypothesis “that the relative proportions of one variable are independent of the second variable” (McDonald, 2009a). For example, FET concluded that of those participants who attended environmental events regularly, 68% (15/22) also attended PMD-focused events regularly, but of those who attended environmental events sporadically, only 22% (6/27) attended PMD-focused events regularly, a difference that was significant ($p = 0.002$). In this example, the relative proportion of regular attendees at the two types of events is significantly higher than that of mixed attendees (sporadic environmental event-goers attending PMD-focused events regularly).

Variables were grouped into binomial categories from closed-ended questions to provide frequencies for contingency tables (see Appendices B and C). Two particular response categories, *sporadically* and *regularly*, differ depending on the variable analyzed. Participants had more opportunities to attend general environmental events and convey information about PMD to others than the opportunity to attend a specifically PMD-focused

event or directly interact with an expert about PMD. In the context of attending environmental events and conveying information, *regularly* is defined as several times a month and weekly or more, while for attending PMD-focused events and interacting with an expert about PMD, *regularly* is defined as once a month or less, several times a month, and weekly or more.

A randomization test for goodness-of-fit using 10,000 replicates was used to determine if participants had preferences for DPSIR-grouped categories of PMD research. Null hypothesis assumed equal distribution of responses within a rank. Participants' top three ranks were analyzed. Fisher's tests (McDonald, 2009a) and the randomization test (McDonald, 2009b) were analyzed using Microsoft Excel spreadsheets provided by McDonald.

Results

Survey respondents were largely retired, older females (Table 1). Most did not hold an advanced (post-bachelor's) or environmental degree. Approximately half of the respondents had only participated in a sampling event one or two times at the time the survey was conducted. Demographic information including gender, retirement status, education, living on the waterfront, and attendance at PS2010 had no significant association with participant behavior.

Table 1. Demographic profile of participants

Participant Demographic Category	Frequency
Males	11
Females	41
Age 20-59	20
Age 60-79	32
Retired	33
Basic Degree (High School/GED, Associates, Bachelors)	30
Advanced Degree (Post-Bachelors)	20
Environmental Education	16
Sampled 1-2 Times	27
Sampled 3 or More Times	26

All participants agreed or strongly agreed they were more knowledgeable about PMD due to participating in PP (Figure 1). Valuation of the responses on a Likert scale with one being Strongly Agree and five as Strongly Disagree yielded a mean response of 1.64 ($SD = 0.48$).

Most participants agreed their consumer behavior had changed due to the information they have learned about PMD (Figure 2). Following the same Likert valuation, mean response was 1.77 ($SD = 0.70$). Half of the participants, however, were uncertain about

potential consumer behavior changes of other people participants had educated about PMD (Figure 2). For consumer behavior change of others educated about PMD, mean response was 2.60 ($SD = 0.72$), placing this response closer to agreement rather than disagreement.

Figure 1. Participant agreement with the statement, "I believe I am becoming better educated about plastic marine debris by my participation in the Plastics Project."

Figure 2. Participant agreement with the statement, "My behavior as a consumer has changed because of the information I have learned about plastic marine debris" (Participant CB) and, "I have noticed a change in the consumer behavior of others I have educated about plastic marine debris" (Other CB)

Participant Preferences for Communication Media

The ways in which participants have received information about PMD were very similar to their preferred methods of receiving information (Figure 3). Media most preferred and used to receive information included lectures and speaker events, training seminars (e.g.

Beach Watcher training events), email, magazines and newspapers, and community education centers (e.g. PTMSC). The least preferred and used media included podcasts, blogs, social media (e.g. Facebook), postal mail, and coworkers. Participants' top three out of five preference ranks were examined for receiving environmentally-focused information (Rank 1, $n = 52$; Rank 2, $n = 52$; Rank 3, $n = 49$).

Figure 3. Percent of participants who have received information about PMD via a specific media (actual) and participant preferences of media used for receiving environmentally-focused information (preferred)

Participants most often conveyed information about PMD to another person through conversations with friends, family members, and unfamiliar individuals (Figure 4). Concurrent with participant preference and use of media to receive information, the least used media to convey information included postal mail, social media posts (e.g. sharing on Facebook), and blog entries.

Figure 4. Media used by participants to send or convey information about PMD to another person

Participants as Educators

People who regularly conveyed PMD information (several times a month, or weekly or more) to others tended to attend educational activities of an environmental nature ($p = 0.030$; FET), educational activities where PMD was specifically discussed ($p = 0.059$; FET), and directly interact with an expert about PMD ($p = 0.047$; FET) more frequently. Due to the small sample size of this survey the effect of attendance at plastic events will be considered significant despite the p-value exceeding 0.05. No other factors had a significant effect on the frequency of PMD communication, including frequency of sampling, age, or education.

Three variables were likely interrelated: frequency of attending educational activities of an environmental nature (environmental event), frequency of attending educational activities where PMD was specifically discussed (plastic event), and frequency of directly interacting with an expert about PMD (interact expert) (Table 2). Participants whom attended

environmental events regularly (several times a month, or weekly or more) were more likely to regularly attend plastic events (once a month or less, several times a month, or weekly or more). Furthermore, participants whom regularly attended plastic events were more likely to regularly interact with experts (once a month or less, several times a month, or weekly or more). While there was no significant interaction between the frequency of attending environmental events and the frequency of interacting with an expert, a larger sample size would logically express this.

Table 2. P-values from FET displaying the interrelatedness of independent variables, * indicates $p < 0.05$

Variable	Plastic Event	Interact Expert
Environmental Event	$1.66 \times 10^{-3}*$	1.27×10^{-1}
Plastic Event	-	$3.41 \times 10^{-4}*$

None of the independent variables examined in this analysis were able to differentiate recommenders from direct educators as a method of communication.

Participant Interactions with Scientists, Researchers, and Other Experts

The majority of participants felt direct interaction with scientists, researchers, and other experts was very important (Figure 5). Using the same valuation as pervious Likert scale questions, mean response was 1.60 ($SD = 0.72$), well on the agreement side.

Figure 5. Responses for Question 4, “How important is it that scientists, researchers, and other experts directly interact with participants in programs such as the Port Townsend Marine Science Center Plastics Project?”

Participants recognized a broad range of people as experts (Table 3); Program Coordinators from the various volunteer organizations, PS2010 speakers, and PTMSC staff members were all listed. Participants with basic and advanced degrees recognized individuals in each category as experts. Frequent and infrequent samplers showed similar results. No statistical tests were performed with these data due to small frequencies.

Table 3. Participant-provided identifications of experts directly interacted with about PMD

N = 32; N = 30	Participants who Sampled 1-2 Times	Participants who Sampled 3+ Times	Advanced Degree	Basic Degree
Program Coordinator	8 62%	5 38%	3 27%	8 73%
PS2010 Speaker	2 22%	7 78%	3 38%	5 63%
PTMSC Staff	5 28%	13 72%	7 44%	9 56%

Participant responses varied for attitudes regarding the level of assistance the Plastics Project currently receives from scientists, researchers, and other experts (Figure 6). The majority of participants were unsure about the level of assistance, while 23 were able to provide an opinion by selecting “about right,” “could be somewhat improved,” or, “needs

considerable improvement.” Younger participants were significantly more likely ($p = 0.0499$; FET) to express an opinion about the level of assistance (12/20; 60%) compared to older participants (10/32; 31%). Similarly, participants who sampled three or more times were significantly more likely ($p = 0.013$; FET) to express an opinion (16/26; 62%) compared to infrequent samplers (7/27; 26%).

Figure 6. Responses for Question 5, “How do you feel about the level of assistance the Plastics Project gets from scientists, researchers, and other experts now?”

When asked about the ways experts could assist the Plastics Project and/or Plastics Project participants, responses were varied and often did not answer the question. Participants occasionally provided information about specific ways experts could provide assistance (e.g. securing more funding, explaining methods, etc.) but often expressed frustrations with the Project itself (e.g., stating that results had not been communicated to the participant’s liking, expressing confusion over what the project will “prove,” etc.). Overall, participants wanted to understand project results and wanted better communication with experts the most (Table 4).

Table 4. Responses for Question 6, “In what ways could scientists, researchers, and other experts assist the Plastics Project and/or the Plastics Project participants? Please be as specific as you feel you can.”

Response (code used)	Frequency	Percentage¹
Results	16	40.00%
Better communication with experts	14	35.00%
Clarify methods	7	17.50%
Participant expressed confusion over the scientific process	6	15.00%
More direct interaction with experts	6	15.00%
Good job already, no more assistance needed	4	10.00%
Provide participants with reasons for the project	4	10.00%
Help with funding	2	5.00%
How participants should educate others	2	5.00%
Publicity	2	5.00%

¹Percentage of sample population (N=40) used as responses were not mutually exclusive

Participant Research Interests following the DPSIR Model

When asked, participants preferred PMD research in the Impacts and Responses groups of the DPSIR model (rank 1, $n = 51$, $p = 0.005$; rank 2, $n = 51$, $p = 0$; rank 3, $n = 50$, $p = 0.007$) (Figure 7). Funding for studying States, including geographic distribution of PMD, ranked lowest.

Figure 7. Participant preferences for PMD research following the question, “Suppose you are in a position to fund research for up to 3 of the 8 aspects of plastic marine debris mentioned above. Please rank in order of importance which aspects of plastic marine debris research you would fund.”

Conclusions

Citizen science projects can be effective at educating citizens about environmental problems. In the present study, all participants stated they were more knowledgeable about PMD due to participating in the Plastics Project. This demonstrates that increased knowledge likely translated into action, another hypothesis that framed this study, as nearly all participants stated changes in their own consumer behavior. Almost half of participants reported changes in the consumer behavior of others educated about PMD, indicating participants may be adept and influential conveyors of information. The fact that 80% of participants conveyed information sporadically (once a month or less) makes reported consumer behavior changes in participant-educated individuals intriguing. It is important to note that these are believed behavior changes in others that participants educated or attempted to educate; this study did not follow-up with those educated by participants to be sure such changes took effect. Similarly, reported consumer behavior changes of participants were not verified for this analysis. Actual behavior changes in other individuals may have been more or less prevalent than reported by participants. Reports of consumer behavior changes in participants themselves, however, are likely accurate as participants would presumably be the best measures of their own consumer behavior. Citizen science projects may thus be effective at inducing behavior changes at a local level, with participants primarily conveying information conversationally combined with associated changes in consumer behavior.

Participant Preferences for Communication Media

Participants most often received and conveyed information in direct person-to-person interactions but also via email. Lecture/speaker events, training seminars, and communication/education centers were all among the most popular ways to receive information, with information most often conveyed conversationally. Preferences for communication media among the average American and Plastics Project participants differed, assuming preferences for receiving science and technology news (National Science Board, 2010) were the same as those for environmentally focused information. While the average American utilizes television and the Internet (defined here as websites, blogs, and social media), the average Plastics Project participant rarely relied on these technologies for information about plastic marine debris or environmentally-focused information.

It is important to note the relative lack of use and preference for new media technologies: social media, blogs and podcasts. While businesses may benefit from resources invested in new media, citizen science projects with similar participant demographics as the Plastics Project may not. Direct email communications may have been more effective than social media announcements to communicate information deriving from this project. Citizen science projects may want to advertise the new media to their participants to encourage and increase use of these technologies.

Participants as Educators

Frequent educators were also regular attendees at environmental and PMD-focused events, and frequently interacted with experts; however, one's engagement in environmental events, PMD-focused events, and interactions with experts was unable to be determined from

this study. Participants who performed one of these tasks on a regular basis were more likely to perform another regularly as well, an indication of the interrelatedness of these three variables. It is likely that the variables are measures of a fourth, higher-level variable, such as environmental stewardship, that was not assessed in this study. Future studies could seek to illustrate ways in which participation in these activities is interconnected, potentially shedding light on the nature of environmental stewardship beliefs and practices among citizens like the Plastics Project volunteers. The fact that attendance at events and interacting with experts correlated with an increase in the frequency of conveying environmental information shows positive effects for educating participants. Behavior changes, i.e. participants becoming better (more frequent) educators themselves, may be a result of the participant becoming better educated.

