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### Title

Utilization of Front-End Evaluations for Exhibit Creation: SEAPLEX Cruise and Marine Debris at Birch