While it was hypothesized that frequent samplers would have been regular conveyors of information due to being more familiar with the project, this hypothesis was not supported in this study. Furthermore, neither age nor education had an effect on conveying information, another hypothesis that was not supported.

None of the examined variables were able to discern a difference between communication methods: directly educating or simply recommending sources of information to others. This suggests recommending information to or directly educating others may be a factor of the audience being educated rather than the behavior of the participant. Participants may adjust their education style to best suit the audience the participant is communicating with.

Participant Interactions with Scientists, Researchers, and Other Experts

Citizen science projects similar to the Plastics Project which have limited resources or access to PhD-holding scientists (herein referred to as *scientists*) could fulfill participant desires for expert interactions by more fully utilizing Program Coordinators and project staff (henceforth referred to as *staff*). Participants view staff as experts (see results) even though staff may not consider themselves experts for lack of specialized education. Staff should be confident that their knowledge of the citizen science project is sufficient to be an expert in this regard. Staff likely understands project goals, methods, hypotheses, reasons-for and science-of the project, etc. to about the same degree as scientists. This information can be conveyed to participants via lectures (the most preferred mode of receiving information) or briefings in a similar manner as a university/college professor. Using staff as experts instead of scientists could increase opportunities for expert interaction. Citizen science projects should not assume scientists are needed to fulfill participant desires for interaction.

Citizen science projects should take care to provide participants with preliminary results, as the lack of understanding results was the most common concern participants had with the Plastics Project. Citizen science projects should also provide ample opportunities for participants to interact with experts, the second most common suggestion from the survey. It is intriguing that participants who attended PS2010 responded similarly regarding suggestions for assistance from experts, as those who had not attended the event. PS2010 provided participants with preliminary results, reasons for the project and the science involved, explanations of the methodology, etc. Despite the amount of information PS2010 provided participants, this one event seemed to have little effect on participant behavior and

knowledge of the Plastics Project. Citizen science projects should perhaps focus on increasing the number of events to increase learning and comprehension of project-sensitive material.

More frequent samplers and younger participants expressed an opinion on the level of assistance the project received from experts significantly more than any other groups. This could be because more frequent samplers were more familiar with the project. Younger participants may be more vocal critics than older participants who are simply participating for pleasure, but exact reasoning for these phenomena are uncertain.

Participant Research Interests following the DPSIR Model

Despite sampling for a study of ecosystem States (the abundance of PMD on beaches along Puget Sound), participants, when asked to allocate funds hypothetically to research on PMD, would have allocated the least amount of funding to these types of studies if given the choice. Participant preference of research importance were primarily in the Impacts and Responses categories with funding especially allocated to studies of PMD's impacts on human health and marine life, and ways to reduce the abundance of PMD. The relative noninterest in funding for studies of ecosystem States (i.e. environmental quality) may indicate a reason for the high turnover of participants seen in the Plastics Project; participants rarely volunteered for more than one sampling season. Based on the results from this study, citizen science projects that focus on Drivers, Pressures, and States could appeal to participant interests by educating participants about the feedback mechanisms of the framework. Studies of Pressures and States, for example, are important for determining the intensity of Impacts and therefore the importance of Response actions.

Discussion and Recommendations

Citizen science projects should be deliberate in choosing media to interact with participants. Plastics Project participants showed almost no use or preference for social media or other Internet technologies other than email, which could be common for citizen scientists altogether. Citizen science projects with similar participant demographics as the Plastics Project would be most effective in communicating with volunteers via email or in-person lecture and speaker events. Determining participant preferences for communication media could optimize the potential to reach project education goals and decrease time and money invested in unpreferred media. Social media and the blogosphere provide quick and easy ways for citizen science projects to engage with participants, so these media should not be terminated entirely. Advertising the use of new media technologies could help to increase use of social media and blogs by participants. New media may be especially useful for engaging younger participants (Zickuhr, 2010) which could help to expand the demographics of citizen science projects.

Project staff members should be utilized to increase opportunities for participants to interact with experts. Allowing participants the opportunity to have questions answered about the project may facilitate learning and engagement, increasing the number of sampling events volunteers participate in. People perceived to be experts are likely the best candidates to educate participants about the project, so this broad definition is particularly useful. In the future, the Plastics Project and similar projects should use expert authority from a variety of sources for conveying information to participants. Citizen science projects would do well to find and recruit experts, using a broader definition than simply *scientist*, who could be

presented to participants. These experts should not only increase the amount of interactions with participants, but also be sure to provide participants with information perceived important to maintaining their attention, especially preliminary results as they become available. These experts should be prepared to answer questions on the reasoning and science behind the citizen science project, including questions on methodology.

Communication with participants should take place early and often to enhance involvement with the citizen science project. Participants frequently stated the desire to know results, rationale for sampling methods, and why PMD was being sampled to begin with. This was true even with those who had attended PS2010 where such topics were discussed. Regularly conveying the reasons for the project, along with sampling methodology and preliminary results would help to ensure all participants are informed of these topics. Educated participants may be more engaged in the project: sampling more often, educating others about the project and perhaps recruiting new volunteers. Citizen science participants should not be viewed as labor for data collection, but as people who desire to become better educated about the projects in which they participate.

Future studies should track consumer behavior changes of citizen scientists and individuals that participants have educated about project goals, outcomes, etc. Citizen science projects may be effective catalysts of consumer behavior change as nearly all participants in this study indicated such phenomena. Education may thus not be the only outcome of a citizen science project. Projects could tailor communication methods to augment consumer behavior changes depending on the results of such studies.

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APPENDIX A: SURVEY AS PRESENTED TO PARTICIPANTS

PTMSC Plastic Marine Debris

Environmental Outreach & Education Events

Question 1.

For what environmental outreach/education organizations have you attended an event within the past 12-18 months? Please check all that apply.

- ☐ People for Puget Sound's Sound Citizens
- ☐ Port Townsend Marine Science Center
- ☐ Puget Sound Partnership
- ☐ Seattle Aquarium's Beach Naturalists
- ☐ University of Washington's Sound Science
- ☐ Washington Shore Stewards
- ☐ Washington State University (WSU) Beach Watchers
- ☐ Washington State University (WSU) Sound Waters
- ☐ I have attended an event, or multiple events, but cannot recall which one(s)
- ☐ None
- ☐ Other: please specify, include a semicolon (;) between multiple organizations (e.g. organization 1; organization 2)

Question 2.

Did you attend Port Townsend Marine Science Center's Plastics Summit 2010, which was held in May 2010 at Fort Worden State Park?

- ☐ Yes
- ☐ No
- ☐ Don't remember

Question 3.

Approximately how many times have you participated in sampling (including collecting sand, sorting debris, and counting debris) for the Plastics Project?

- ☐ 1-2 times
- ☐ 3-5 times
- ☐ 6-10 times
- ☐ More than 10 times
- ☐ Don't remember

Question 4.

How important is it that scientists, researchers, and other experts directly interact with participants in programs such as the Port Townsend Marine Science Center Plastics Project?

- ☐ Very important
 - ☐ Important
 - ☐ Not sure
 - ☐ Relatively unimportant
 - ☐ Not at all important
-

Assistance from Scientists, Researchers and Other Experts**Question 5.**

How do you feel about the level of assistance the Plastics Project gets from scientists, researchers, and other experts now?

- ☐ About right
- ☐ Could be somewhat improved
- ☐ Needs considerable improvement
- ☐ I don't know how much assistance the project gets
- ☐ I am aware of such assistance but I am unsure or cannot evaluate

Question 6.

In what ways could scientists, researchers, and other experts assist the Plastics Project and/or the Plastics Project participants? Please be as specific as you feel you can.

(Short response question)

Educational Activities of an Environmental Nature

For the purposes of this survey, "educational activities of an environmental nature" consist of events such as Port Townsend Marine Science Center's Plastics Summit 2010, workshops/events at the Seattle Aquarium, Beach Watcher training, and other similar events of environmental education that have formal organizational sponsors.

Question 7.

During the past 12-18 months, what is the approximate frequency of educational activities of an environmental nature you have attended?

- ☐ Once a year or less
- ☐ Once a month or less
- ☐ Several a month
- ☐ Weekly or more
- ☐ Don't remember

Question 8.

During the past 12-18 months, what is the approximate frequency of educational activities of an environmental nature you have attended in which plastic marine debris was specifically discussed?

- ☐ Once a year or less
- ☐ Once a month or less
- ☐ Several a month
- ☐ Weekly or more
- ☐ Don't remember

Participant Outreach

Question 9.

Compared to other people you know who do not participate in the Plastics Project, how much more knowledgeable do you consider yourself to be in regards to environmental implications of plastic marine debris?

- ☐ Much more knowledgeable
- ☐ More knowledgeable
- ☐ About the same
- ☐ Less knowledgeable
- ☐ Can't judge

Question 10.

Why did you choose to participate in the Port Townsend Marine Science Center's Plastics Project?

(Short response question)

Sending and Receiving Environmental Information**Question 11.**

Scientists, researchers, and other experts can convey information through many different media. Of the following, which of these communication methods have you received information about plastic marine debris within the past 12-18 months? Please check all that apply.

- ☐ Agency Reports (e.g. WA Department of Ecology, Fish & Wildlife, etc.)
- ☐ Blogs
- ☐ Books
- ☐ Community Education Centers (e.g. Seattle Aquarium, Port Townsend Marine Science Center, etc.)
- ☐ Coworkers
- ☐ Email
- ☐ Foundation/NGO Websites (e.g. Algalita Foundation, 5 Gyres Project, etc.)
- ☐ Friends/Family Members
- ☐ Lectures/Speaker Events
- ☐ Magazines/Newspapers
- ☐ Movies/Documentaries
- ☐ Podcasts
- ☐ Postal Mail
- ☐ Radio
- ☐ Scholarly Journals (e.g. Nature, Science, Marine Pollution Bulletin, etc.)
- ☐ Social Media (e.g. Facebook, Twitter, LinkedIn, etc.)
- ☐ Television
- ☐ Training Seminars (e.g. Beach Watcher training, etc.)
- ☐ University/College Courses
- ☐ None (I have not received information on plastic marine debris within the past 12-18 months)
- ☐ Don't remember
- ☐ Other: please describe

Question 12.

Citizens may receive information from many different media. Please rank your top 5 most-preferred modes of receiving environmentally-focused information. If you prefer fewer than 5 modes, you may leave the remaining menus unchanged.

Rows

1st Choice: Most Preferred (drop-down menus)

2nd Choice

3rd Choice

4th Choice

5th Choice

(Choices for each drop-down menu)

- ☐ Agency Reports (e.g. WA Department of Ecology, Fish & Wildlife, etc.)
 - ☐ Blogs
 - ☐ Books
 - ☐ Community Education Centers (e.g. Seattle Aquarium, Port Townsend Marine Science Center, etc.)
 - ☐ Coworkers
 - ☐ Email
 - ☐ Foundation/NGO Websites (e.g. Algalita Foundation, 5 Gyres Project, etc.)
 - ☐ Friends/Family Members
 - ☐ Lectures/Speaker Events
 - ☐ Magazines/Newspapers
 - ☐ Movies/Documentaries
 - ☐ Podcasts
 - ☐ Postal Mail
 - ☐ Radio
 - ☐ Scholarly Journals (e.g. Nature, Science, Marine Pollution Bulletin, etc.)
 - ☐ Social Media (e.g. Facebook, Twitter, LinkedIn, etc.)
 - ☐ Television
 - ☐ Training Seminars (e.g. Beach Watcher training, etc.)
 - ☐ University/College Courses
 - ☐ Other
-

Sending and Receiving Environmental Information

Question 13.

During the past 12-18 months, what is the approximate frequency of occasions where you have directly interacted with a scientist, researcher, or other expert about plastic marine debris?

- ☐ Once a year or less
- ☐ Once a month or less
- ☐ Several a month
- ☐ Weekly or more
- ☐ Don't remember

Question 14.

Referring to the question above: who were the scientists, researchers, or other experts you directly interacted with about plastic marine debris? Exact names are not necessary, but please describe to the best of your ability.

Sending and Receiving Environmental Information

Question 15.

Citizens can convey information through many different media. Of the following, which of these communication methods have you sent or conveyed information about plastic marine debris to another person within the past 12-18 months? Please check all that apply.

- ☐ Blog Entry
- ☐ Conversation with Friends
- ☐ Conversation with Family Members
- ☐ Conversation with Coworkers
- ☐ Conversation with Another Person (non-relative, non-coworker, non-friend)
- ☐ Email
- ☐ Lecture/Talk
- ☐ Postal Mail
- ☐ Social Media Post (e.g. Facebook, Twitter, LinkedIn, etc.)
- ☐ None (I have not sent information on plastic marine debris within the past 12-18 months)
- ☐ Don't remember
- ☐ Other: please describe

Question 16.

Referring to the question above: During the past 12-18 months, what is the approximate frequency of occasions where you have sent or conveyed information about plastic marine debris to another person?

- ☐ Once a year or less
- ☐ Once a month or less
- ☐ Several a month
- ☐ Weekly or more
- ☐ Don't remember

When people convey information about an environmental issue, they tend to do so in one of two ways: By *recommending* a type of media (e.g. book, newspaper article) to another person for that person to learn more about the issue on their own; or by *directly educating* the target audience by informing the audience about the issue to the best of the person's knowledge.

Question 17.

When you send environmentally-related information to another person, more often than not, are you *recommending* a type of media to another person or *directly educating* the another person? Please choose the one item that best applies to you.

- ☐ Almost always only recommending
 - ☐ Mostly recommending and sometimes directly educating
 - ☐ Recommending and directly educating at about the same degree
 - ☐ Mostly directly educating and sometimes recommending
 - ☐ Almost always directly educating
 - ☐ Can't evaluate
-

Educating Others

Please indicate on the given range your level of agreement with the following statements based on your own experience and observations:

Question 18.

I believe I am becoming better educated about environmental problems by my participation in the activities in which I engage.

- ☐ Strongly Agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly Disagree
- ☐ Don't know

Question 19.

I believe I am becoming better educated about plastic marine debris by my participation in the Plastics Project.

- ☐ Strongly Agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly Disagree
- ☐ Don't know

Question 20.

My behavior as a consumer has changed because of the information I have learned about plastic marine debris.

- ☐ Strongly Agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly Disagree
- ☐ Don't know

Question 21.

I have noticed a change in the consumer behavior of others I have educated about plastic marine debris.

- ☐ Strongly Agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly Disagree
- ☐ Don't know

Plastic Marine Debris

The following questions will ask how important you feel it is for the public to know information about an aspect of plastic marine debris.

How important do you feel it is for the public to know about:

Question 22.

Quantity of plastic goods consumed annually in the United States

- ☐ Very Important
- ☐ Important
- ☐ Unimportant
- ☐ Very unimportant
- ☐ Don't know

Question 23.

Breakdown/fate of plastic marine debris once in the water

- ☐ Very Important
- ☐ Important
- ☐ Unimportant
- ☐ Very unimportant
- ☐ Don't know

Question 24.

Where plastic marine debris found on shorelines comes from and how it got there

- ☐ Very Important
- ☐ Important
- ☐ Unimportant
- ☐ Very unimportant
- ☐ Don't know

Question 25.

Vertical distribution of plastic marine debris in the water column

- ☐ Very Important
- ☐ Important
- ☐ Unimportant
- ☐ Very unimportant
- ☐ Don't know

Question 26.

Distribution of plastic marine debris among geographic regions (Puget Sound, Pacific Ocean, etc.)

- ☐ Very Important
- ☐ Important
- ☐ Unimportant
- ☐ Very unimportant
- ☐ Don't know

Question 27.

Effects of plastic marine debris on human health

- ☐ Very Important
- ☐ Important
- ☐ Unimportant
- ☐ Very unimportant
- ☐ Don't know

Question 28.

Effects of plastic marine debris on marine life

- ☐ Very Important
- ☐ Important
- ☐ Unimportant
- ☐ Very unimportant
- ☐ Don't know

Question 29.

Ways to help reduce the abundance of plastic marine debris

- ☐ Very Important
- ☐ Important
- ☐ Unimportant
- ☐ Very unimportant

☐ Don't know

Question 30.

Is there anything else you feel it is important for the public to know about plastic marine debris?

(Short response question)

Question 31.

Suppose you are in a position to fund research for up to 3 of the 8 aspects of plastic marine debris mentioned above.

Please rank **in order of importance** which aspects of plastic marine debris research you would fund. You may select the same aspect multiple times if you feel it is especially important.

Rows

Most important (drop-down menus)

Moderately important

Less important

(Choices for each drop-down menu)

☐	Quantity of plastic goods consumed in the United States
☐	Breakdown/fate of plastic marine debris once in the water
☐	Where plastic marine debris found on shorelines comes from and how it got there
☐	Vertical distribution of plastic marine debris in the water column
☐	Distribution of plastic marine debris among geographic regions (Puget Sound, Pacific Ocean, etc.)
☐	Effects of plastic marine debris on human health
☐	Effects of plastic marine debris on marine life
☐	Ways to help reduce the abundance of plastic marine debris
☐	Don't know

Personal Background Information

Question 32.

What is your gender?

- ☐ Male
☐ Female

Question 33.

What was your age on your last birthday?

(Short response question)

Question 34.

Where do you maintain your primary residence?

- ☐ California
- ☐ Canada
- ☐ Idaho
- ☐ Montana
- ☐ Oregon
- ☐ Other
- ☐ Washington: please specify county

Question 35.

Do you consider yourself to live "on the water" along a marine shoreline in the greater Puget Sound? (e.g. directly adjacent to a shoreline, on a bluff, or very near the water)

Logic destinations

- ☐ Yes ➔ Shoreline Property
- ☐ No ➔ Formal Education
- No response* ➔ Shoreline Property

Shoreline Property**Question 36.**

Is your shoreline property your primary or secondary residence?

- ☐ Primary residence
- ☐ Secondary residence
- ☐ Both primary and secondary residence

Formal Education

Question 37.

What is the highest formal education degree you earned?

- ☐ High School or GED
- ☐ Associates
- ☐ Bachelors
- ☐ Post-Bachelors (e.g. Masters, PhD, MD, etc.)
- ☐ Other: please specify

Question 38.

Were one or more of your degrees beyond high school in an environmentally-related field? This would include non-natural science degrees with an environmental focus (e.g. environmental sciences, environmental policy, marine affairs, etc.)

Logic destinations

- ☐ Yes ➔ Environmental Education
- ☐ No ➔ Employment
- ☐ Not sure ➔ Environmental Education
- No response* ➔ Environmental Education

Environmental Education

Question 39.

In which field(s) was your environmentally-focused degree(s)? You may select more than one response.

- ☐ Business
- ☐ Communications/Journalism
- ☐ Education
- ☐ English/Literature
- ☐ Environmental Studies
- ☐ Law
- ☐ Marine or Environmental Affairs/Policy
- ☐ Medicine/Public Health
- ☐ Natural Sciences (e.g. physics, chemistry, etc.)
- ☐ Public Policy
- ☐ Social Sciences (e.g. psychology, sociology, etc.)
- ☐ Other: please specify

Employment

Question 40.

Does your current primary occupation, or if retired your previous occupation, have an environmental focus?

- ☐ Yes
- ☐ No
- ☐ Don't know

Question 41.

Which of these categories best describes you?

- ☐ Retired
- ☐ Student
- ☐ Employed
- ☐ Currently Unemployed
- ☐ Other: please specify

APPENDIX B:

RESPONSES WITH DESCRIPTIVE STATISTICS

Question 1. Total responses (N): 53 Did not respond: 0

For what environmental outreach/education organizations have you attended an event within the past 12-18 months? Please check all that apply.

Answer	Frequency	Percentage*
People for Puget Sound's Sound Citizens	7	13.21%
Port Townsend Marine Science Center	20	37.74%
Puget Sound Partnership	6	11.32%
Seattle Aquarium's Beach Naturalists	3	5.66%
University of Washington's Sound Science	1	1.89%
Washington Shore Stewards	3	5.66%
Washington State University (WSU) Beach Watchers	38	71.70%
Washington State University (WSU) Sound Waters	3	5.66%
I have attended an event, or multiple events, but cannot recall which one(s)	3	5.66%
None	3	5.66%
Other	15	28.30%

*Percentage of sample population (N=53) used as responses are not mutually exclusive

Question 2. Total responses (N): 52 Did not respond: 1

Did you attend Port Townsend Marine Science Center's Plastics Summit 2010, which was held in May 2010 at Fort Worden State Park?

Answer	Frequency	Percentage
Yes	15	28.85%
No	37	71.15%
Don't remember	0	0.00%

Question 3. Total responses (N): 53 Did not respond: 0

Approximately how many times have you participated in sampling (including collecting sand, sorting debris, and counting debris) for the Plastics Project?

Answer	Frequency	Percentage
1-2 times	27	50.94%
3-5 times	20	37.74%
6-10 times	6	11.32%
More than 10 times	0	0.00%
Don't remember	0	0.00%

Grouped for Analysis: N=53

Answer	Frequency	Percentage
1-2 times	27	50.94%
3+ times	26	49.06%

Question 4. Total responses (N): 53 Did not respond: 0

How important is it that scientists, researchers, and other experts directly interact with participants in programs such as the Port Townsend Marine Science Center Plastics Project?

Numeric Value	Answer	Frequency	Percentage
1	Very important	27	50.94%
2	Important	21	39.62%
3	Not sure	4	7.55%
4	Relatively unimportant	1	1.89%
5	Not at all important	0	0.00%
Mean		1.60	
Standard Deviation		0.72

Question 5. Total responses (N): 53 Did not respond: 0

How do you feel about the level of assistance the Plastics Project gets from scientists, researchers, and other experts now?

Answer	Frequency	Percentage
About right	13	24.53%
Could be somewhat improved	8	15.09%
Needs considerable improvement	2	3.77%
I don't know how much assistance the project gets	28	52.83%
I am aware of such assistance but I am unsure or cannot evaluate	2	3.77%

Grouped for Analysis: N=53

Answer	Frequency	Percentage
Any level of assistance: About right; Could be somewhat improved; and Needs considerable improvement	23	43.40%
Don't know: I don't know how much assistance the project gets; and I am aware of such assistance but I am unsure or cannot evaluate	30	56.60%

Question 6. Total responses (N): 40 Did not respond: 13

In what ways could scientists, researchers, and other experts assist the Plastics Project and/or the Plastics Project participants? Please be as specific as you feel you can.

(Short response question)

Answer (codes used)	Frequency	Percentage*
Better communication	14	35.00%
Confusion over the scientific process	6	15.00%
Funding	2	5.00%
Good job already	4	10.00%
How to educate others	2	5.00%
Methods	7	17.50%
More direct interaction	6	15.00%
Publicity	2	5.00%
Reasons for the project	4	10.00%
Results	16	40.00%

*Percentage of sample population (N=40) used as responses are not mutually exclusive

Question 7. Total responses (N): 53 Did not respond: 0

During the past 12-18 months, what is the approximate frequency of educational activities of an environmental nature you have attended?

Answer	Frequency	Percentage
Once a year or less	6	11.32%
Once a month or less	24	45.28%
Several a month	20	37.74%
Weekly or more	3	5.66%
Don't remember	0	0.00%

Grouped for Analysis: N=53

Answer	Frequency	Percentage
Sporadically: Once a year or less; and Once a month or less	30	56.60%
Regularly: Several a month; and Weekly or more	23	43.40%

Question 8. Total responses (N): 53 Did not respond: 0

During the past 12-18 months, what is the approximate frequency of educational activities of an environmental nature you have attended in which plastic marine debris was specifically discussed?

Answer	Frequency	Percentage
Once a year or less	28	52.83%
Once a month or less	20	37.74%
Several a month	0	0.00%
Weekly or more	1	1.89%
Don't remember	4	7.55%

Grouped for Analysis: N=49

Answer	Frequency	Percentage
Sporadically: Once a year or less	28	57.14%
Regularly: Once a month or less; Several a month; and Weekly or more	21	42.86%

Question 9. Total responses (N): 53 Did not respond: 0

Compared to other people you know who do not participate in the Plastics Project, how much more knowledgeable do you consider yourself to be in regards to environmental implications of plastic marine debris?

Answer	Frequency	Percentage
Much more knowledgeable	20	37.74%
More knowledgeable	30	56.60%
About the same	2	3.77%
Less knowledgeable	0	0.00%
Can't judge	1	1.89%

Question 10. Total responses (N): 47 Did not respond: 6

Why did you choose to participate in the Port Townsend Marine Science Center's Plastics Project?

Answer (codes used)	Frequency	Percentage*
Accessibility	3	6.38%
Course assignment	2	4.26%
Environmental stewardship	18	38.30%
Extra time	2	4.26%
Interested in project	10	21.28%
Organizational volunteering option	16	34.04%
Plastics are a problem	7	14.89%
Referral from a friend	1	2.13%

*Percentage of sample population (N=47) used as responses are not mutually exclusive

Question 11. Total responses (N): 53 Did not respond: 0

Scientists, researchers, and other experts can convey information through many different media. Of the following, which of these communication methods have you received information about plastic marine debris within the past 12-18 months? Please check all that apply.

Answer	Frequency	Percentage*
Agency Reports (e.g. WA Department of Ecology, Fish & Wildlife, etc.)	13	24.53%
Blogs	6	11.32%
Books	14	26.42%
Community Education Centers (e.g. Seattle Aquarium, Port Townsend Marine Science Center, etc.)	24	45.28%
Coworkers	6	11.32%
Email	34	64.15%
Foundation/NGO Websites (e.g. Algalita Foundation, 5 Gyres Project, etc.)	8	15.09%
Friends/Family Members	14	26.42%
Lectures/Speaker Events	31	58.49%
Magazines/Newspapers	23	43.40%
Movies/Documentaries	14	26.42%
Podcasts	3	5.66%
Postal Mail	1	1.89%
Radio	10	18.87%
Scholarly Journals (e.g. Nature, Science, Marine Pollution Bulletin, etc.)	16	30.19%
Social Media (e.g. Facebook, Twitter, LinkedIn, etc.)	4	7.55%
Television	14	26.42%
Training Seminars (e.g. Beach Watcher training, etc.)	31	58.49%
University/College Courses	11	20.75%
None (I have not received information on plastic marine debris within the past 12-18 months)	4	7.55%
Don't remember	0	0.00%
Other	1	1.89%

*Percentage of sample population (N=53) used as responses are not mutually exclusive

Question 12.

Citizens may receive information from many different media. Please rank your top 5 most-preferred modes of receiving environmentally-focused information. If you prefer fewer than 5 modes, you may leave the remaining menus unchanged.

Rank 1: Total responses (N): 52 Did not respond: 1

Answer	Frequency	Percentage
Agency Reports (e.g. WA Department of Ecology, Fish & Wildlife, etc.)	3	5.77%
Blogs	0	0.00%
Books	0	0.00%
Community Education Centers (e.g. Seattle Aquarium, Port Townsend Marine Science Center, etc.)	3	5.77%
Coworkers	1	1.92%
Email	13	25.00%
Foundation/NGO Websites (e.g. Algalita Foundation, 5 Gyres Project, etc.)	0	0.00%
Friends/Family Members	1	1.92%
Lectures/Speaker Events	6	11.54%
Magazines/Newspapers	7	13.46%
Movies/Documentaries	0	0.00%
Podcasts	0	0.00%
Postal Mail	1	1.92%
Radio	2	3.85%
Scholarly Journals (e.g. Nature, Science, Marine Pollution Bulletin, etc.)	4	7.69%
Social Media (e.g. Facebook, Twitter, LinkedIn, etc.)	1	1.92%
Television	0	0.00%
Training Seminars (e.g. Beach Watcher training, etc.)	9	17.31%
University/College Courses	1	1.92%
Other	0	0.00%

Rank 2: Total responses (N): 52 Did not respond: 1

Answer	Frequency	Percentage
Agency Reports (e.g. WA Department of Ecology, Fish & Wildlife, etc.)	3	5.77%
Blogs	1	1.92%
Books	2	3.85%
Community Education Centers (e.g. Seattle Aquarium, Port Townsend Marine Science Center, etc.)	6	11.54%
Coworkers	0	0.00%
Email	5	9.62%
Foundation/NGO Websites (e.g. Algalita Foundation, 5 Gyres Project, etc.)	1	1.92%
Friends/Family Members	1	1.92%
Lectures/Speaker Events	10	19.23%
Magazines/Newspapers	4	7.69%
Movies/Documentaries	2	3.85%
Podcasts	0	0.00%
Postal Mail	0	0.00%
Radio	3	5.77%
Scholarly Journals (e.g. Nature, Science, Marine Pollution Bulletin, etc.)	2	3.85%
Social Media (e.g. Facebook, Twitter, LinkedIn, etc.)	0	0.00%
Television	2	3.85%
Training Seminars (e.g. Beach Watcher training, etc.)	7	13.46%
University/College Courses	3	5.77%
Other	0	0.00%

Rank 3: Total responses (N): 49 Did not respond: 4

Answer	Frequency	Percentage
Agency Reports (e.g. WA Department of Ecology, Fish & Wildlife, etc.)	2	4.08%
Blogs	0	0.00%
Books	0	0.00%
Community Education Centers (e.g. Seattle Aquarium, Port Townsend Marine Science Center, etc.)	5	10.20%
Coworkers	0	0.00%
Email	2	4.08%
Foundation/NGO Websites (e.g. Algalita Foundation, 5 Gyres Project, etc.)	1	2.04%
Friends/Family Members	0	0.00%
Lectures/Speaker Events	12	24.49%
Magazines/Newspapers	3	6.12%
Movies/Documentaries	7	14.29%
Podcasts	0	0.00%
Postal Mail	0	0.00%
Radio	3	6.12%
Scholarly Journals (e.g. Nature, Science, Marine Pollution Bulletin, etc.)	4	8.16%
Social Media (e.g. Facebook, Twitter, LinkedIn, etc.)	0	0.00%
Television	3	6.12%
Training Seminars (e.g. Beach Watcher training, etc.)	5	10.20%
University/College Courses	2	4.08%
Other	0	0.00%

Rank 4: Total responses (N): 42 Did not respond: 11

Answer	Frequency	Percentage
Agency Reports (e.g. WA Department of Ecology, Fish & Wildlife, etc.)	2	4.76%
Blogs	0	0.00%
Books	4	9.52%
Community Education Centers (e.g. Seattle Aquarium, Port Townsend Marine Science Center, etc.)	4	9.52%
Coworkers	0	0.00%
Email	1	2.38%
Foundation/NGO Websites (e.g. Algalita Foundation, 5 Gyres Project, etc.)	2	4.76%
Friends/Family Members	1	2.38%
Lectures/Speaker Events	6	14.29%
Magazines/Newspapers	2	4.76%
Movies/Documentaries	8	19.05%
Podcasts	0	0.00%
Postal Mail	2	4.76%
Radio	5	11.90%
Scholarly Journals (e.g. Nature, Science, Marine Pollution Bulletin, etc.)	2	4.76%
Social Media (e.g. Facebook, Twitter, LinkedIn, etc.)	0	0.00%
Television	1	2.38%
Training Seminars (e.g. Beach Watcher training, etc.)	2	4.76%
University/College Courses	0	0.00%
Other	0	0.00%

Rank 5: Total responses (N): 38 Did not respond: 15

Answer	Frequency	Percentage
Agency Reports (e.g. WA Department of Ecology, Fish & Wildlife, etc.)	1	2.63%
Blogs	0	0.00%
Books	3	7.89%
Community Education Centers (e.g. Seattle Aquarium, Port Townsend Marine Science Center, etc.)	5	13.16%
Coworkers	0	0.00%
Email	4	10.53%
Foundation/NGO Websites (e.g. Algalita Foundation, 5 Gyres Project, etc.)	1	2.63%
Friends/Family Members	3	7.89%
Lectures/Speaker Events	2	5.26%
Magazines/Newspapers	4	10.53%
Movies/Documentaries	1	2.63%
Podcasts	1	2.63%
Postal Mail	1	2.63%
Radio	1	2.63%
Scholarly Journals (e.g. Nature, Science, Marine Pollution Bulletin, etc.)	0	0.00%
Social Media (e.g. Facebook, Twitter, LinkedIn, etc.)	1	2.63%
Television	3	7.89%
Training Seminars (e.g. Beach Watcher training, etc.)	6	15.79%
University/College Courses	1	2.63%
Other	0	0.00%

Question 13. Total responses (N): 53 Did not respond: 0

During the past 12-18 months, what is the approximate frequency of occasions where you have directly interacted with a scientist, researcher, or other expert about plastic marine debris?

Answer	Frequency	Percentage
Once a year or less	33	62.26%
Once a month or less	15	28.30%
Several a month	0	0.00%
Weekly or more	1	1.89%
Don't remember	4	7.55%

Grouped for Analysis: N=49

Answer	Frequency	Percentage
Sporadically: Once a year or less	33	67.35%
Regularly: Once a month or less; Several a month; and Weekly or more	16	32.65%

Question 14. Total responses (N): 44 Did not respond: 9

Referring to the question above: who were the scientists, researchers, or other experts you directly interacted with about plastic marine debris? Exact names are not necessary, but please describe to the best of your ability.

Answer (codings)	Frequency	Percentage*
Program Coordinators	13	29.55%
Plastics Summit 2010 Speaker	9	20.45%
PTMSC Staff Member	18	40.91%

*Percentage of sample population (N=44) used as responses are not mutually exclusive

Question 15. Total responses (N): 53 Did not respond: 0

Citizens can convey information through many different media. Of the following, which of these communication methods have you sent or conveyed information about plastic marine debris to another person within the past 12-18 months? Please check all that apply.

Answer	Frequency	Percentage*
Blog Entry	1	1.89%
Conversation with Friends	41	77.36%
Conversation with Family Members	30	56.60%
Conversation with Coworkers	17	32.08%
Conversation with Another Person	34	64.15%
Email	24	45.28%
Lecture/Talk	10	18.87%
Postal Mail	3	5.66%
Social Media Post	2	3.77%
None	7	13.21%
Don't Remember	1	1.89%
Other	3	5.66%

*Percentage of sample population used (N=53) as responses are not mutually exclusive

Question 16. Total responses (N): 53 Did not respond: 0

Referring to the question above: During the past 12-18 months, what is the approximate frequency of occasions where you have sent or conveyed information about plastic marine debris to another person?

Answer	Frequency	Percentage
Once a year or less	10	18.87%
Once a month or less	30	56.60%
Several a month	7	13.21%
Weekly or more	3	5.66%
Don't remember	3	5.66%

Grouped for Analysis: N=50

Answer	Frequency	Percentage
Sporadically: Once a year or less; and Once a month or less	40	80.00%
Regularly: Several a month; and Weekly or more	10	20.00%

Question 17. Total responses (N): 52 Did not respond: 1

When you send environmentally-related information to another person, more often than not, are you *recommending* a type of media to another person or *directly educating* the another person? Please choose the one item that best applies to you.

Answer	Frequency	Percentage
Almost always only recommending	2	3.85%
Mostly recommending and sometimes directly educating	9	17.31%
Recommending and directly educating at about the same degree	10	19.23%
Mostly directly educating and sometimes recommending	12	23.08%
Almost always directly educating	11	21.15%
Can't evaluate	8	15.38%

Grouped for Analysis: N=34

Answer	Frequency	Percentage
Recommenders: Almost always only recommending; and Mostly recommending and sometimes directly educating	11	32.35%
Direct Educators: Almost always directly educating; and Mostly directly educating and sometimes recommending	23	67.65%

Question 18. Total responses (N): 53 Did not respond: 0

I believe I am becoming better educated about environmental problems by my participation in the activities in which I engage.

Numeric Value	Answer	Frequency	Percentage
1	Strongly agree	34	64.15%
2	Agree	19	35.85%
3	Don't know	0	0.00%
4	Disagree	0	0.00%
5	Strongly Disagree	0	0.00%
Mean		1.36	
Standard Deviation		0.48

Question 19. Total responses (N): 53 Did not respond: 0

I believe I am becoming better educated about plastic marine debris by my participation in the Plastics Project.

Numeric Value	Answer	Frequency	Percentage
1	Strongly agree	19	35.85%
2	Agree	34	64.15%
3	Don't know	0	0.00%
4	Disagree	0	0.00%
5	Strongly Disagree	0	0.00%
Mean		1.64	
Standard Deviation		0.07

Question 20. Total responses (N): 53 Did not respond: 0

My behavior as a consumer has changed because of the information I have learned about plastic marine debris.

Numeric Value	Answer	Frequency	Percentage
1	Strongly agree	18	33.96%
2	Agree	31	58.49%
3	Don't know	2	3.77%
4	Disagree	2	3.77%
5	Strongly Disagree	0	0.00%
Mean		1.77	
Standard Deviation		0.70

Question 21. Total responses (N): 53 Did not respond: 0

I have noticed a change in the consumer behavior of others I have educated about plastic marine debris.

Numeric Value	Answer	Frequency	Percentage
1	Strongly agree	3	5.66%
2	Agree	19	35.85%
3	Don't know	27	50.94%
4	Disagree	4	7.55%
5	Strongly Disagree	0	0.00%
Mean		2.60	
Standard Deviation		0.72

Question 22. Total responses (N): 53 Did not respond: 0

Quantity of plastic goods consumed annually in the United States

Numeric Value	Answer	Frequency	Percentage
1	Very important	42	79.25%
2	Important	11	20.75%
3	Don't know	0	0.00%
4	Unimportant	0	0.00%
5	Very unimportant	0	0.00%
Mean		1.21	
Standard Deviation		0.41

Question 23. Total responses (N): 53 Did not respond: 0

Breakdown/fate of plastic marine debris once in the water

Numeric Value	Answer	Frequency	Percentage
1	Very important	45	84.91%
2	Important	7	13.21%
3	Don't know	0	0.00%
4	Unimportant	1	1.89%
5	Very unimportant	0	0.00%
Mean		1.19	
Standard Deviation		0.52

Question 24. Total responses (N): 53 Did not respond: 0

Where plastic marine debris found on shorelines comes from and how it got there

Numeric Value	Answer	Frequency	Percentage
1	Very important	42	79.25%
2	Important	11	20.75%
3	Don't know	0	0.00%
4	Unimportant	0	0.00%
5	Very unimportant	0	0.00%
Mean		1.21	
Standard Deviation		0.41

Question 25. Total responses (N): 53 Did not respond: 0

Vertical distribution of plastic marine debris in the water column

Numeric Value	Answer	Frequency	Percentage
1	Very important	26	49.06%
2	Important	23	43.40%
3	Don't know	2	3.77%
4	Unimportant	2	3.77%
5	Very unimportant	0	0.00%
Mean		1.62	
Standard Deviation		0.74

Question 26. Total responses (N): 53 Did not respond: 0
 Distribution of plastic marine debris among geographic regions (Puget Sound, Pacific Ocean, etc.)

Numeric Value	Answer	Frequency	Percentage
1	Very important	24	45.28%
2	Important	29	54.72%
3	Don't know	0	0.00%
4	Unimportant	0	0.00%
5	Very unimportant	0	0.00%
Mean		1.55	
Standard Deviation		0.50

Question 27. Total responses (N): 53 Did not respond: 0
Effects of plastic marine debris on human health

Numeric Value	Answer	Frequency	Percentage
1	Very important	38	71.70%
2	Important	15	28.30%
3	Don't know	0	0.00%
4	Unimportant	0	0.00%
5	Very unimportant	0	0.00%
Mean		1.28	
Standard Deviation		0.45

Question 28. Total responses (N): 53 Did not respond: 0
Effects of plastic marine debris on marine life

Numeric Value	Answer	Frequency	Percentage
1	Very important	49	92.45%
2	Important	4	7.55%
3	Don't know	0	0.00%
4	Unimportant	0	0.00%
5	Very unimportant	0	0.00%
Mean		1.08	
Standard Deviation		0.27

Question 29. Total responses (N): 53 Did not respond: 0
 Ways to help reduce the abundance of plastic marine debris

Numeric Value	Answer	Frequency	Percentage
1	Very important	45	84.91%
2	Important	7	13.21%
3	Don't know	1	1.89%
4	Unimportant	0	0.00%
5	Very unimportant	0	0.00%
Mean		1.17	
Standard Deviation		0.43

Question 30. Total responses (N): 18 Did not respond: 35
 Is there anything else you feel it is important for the public to know about plastic marine debris?

No codes created for this question.

Question 31.

Suppose you are in a position to fund research for up to 3 of the 8 aspects of plastic marine debris mentioned above.

Rank 1: Total responses (N): 51 Did not respond: 2

Answer	Frequency	Percentage
Quantity of plastic goods consumed in the United States	6	11.76%
Breakdown/fate of plastic marine debris once in the water	7	13.73%
Where plastic marine debris found on shorelines comes from and how it got there	7	13.73%
Vertical distribution of plastic marine debris in the water column	0	0.00%
Distribution of plastic marine debris among geographic regions (Puget Sound, Pacific Ocean, etc.)	2	3.92%
Effects of plastic marine debris on human health	9	17.65%
Effects of plastic marine debris on marine life	6	11.76%
Ways to help reduce the abundance of plastic marine debris	14	27.45%
Don't know	0	0.00%

Grouped for Analysis: N=51

Answer	Frequency	Weighted Frequency*	Weighted Percent
Driving Forces: Quantity of plastic goods consumed in the United States	6	6.00	16.00%
Pressures: Breakdown/fate of plastic marine debris once in the water	7	7.00	18.67%
States: Where plastic marine debris found on shorelines comes from and how it got there; Vertical distribution of plastic marine debris in the water column; and Distribution of plastic marine debris among geographic regions	9	3.00	8.00%
Impacts: Effects of plastic marine debris on human health; and Effects of plastic marine debris on marine life	15	7.50	20.00%
Responses: Ways to help reduce the abundance of plastic marine debris	14	14.00	37.33%

*Frequency divided by the number of categories in a grouping, e.g. States: $9/3=3$.

Rank 2: Total responses (N): 51 Did not respond: 2

Answer	Frequency	Percentage
Quantity of plastic goods consumed in the United States	2	3.92%
Breakdown/fate of plastic marine debris once in the water	6	11.76%
Where plastic marine debris found on shorelines comes from and how it got there	3	5.88%
Vertical distribution of plastic marine debris in the water column	0	0.00%
Distribution of plastic marine debris among geographic regions (Puget Sound, Pacific Ocean, etc.)	4	7.84%
Effects of plastic marine debris on human health	12	23.53%
Effects of plastic marine debris on marine life	18	35.29%
Ways to help reduce the abundance of plastic marine debris	6	11.76%
Don't know	0	0.00%

Grouped for Analysis: N=51

Answer	Frequency	Weighted Frequency*	Weighted Percent
Driving Forces: Quantity of plastic goods consumed in the United States	2	2.00	5.33%
Pressures: Breakdown/fate of plastic marine debris once in the water	6	6.00	16.00%
States: Where plastic marine debris found on shorelines comes from and how it got there; Vertical distribution of plastic marine debris in the water column; and Distribution of plastic marine debris among geographic regions	7	2.33	6.22%
Impacts: Effects of plastic marine debris on human health; and Effects of plastic marine debris on marine life	30	15.00	40.00%
Responses: Ways to help reduce the abundance of plastic marine debris	6	6.00	16.00%

*Frequency divided by the number of categories in a grouping, e.g. States: $7/3=2.33$.

Rank 3: Total responses (N): 50 Did not respond: 3

Answer	Frequency	Percentage
Quantity of plastic goods consumed in the United States	3	6.00%
Breakdown/fate of plastic marine debris once in the water	8	16.00%
Where plastic marine debris found on shorelines comes from and how it got there	4	8.00%
Vertical distribution of plastic marine debris in the water column	2	4.00%
Distribution of plastic marine debris among geographic regions (Puget Sound, Pacific Ocean, etc.)	0	0.00%
Effects of plastic marine debris on human health	6	12.00%
Effects of plastic marine debris on marine life	15	30.00%
Ways to help reduce the abundance of plastic marine debris	12	24.00%
Don't know	0	0.00%

Grouped for Analysis: N=50

Answer	Frequency	Weighted Frequency*	Weighted Percent
Driving Forces: Quantity of plastic goods consumed in the United States	3	3.00	8.00%
Pressures: Breakdown/fate of plastic marine debris once in the water	8	8.00	21.33%
States: Where plastic marine debris found on shorelines comes from and how it got there; Vertical distribution of plastic marine debris in the water column; and Distribution of plastic marine debris among geographic regions	6	2.00	5.33%
Impacts: Effects of plastic marine debris on human health; and Effects of plastic marine debris on marine life	21	10.50	28.00%
Responses: Ways to help reduce the abundance of plastic marine debris	12	12.00	32.00%

*Frequency divided by the number of categories in a grouping, e.g. States: 6/3=2.00.

Question 32. Total responses (N): 52 Did not respond: 1
What is your gender?

Numeric Value	Answer	Frequency	Percentage
1	Male	11	21.15%
2	Female	41	78.85%
Mean		1.79	
Standard Deviation		0.41

Question 33. Total responses (N): 52 Did not respond: 1
What was your age on your last birthday?

Answer	Frequency	Percentage
20-29	6	11.54%
30-39	0	0.00%
40-49	4	7.69%
50-59	10	19.23%
60-69	23	44.23%
70-79	9	17.31%
Mean	58.79	
Standard Deviation	14.12

Grouped for Analysis: N=52

Answer	Frequency	Percentage
20-59	20	38.46%
60+	32	61.54%

Question 34. Total responses (N): 53 Did not respond: 0
Where do you maintain your primary residence?

Answer	Frequency	Percentage
Washington State	53	100.00%

Question 35. Total responses (N): 53 Did not respond: 0
Do you consider yourself to live "on the water" along a marine shoreline in the greater Puget Sound? (e.g. directly adjacent to a shoreline, on a bluff, or very near the water)

Answer	Frequency	Percentage
Yes	32	60.38%
No	21	39.62%

Question 36. Total responses (N): 32 Did not respond: 0
Is your shoreline property your primary or secondary residence?

Answer	Frequency	Percentage
Primary residence	28	87.50%
Both primary and secondary residence	3	9.38%
Secondary residence	1	3.12%

Grouped for Analysis: N=53

Answer	Frequency	Percentage
Primarily Lives on Water: Primary residence; and Both primary and secondary residence	31	58.49%
Secondarily or Does Not Live on Water: Secondary residence; and does not live on water from Q35	22	41.51%

Question 37. Total responses (N): 53 Did not respond: 0

What is the highest formal education degree you earned?

Answer	Frequency	Percentage
High School or GED	1	1.89%
Associates	7	13.21%
Bachelors	22	41.51%
Post-Bachelors (e.g. Masters, PhD, MD, etc.)	20	37.74%
Other: please specify	3	5.66%

Grouped for Analysis: N=50

Answer	Frequency	Percentage
Basic Degree: High School or GED; Associates; and Bachelors	30	60.00%
Advanced Degree: Post-Bachelors	20	40.00%

Question 38. Total responses (N): 53 Did not respond: 0

Were one or more of your degrees beyond high school in an environmentally-related field? This would include non-natural science degrees with an environmental focus (e.g. environmental sciences, environmental policy, marine affairs, etc.)

Answer	Frequency	Percentage
Yes	16	30.19%
No	37	69.81%
Not sure	0	41.51%

Question 39. Total responses (N): 16 Did not respond: 0

In which field(s) was your environmentally-focused degree(s)? You may select more than one response.

Answer	Frequency	Percentage*
Business	0	0.00%
Communications/Journalism	0	0.00%
Education	1	6.25%
English/Literature	0	0.00%
Environmental Studies	7	43.75%
Law	1	6.25%
Marine or Environmental Affairs/Policy	3	18.75%
Medicine/Public Health	3	18.75%
Natural Sciences (e.g. physics, chemistry, etc.)	6	37.50%
Public Policy	1	6.25%
Social Sciences (e.g. psychology, sociology, etc.)	0	0.00%
Other: please specify	0	0.00%

*Percentage of sample population (N=16) used as responses are not mutually exclusive

Grouped for Analysis: N=53

Answer	Frequency	Percentage
Natural/Environmental Degree: Environmental Studies; Marine or Environmental Affairs/Policy; and Natural Sciences	13	24.53%
Non-Natural/Environmental Degree: Education; Law; Medicine/Public Health; Public Policy; and no environmental degree from Q38	40	75.47%

Question 40. Total responses (N): 52 Did not respond: 1

Does your current primary occupation, or if retired your previous occupation, have an environmental focus?

Answer	Frequency	Percentage
Yes	15	28.85%
No	36	69.23%
Don't know	1	1.92%

Question 41. Total responses (N): 52 Did not respond: 1
Which of these categories best describes you?

Answer	Frequency	Percentage
Retired	33	63.46%
Student	3	5.77%
Employed	12	23.08%
Currently Unemployed	2	3.85%
Other: please specify	2	3.85%

Grouped for Analysis: N=50

Answer	Frequency	Percentage
Retired: Retired	33	66.00%
Not Retired: Student; Employed; and Currently unemployed	17	34.00%

APPENDIX C: QUANTITATIVE ANALYSIS

1. Randomization Tests for Goodness-of-Fit: Rankings with a star (*) are significant at the $\alpha = 0.05$ level.
 - a. DPSIR Model Rankings: Question 31
 - i. 10,000 replicates were used for each analysis with the null hypothesis of equal distribution of responses within each category. The alternative hypothesis used was an unequal distribution of responses, indicating preference of a certain category or the preference of multiple categories.
 1. Rank 1: P-Value = 0.005*
 - a. Driving Forces: 6
 - b. Pressures: 7
 - c. States: 9
 - d. Impacts: 15
 - e. Responses: 14
 2. Rank 2: P-Value = 0.000*
 - a. Driving Forces: 2
 - b. Pressures: 6
 - c. States: 7
 - d. Impacts: 30
 - e. Responses: 6
 3. Rank 3: P-Value = 0.007*
 - a. Driving Forces: 3
 - b. Pressures: 8
 - c. States: 6
 - d. Impacts: 21
 - e. Responses: 12

2. Fisher's Exact Tests of Independence: Rankings with a star (*) are significant at the $\alpha = 0.05$ level. Results are organized by independent variable, followed by the various dependent variables analyzed for significance. Column and row totals display the proportion of the sample population in the independent and dependent variable tested, respectively, in percent. Proportions, in percent, expressed in the two-by-two matrix tested using Fisher's Exact Test of Independence were calculated using the frequency of the column total (independent variable) as the denominator to illustrate proportions analyzed.

a. Frequency of Sampling

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.412

N = 53	Participants who Sampled 1-2 Times	Participants who Sampled 3+ Times	Row Total
Environmental Event Regularly ¹	10 (37%)	13 (50%)	23 (43%)
Environmental Event Sporadically ¹	17 (73%)	13 (50%)	30 (57%)
Column Total	27 (51%)	26 (49%)	

ii. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 0.393

N = 49	Participants who Sampled 1-2 Times	Participants who Sampled 3+ Times	Row Total
Plastic Event Regularly ²	9 (36%)	12 (50%)	21 (43%)
Plastic Event Sporadically ²	16 (64%)	12 (50%)	28 (57%)
Column Total	25 (51%)	24 (49%)	

iii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 1.00

N = 49	Participants who Sampled 1-2 Times	Participants who Sampled 3+ Times	Row Total
Interact Expert Regularly ²	8 (31%)	8 (35%)	16 (33%)
Interact Expert Sporadically ²	18 (69%)	15 (65%)	33 (67%)
Column Total	26 (53%)	23 (47%)	

iv. Plastics Project Current Level of Assistance from Experts: P-Value = 0.013*

N = 53	Participants who Sampled 1-2 Times	Participants who Sampled 3+ Times	Row Total
Any Level of Assistance	7 (26%)	16 (62%)	23 (43%)
Don't Know Level of Assistance	20 (74%)	10 (38%)	30 (57%)
Column Total	27 (51%)	26 (49%)	

v. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.725

N = 50	Participants who Sampled 1-2 Times	Participants who Sampled 3+ Times	Row Total
Frequency of Sending Regularly ¹	4 (16%)	6 (24%)	10 (20%)
Frequency of Sending Sporadically ¹	21 (84%)	19 (76%)	40 (80%)
Column Total	25 (50%)	25 (50%)	

vi. Recommending or Directly Educating: P-Value = 1.00

N = 34	Participants who Sampled 1-2 Times	Participants who Sampled 3+ Times	Row Total
Recommenders	6 (33%)	5 (31%)	11 (32%)
Direct Educators	12 (67%)	11 (69%)	23 (68%)
Column Total	18 (53%)	16 (47%)	

b. Frequency of Educational Activities of an Environmental Nature Attended

i. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 0.002*

N = 49	Environmental Event Regularly ¹	Environmental Event Sporadically ¹	Row Total
Plastic Event Regularly ²	15 (68%)	6 (22%)	21 (43%)
Plastic Event Sporadically ²	7 (32%)	21 (78%)	28 (57%)
Column Total	22 (45%)	27 (55%)	

ii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 0.127

N = 49	Environmental Event Regularly ¹	Environmental Event Sporadically ¹	Row Total
Interact Expert Regularly ²	10 (45%)	6 (22%)	16 (33%)
Interact Expert Sporadically ²	12 (55%)	21 (55%)	33 (67%)
Column Total	22 (45%)	27 (55%)	

iii. Plastics Project Current Level of Assistance: P-Value = 0.590

N = 53	Environmental Event Regularly ¹	Environmental Event Sporadically ¹	Row Total
Any Level of iv. Assistance	11 (48%)	12 (40%)	23 (43%)
Don't Know Level of Assistance	12 (52%)	18 (60%)	30 (57%)
Column Total	23 (43%)	30 (57%)	

vi. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.030*

N = 50	Environmental Event Regularly ¹	Environmental Event Sporadically ¹	Row Total
Frequency of Sending Regularly ¹	8 (35%)	2 (7%)	10 (20%)
Frequency of Sending Sporadically ¹	15 (65%)	25 (93%)	40 (80%)
Column Total	23 (46%)	27 (54%)	

vii. Recommending or Directly Educating: P-Value = 1.00

N = 34	Environmental Event Regularly ¹	Environmental Event Sporadically ¹	Row Total
Recommenders	5 (33%)	6 (32%)	11 (32%)
Direct Educators	10 (67%)	13 (68%)	23 (68%)
Column Total	15 (44%)	19 (56%)	

c. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.002*

N = 49	Plastic Event Regularly ²	Plastic Event Sporadically ²	Row Total
Environmental Event Regularly ¹	15 (71%)	7 (25%)	22 (45%)
Environmental Event Sporadically ¹	6 (29%)	21 (75%)	27 (55%)
Column Total	21 (43%)	28 (57%)	

ii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 0.000*

N = 46	Plastic Event Regularly ²	Plastic Event Sporadically ²	Row Total
Interact Expert Regularly ²	12 (63%)	3 (11%)	15 (33%)
Interact Expert Sporadically ²	7 (37%)	24 (89%)	31 (67%)
Column Total	19 (41%)	27 (59%)	

iii. Plastics Project Current Level of Assistance: P-Value = 1.00

N = 49	Plastic Event Regularly ²	Plastic Event Sporadically ²	Row Total
Any Level of Assistance	9 (43%)	11 (39%)	20 (41%)
Don't Know Level of Assistance	12 (57%)	17 (61%)	29 (59%)
Column Total	21 (43%)	28 (57%)	

iv. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.059

N = 46	Plastic Event Regularly ²	Plastic Event Sporadically ²	Row Total
Frequency of Sending Regularly ¹	7 (33%)	2 (8%)	9 (20%)
Frequency of Sending Sporadically ¹	14 (67%)	23 (92%)	37 (80%)
Column Total	21 (46%)	25 (54%)	

v. Recommending or Directly Educating: P-Value = 0.721

N = 32	Plastic Event Regularly ²	Plastic Event Sporadically ²	Row Total
Recommenders	5 (38%)	6 (32%)	11 (34%)
Direct Educators	8 (62%)	13 (68%)	21 (66%)
Column Total	13 (41%)	19 (59%)	

d. Attendance of Plastics Summit 2010

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 1.00

N = 52	Attended Plastics Summit 2010	Did Not Attend Plastics Summit 2010	Row Total
Environmental Event Regularly ¹	6 (40%)	16 (43%)	22 (42%)
Environmental Event Sporadically ¹	9 (60%)	21 (57%)	30 (58%)
Column Total	15 (29%)	37 (71%)	

ii. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 0.349

N = 48	Attended Plastics Summit 2010	Did Not Attend Plastics Summit 2010	Row Total
Plastic Event Regularly ²	8 (53%)	12 (36%)	20 (42%)
Plastic Event Sporadically ²	7 (47%)	21 (64%)	28 (58%)
Column Total	15 (31%)	33 (69%)	

iii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 0.746

N = 48	Attended Plastics Summit 2010	Did Not Attend Plastics Summit 2010	Row Total
Interact Expert Regularly ²	4 (27%)	11 (33%)	15 (31%)
Interact Expert Sporadically ²	11 (73%)	22 (67%)	33 (69%)
Column Total	15 (31%)	33 (69%)	

iv. Plastics Project Current Level of Assistance: P-Value = 0.128

N = 52	Attended Plastics Summit 2010	Did Not Attend Plastics Summit 2010	Row Total
Any Level of Assistance	9 (60%)	13 (35%)	22 (42%)
Don't Know Level of Assistance	6 (40%)	24 (65%)	30 (58%)
Column Total	15 (29%)	37 (71%)	

v. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.470

N = 49	Attended Plastics Summit 2010	Did Not Attend Plastics Summit 2010	Row Total
Frequency of Sending Regularly ¹	4 (27%)	6 (18%)	10 (20%)
Frequency of Sending Sporadically ¹	11 (73%)	28 (82%)	39 (80%)
Column Total	15 (31%)	34 (69%)	

vi. Recommending or Directly Educating: P-Value = 0.271

N = 34	Attended Plastics Summit 2010	Did Not Attend Plastics Summit 2010	Row Total
Recommenders	2 (18%)	9 (39%)	11 (32%)
Direct Educators	9 (82%)	14 (61%)	23 (68%)
Column Total	11 (32%)	23 (68%)	

e. Frequency of Directly Interacting with an Expert about Plastic Marine Debris

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.127

N = 49	Interact Expert Regularly ²	Interact Expert Sporadically ²	Row Total
Environmental Event Regularly ¹	10 (63%)	12 (36%)	22 (45%)
Environmental Event Sporadically ¹	6 (37%)	21 (64%)	27 (55%)
Column Total	16 (33%)	33 (67%)	

ii. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 0.000*

N = 46	Interact Expert Regularly ²	Interact Expert Sporadically ²	Row Total
Plastic Event Regularly ²	12 (80%)	7 (23%)	19 (41%)
Plastic Event Sporadically ²	3 (20%)	24 (77%)	27 (59%)
Column Total	15 (33%)	31 (67%)	

iii. Plastics Project Current Level of Assistance: P-Value = 1.000

N = 49	Interact Expert Regularly ²	Interact Expert Sporadically ²	Row Total
Any Level of Assistance	7 (44%)	15 (45%)	22 (45%)
Don't Know Level of Assistance	9 (56%)	18 (55%)	27 (55%)
Column Total	16 (33%)	33 (67%)	

iv. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.047*

N = 46	Interact Expert Regularly ²	Interact Expert Sporadically ²	Row Total
Frequency of Sending Regularly ¹	6 (38%)	3 (10%)	9 (20%)
Frequency of Sending Sporadically ¹	10 (62%)	27 (90%)	37 (80%)
Column Total	16 (35%)	30 (65%)	

v. Recommending or Directly Educating: P-Value = 1.00

N = 31	Interact Expert Regularly ²	Interact Expert Sporadically ²	Row Total
Recommenders	3 (33%)	7 (32%)	10 (32%)
Direct Educators	6 (67%)	15 (68%)	21 (68%)
Column Total	9 (29%)	22 (71%)	

f. Highest Formal Degree Earned

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.251

N = 50	Advanced Degree	Basic Degree	Row Total
Environmental Event Regularly ¹	11 (55%)	11 (37%)	22 (44%)
Environmental Event Sporadically ¹	9 (45%)	19 (63%)	28 (56%)
Column Total	20 (40%)	30 (60%)	

ii. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 1.00

N = 46	Advanced Degree	Basic Degree	Row Total
Plastic Event Regularly ²	8 (42%)	11 (41%)	19 (41%)
Plastic Event Sporadically ²	11 (58%)	16 (59%)	27 (59%)
Column Total	19 (41%)	27 (59%)	

iii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 1.00

N = 46	Advanced Degree	Basic Degree	Row Total
Interact Expert Regularly ²	6 (32%)	9 (33%)	15 (33%)
Interact Expert Sporadically ²	13 (68%)	18 (67%)	31 (67%)
Column Total	19 (41%)	27 (59%)	

iv. Plastics Project Current Level of Assistance: P-Value = 0.567

N = 50	Advanced Degree	Basic Degree	Row Total
Any Level of Assistance	10 (50%)	12 (40%)	22 (44%)
Don't Know Level of Assistance	10 (50%)	18 (60%)	28 (56%)
Column Total	20 (40%)	30 (60%)	

v. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.707

N = 47	Advanced Degree	Basic Degree	Row Total
Frequency of Sending Regularly ¹	4 (20%)	4 (15%)	8 (17%)
Frequency of Sending Sporadically ¹	16 (80%)	23 (85%)	39 (83%)
Column Total	20 (43%)	27 (57%)	

vi. Recommending or Directly Educating: P-Value = 1.00

N = 32	Advanced Degree	Basic Degree	Row Total
Recommenders	3 (38%)	8 (33%)	11 (34%)
Direct Educators	5 (62%)	16 (67%)	21 (66%)
Column Total	8 (25%)	24 (75%)	

g. Environmental Education

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.242

N = 53	Environmental Education Focus	No Environmental Education Focus	Row Total
Environmental Event Regularly ¹	9 (56%)	14 (26%)	23 (43%)
Environmental Event Sporadically ¹	7 (44%)	23 (74%)	30 (57%)
Column Total	16 (30%)	37 (70%)	

ii. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 0.547

N = 49	Environmental Education Focus	No Environmental Education Focus	Row Total
Plastic Event Regularly ²	8 (50%)	13 (39%)	21 (43%)
Plastic Event Sporadically ²	8 (50%)	20 (61%)	28 (57%)
Column Total	16 (33%)	33 (67%)	

iii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 0.198

N = 49	Environmental Education Focus	No Environmental Education Focus	Row Total
Interact Expert Regularly ²	7 (47%)	9 (26%)	16 (33%)
Interact Expert Sporadically ²	8 (53%)	25 (74%)	33 (67%)
Column Total	15 (31%)	34 (69%)	

iv. Plastics Project Current Level of Assistance: P-Value = 0.242

N = 53	Environmental Education Focus	No Environmental Education Focus	Row Total
Any Level of Assistance	9 (56%)	14 (38%)	23 (43%)
Don't Know Level of Assistance	7 (44%)	23 (62%)	30 (57%)
Column Total	16 (30%)	37 (70%)	

v. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.256

N = 50	Environmental Education Focus	No Environmental Education Focus	Row Total
Frequency of Sending Regularly ¹	5 (31%)	5 (15%)	10 (20%)
Frequency of Sending Sporadically ¹	11 (69%)	29 (85%)	40 (80%)
Column Total	16 (32%)	34 (68%)	

vi. Recommending or Directly Educating: P-Value = 0.465

N = 34	Environmental Education Focus	No Environmental Education Focus	Row Total
Recommenders	3 (23%)	8 (38%)	11 (32%)
Direct Educators	10 (77%)	13 (62%)	23 (68%)
Column Total	13 (38%)	21 (62%)	

h. Field of Environmentally-focused Degree

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.198

N = 53	Natural Science or Environmental Degree	No Natural Science or Environmental Degree	Row Total
Environmental Event Regularly ¹	8 (62%)	15 (38%)	23 (43%)
Environmental Event Sporadically ¹	5 (38%)	25 (62%)	30 (57%)
Column Total	13 (25%)	40 (75%)	

ii. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 0.514

N = 49	Natural Science or Environmental Degree	No Natural Science or Environmental Degree	Row Total
Plastic Event Regularly ²	7 (54%)	14 (39%)	21 (43%)
Plastic Event Sporadically ²	6 (46%)	22 (61%)	28 (57%)
Column Total	13 (27%)	36 (73%)	

iii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 0.169

N = 49	Natural Science or Environmental Degree	No Natural Science or Environmental Degree	Row Total
Interact Expert Regularly ²	6 (50%)	10 (27%)	16 (33%)
Interact Expert Sporadically ²	6 (50%)	27 (73%)	33 (67%)
Column Total	12 (24%)	37 (76%)	

iv. Plastics Project Current Level of Assistance: P-Value = 0.198

N = 53	Natural Science or Environmental Degree	No Natural Science or Environmental Degree	Row Total
Any Level of Assistance	8 (62%)	15 (31%)	23 (43%)
Don't Know Level of Assistance	5 (38%)	25 (69%)	30 (57%)
Column Total	13 (25%)	49 (75%)	

v. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.420

N = 50	Natural Science or Environmental Degree	No Natural Science or Environmental Degree	Row Total
Frequency of Sending Regularly ¹	4 (31%)	6 (16%)	10 (20%)
Frequency of Sending Sporadically ¹	9 (69%)	31 (84%)	40 (80%)
Column Total	13 (26%)	37 (74%)	

vi. Recommending or Directly Educating: P-Value = 1.00

N = 34	Natural Science or Environmental Degree	No Natural Science or Environmental Degree	Row Total
Recommenders	3 (30%)	8 (33%)	11 (32%)
Direct Educators	7 (70%)	16 (67%)	23 (68%)
Column Total	10 (29%)	24 (71%)	

i. Status: Retired, Student, Employed or Currently Unemployed

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.548

N = 50	Retired	Not Retired	Row Total
Environmental Event Regularly ¹	16 (48%)	6 (35%)	22 (44%)
Environmental Event Sporadically ¹	17 (52%)	11 (65%)	28 (56%)
Column Total	33 (66%)	17 (34%)	

ii. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 0.541

N = 47	Retired	Not Retired	Row Total
Plastic Event Regularly ²	12 (39%)	8 (50%)	20 (43%)
Plastic Event Sporadically ²	19 (61%)	8 (50%)	27 (57%)
Column Total	31 (66%)	16 (34%)	

iii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 0.189

N = 46	Retired	Not Retired	Row Total
Interact Expert Regularly ²	7 (23%)	7 (44%)	14 (30%)
Interact Expert Sporadically ²	23 (77%)	9 (56%)	32 (70%)
Column Total	30 (65%)	16 (35%)	

iv. Plastics Project Current Level of Assistance: P-Value = 0.386

N = 50	Retired	Not Retired	Row Total
Any Level of Assistance	13 (39%)	9 (53%)	22 (44%)
Don't Know Level of Assistance	20 (61%)	8 (47%)	28 (56%)
Column Total	33 (66%)	17 (34%)	

v. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.239

N = 47	Retired	Not Retired	Row Total
Frequency of Sending Regularly ¹	4 (13%)	5 (31%)	9 (19%)
Frequency of Sending Sporadically ¹	27 (87%)	11 (69%)	38 (81%)
Column Total	31 (66%)	16 (34%)	

vi. Recommending or Directly Educating: P-Value = 1.00

N = 32	Retired	Not Retired	Row Total
Recommenders	7 (33%)	3 (27%)	10 (31%)
Direct Educators	14 (67%)	8 (73%)	22 (69%)
Column Total	21 (66%)	11 (34%)	

j. Age of Participant

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.565

N = 52	20-59	60+	Row Total
Environmental Event Regularly ¹	7 (35%)	15 (47%)	22 (42%)
Environmental Event Sporadically ¹	13 (65%)	17 (53%)	30 (58%)
Column Total	20 (38%)	32 (62%)	

ii. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 0.245

N = 48	20-59	60+	Row Total
Plastic Event Regularly ²	10 (53%)	10 (34%)	20 (42%)
Plastic Event Sporadically ²	9 (47%)	19 (66%)	28 (58%)
Column Total	19 (40%)	29 (60%)	

iii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 0.357

N = 48	20-59	60+	Row Total
Interact Expert Regularly ²	8 (42%)	8 (28%)	16 (33%)
Interact Expert Sporadically ²	11 (58%)	21 (72%)	32 (67%)
Column Total	19 (40%)	29 (60%)	

iv. Plastics Project Current Level of Assistance: P-Value = 0.050*

N = 52	20-59	60+	Row Total
Any Level of Assistance	12 (60%)	10 (31%)	22 (42%)
Don't Know Level of Assistance	8 (40%)	22 (69%)	30 (58%)
Column Total	20 (38%)	32 (62%)	

v. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.480

N = 49	20-59	60+	Row Total
Frequency of Sending Regularly ¹	5 (26%)	5 (17%)	10 (20%)
Frequency of Sending Sporadically ¹	14 (74%)	25 (83%)	39 (80%)
Column Total	19 (39%)	30 (61%)	

vi. Recommending or Directly Educating: P-Value = 0.140

N = 34	20-59	60+	Row Total
Recommenders	2 (15%)	9 (43%)	11 (32%)
Direct Educators	11 (85%)	12 (57%)	23 (68%)
Column Total	13 (38%)	21 (62%)	

k. Gender of Participant

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.741

N = 52	Male	Female	Row Total
Environmental Event Regularly ¹	4 (36%)	18 (44%)	22 (42%)
Environmental Event Sporadically ¹	7 (64%)	23 (56%)	30 (58%)
Column Total	11 (21%)	41 (79%)	

ii. Frequency of Educational Activities where Plastic Marine Debris was

Specifically Discussed: P-Value = 0.488

N = 48	Male	Female	Row Total
Plastic Event Regularly ²	6 (55%)	14 (38%)	20 (42%)
Plastic Event Sporadically ²	5 (45%)	23 (62%)	28 (58%)
Column Total	11 (23%)	37 (77%)	

iii. Frequency of Directly Interacting with an Expert about Plastic Marine

Debris: P-Value = 0.432

N = 48	Male	Female	Row Total
Interact Expert Regularly ²	4 (44%)	11 (28%)	15 (31%)
Interact Expert Sporadically ²	5 (56%)	28 (72%)	33 (69%)
Column Total	9 (19%)	39 (81%)	

iv. Plastics Project Current Level of Assistance: P-Value = 0.507

N = 52	Male	Female	Row Total
Any Level of Assistance	6 (55%)	17 (41%)	23 (44%)
Don't Know Level of Assistance	5 (45%)	24 (59%)	29 (56%)
Column Total	11 (21%)	41 (79%)	

v. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.405

N = 49	Male	Female	Row Total
Frequency of Sending Regularly ¹	3 (30%)	7 (18%)	10 (20%)
Frequency of Sending Sporadically ¹	7 (70%)	32 (82%)	39 (80%)
Column Total	10 (20%)	39 (80%)	

vi. Recommending or Directly Educating: P-Value = 0.336

N = 33	Male	Female	Row Total
Recommenders	3 (50%)	7 (26%)	10 (30%)
Direct Educators	3 (50%)	20 (74%)	23 (70%)
Column Total	6 (18%)	27 (82%)	

1. Living on the Water: Primary residence or both primary and secondary vs.

secondary residence or does not live on water

i. Frequency of Educational Activities of an Environmental Nature

Attended: P-Value = 0.786

N = 53	Primarily Lives on Water	Does Not Primarily Live on Water	Row Total
Environmental Event Regularly ¹	14 (45%)	9 (41%)	23 (43%)
Environmental Event Sporadically ¹	17 (55%)	13 (59%)	30 (57%)
Column Total	31 (58%)	22 (42%)	

- ii. Frequency of Educational Activities where Plastic Marine Debris was Specifically Discussed: P-Value = 0.394

N = 49	Primarily Lives on Water	Does Not Primarily Live on Water	Row Total
Plastic Event Regularly ²	14 (48%)	7 (35%)	21 (43%)
Plastic Event Sporadically ²	15 (52%)	13 (65%)	28 (57%)
Column Total	29 (59%)	20 (41%)	

- iii. Frequency of Directly Interacting with an Expert about Plastic Marine Debris: P-Value = 1.00

N = 49 iv.	Primarily Lives on Water	Does Not Primarily Live on Water	Row Total
Interact Expert v. Regularly ²	10 (33%)	6 (32%)	16 (33%)
Interact Expert vi. Sporadically ²	20 (67%)	13 (68%)	33 (67%)
vii. Column Total viii.	30 (61%)	19 (39%)	

ix. Plastics Project Current Level of Assistance: P-Value = 1.00

N = 53	Primarily Lives on Water	Does Not Primarily Live on Water	Row Total
Any Level of Assistance	13 (42%)	10 (45%)	23 (43%)
Don't Know Level of Assistance	18 (58%)	12 (55%)	30 (57%)
Column Total	31 (58%)	22 (42%)	

x. Frequency of Plastic Marine Debris Communication to Others: P-

Value = 0.302

N = 50	Primarily Lives on Water	Does Not Primarily Live on Water	Row Total
Frequency of Sending Regularly ¹	4 (14%)	6 (27%)	10 (20%)
Frequency of Sending Sporadically ¹	24 (86%)	16 (73%)	40 (80%)
Column Total	28 (56%)	22 (44%)	

xi. Recommending or Directly Educating: P-Value = 0.709

N = 34	Primarily Lives on Water	Does Not Primarily Live on Water	Row Total
Recommenders	6 (29%)	5 (38%)	11 (32%)
Direct Educators	15 (71%)	8 (62%)	23 (68%)
Column Total	21 (62%)	13 (38%)	

¹Note that “regularly” and “sporadically” groupings differ: Environmental Event Regularly and Frequency of Sending Regularly consist of the responses “several a month” and “weekly or more,” while “sporadically” for these same questions consists of “once a year or less” and “once a month or less.” These similar groupings are indicated by a superscript number one (¹).

²Note that “regularly” and “sporadically” groupings differ: Plastic Event Regularly and Interact Expert Regularly, consist of the responses, “once a month or less,” “several a month” and “weekly or more,” while “sporadically” for these same questions consists of only “once a year or less.” These similar groupings are indicated by a superscript number two (²).

Appendix D: SHORT Response Analysis

Explanation of Codes Used

1. Question 6: Ways scientists, researchers, and other experts could assist the Plastics Project and/or the Plastics Project participants.
 - a. Better Communication: Statements expressing the need for better communication between scientists, researchers, and other experts and Plastics Project participants, e.g. “They could be more available for questions during the collecting process.”
 - b. Confusion over the Scientific Process: Statements which alluded to a general misunderstanding of the scientific process, such as changing sampling methods or sampling sites during data collection, e.g. “I’ve also wondered if our sampling methods are really ‘scientific’ and what the samples actually prove.”
 - c. Funding: Participants who expressed the need for extra funding for the Project, e.g. “Helping with funding.”
 - d. Good Job Already: Participants who stated that the Project was operating effectively as-is without the need for increased assistance from scientists, researchers, or other experts, e.g. “I have absolutely no problem with the assistance (specifically, coaching expertise) provided by people with the PTMSC during our sampling on the Dungeness Spit and/or Protection Island.”
 - e. How to Educate Others: Statements which indicated the need for assistance in educating non-participants about the Plastics Project, e.g. “Give us ideas for educating others.”
 - f. Methods: Statements which expressed confusion over the methods used in sampling, e.g. “another county’s program gave us a hands-on workshop on the methodology of a related project that (sic) we better understood the what, why, and how.”
 - g. More Direct Interaction: Participants who expressed the need for increased direct interaction with scientists, researchers, or other experts in the field of plastic marine debris, i.e. “My opinion is that the mere presence of experts, in some way, conveys the importance of the project to lay participants and makes it more likely that volunteers will feel the work is valuable and worth their time and that they will continue to participate and do a lot of the leg work”

- h. **Publicity:** Statements which expressed the need for increased publicity of the Plastics Project, and/or results, to the general public, e.g. “Publisize (sic) this activity to alert others to concerns and gain support.”
 - i. **Reasons for the Project:** Participants who expressed the need to know why the Project is being carried out, e.g. “presentations of reasons for studies”
 - j. **Results:** Statements that expressed the concern about the lack of results shared with Project participants, e.g. “I would like to receive updates about the results of the research.”
2. **Question 10: Why participants chose to participate in the Plastics Project.**
- a. **Accessibility:** Participants who chose to participate based on the location of the sampling sites or because it was the only project in the area, e.g. “Accessibility – location.”
 - b. **Course Assignment:** Participants who were assigned to participate in the Project for course credit, e.g. “Part of an ecology class assignment.”
 - c. **Environmental Stewardship:** Statements that expressed a participant’s reason for sampling was due to an environmentally-focused attitude, e.g. “I love to be involved in environmental work, especially concerning the marine environment.”
 - d. **Have Extra Time:** Participants who noted they have free time to devote to a volunteer activity, e.g. “I am retired and have some time to do that.”
 - e. **Interested in Project:** Participants who expressed that their interest in this particular project lead them to volunteer, e.g. “sampling fit in well with things I like to do.”
 - f. **Organizational Volunteering Option:** Participants who volunteered for the Project as a volunteering option through the Beach Watcher or other similar organizations, e.g. “I like to help with Beachwatcher (sic) activities”.
 - g. **Plastics are a Problem:** Participants who expressed their concern over plastics caused them to volunteer, e.g. “After seeing Chris Jordans (sic) photographs on the devastating effects of plastics pollution I was interested in how widespread this problem was.”
 - h. **Referral from a Friend:** Participants who were told about the Project from a familiar, e.g. “A friend of mine told me about this project.”
3. **Question 14: Whom the scientists, researchers, or other experts were that participants directly interacted with about plastic marine debris.**
- a. **Expert Program Coordinator:** Program Coordinators or leaders of the various organizations volunteers were recruited through. The majority of which were Program Coordinators from the Beach Watcher organizations.

- b. Expert PS2010 Speaker: Researchers/experts who presented at Plastics Summit 2010, including, but not limited to, Dr. Joel Baker (University of Washington, Tacoma) and Courtney Arthur (NOAA Marine Debris Program).
- c. Expert PTMSC Staff: Staff members from the Port Townsend Marine Science Center, including, but not limited to, Jen Kingfisher who leads the Plastics Project.

Frequency of Response Distributions by Independent Variables:

Proportions, expressed in percentages, of responses shown were calculated using “Sum Responses for Variable” as responses were not mutually exclusive.

1. Question 6: Ways scientists, researchers, and other experts could assist the Plastics Project and/or the Plastics Project participants.
 - a. Attendance of Plastics Summit 2010

N = 33	Attended Plastics Summit 2010	Did Not Attend Plastics Summit 2010	Sum Responses for Variable	Sum Responses for Code
Better Communication	5 38%	8 62%	13	14
Confusion over the Scientific Process	3 50%	3 50%	6	6
Funding	2 100%	0 0%	2	2
Good Job Already	1 25%	3 75%	4	4
How to Educate Others	0 0%	2 100%	2	2
Methods	4 67%	2 33%	6	7
More Direct Interaction	4 67%	2 33%	6	6
Publicity	1 50%	1 50%	2	2
Reasons for the Project	2 50%	2 50%	4	4
Results	7 44%	9 56%	16	16

b. Frequency of Sampling

N = 34	Participants who Sampled 1- 2 Times	Participants who Sampled 3+ Times	Sum Responses for Variable	Sum Responses for Code
Better Communication	4 29%	10 71%	14	14
Confusion over the Scientific Process	4 67%	2 33%	6	6
Funding	1 50%	1 50%	2	2
Good Job Already	2 50%	2 50%	4	4
How to Educate Others	2 100%	0 0%	2	2
Methods	2 29%	5 71%	7	7
More Direct Interaction	2 33%	4 67%	6	6
Publicity	1 50%	1 50%	2	2
Reasons for the Project	1 25%	3 75%	4	4
Results	7 44%	9 56%	16	16

c. Highest Degree Earned

N = 31	Advanced Degree	Basic Degree	Sum Responses for Variable	Sum Responses for Code
Better Communication	3 25%	9 75%	12	14
Confusion over the Scientific Process	3 60%	2 40%	5	6
Funding	1 50%	1 50%	2	2
Good Job Already	2 50%	2 50%	4	4
How to Educate Others	1 50%	1 50%	2	2
Methods	2 33%	4 67%	6	7
More Direct Interaction	3 60%	2 40%	5	6
Publicity	1 100%	0 0%	1	2
Reasons for the Project	1 33%	2 67%	3	4
Results	6 43%	8 57%	14	16

d. Environmental Education Focus

N = 34	Environmental Education Focus	No Environmental Education Focus	Sum Responses for Variable	Sum Responses for Code
Better Communication	5 36%	9 64%	14	14
Confusion over the Scientific Process	1 17%	5 83%	6	6
Funding	1 50%	1 50%	2	2
Good Job Already	1 25%	3 75%	4	4
How to Educate Others	1 50%	1 50%	2	2
Methods	2 29%	5 71%	7	7
More Direct Interaction	4 67%	2 33%	6	6
Publicity	2 100%	0 0%	2	2
Reasons for the Project	1 25%	3 75%	4	4
Results	5 31%	11 69%	16	16

2. Question 10: Why participants chose to participate in the Plastics Project.
Analyses by independent variables were not performed for this question.

3. Question 14: Whom the scientists, researchers, or other experts were that participants directly interacted with about plastic marine debris.

a. Attendance of Plastics Summit 2010

N = 31	Attended Plastics Summit 2010	Did Not Attend Plastics Summit 2010	Total Responses for Variable	Total Responses for Code
Expert Program Coordinator	4 31%	9 69%	13	13
Expert PS2010 Speaker	7 78%	2 22%	9	9
Expert PTMSC Staff	7 41%	10 59%	17	18

b. Frequency of Sampling

N = 32	Participants who Sampled 1-2 Times	Participants who Sampled 3+ Times	Total Responses for Variable	Total Responses for Code
Expert Program Coordinator	8 62%	5 38%	13	13
Expert PS2010 Speaker	2 22%	7 78%	9	9
Expert PTMSC Staff	5 28%	13 72%	18	18

c. Highest Degree Earned

N = 30	Advanced Degree	Basic Degree	Total Responses for Variable	Total Responses for Code
Expert Program Coordinator	3 27%	8 73%	11	11
Expert PS2010 Speaker	3 38%	5 63%	8	8
Expert PTMSC Staff	7 44%	9 56%	16	18

d. Environmental Education Focus

N = 40	Environmental Education Focus	No Environmental Education Focus	Total Responses for Variable	Total Responses for Code
Expert Program Coordinator	7 54%	6 46%	13	13
Expert PS2010 Speaker	4 44%	5 56%	9	9
Expert PTMSC Staff	6 33%	12 67%	18	18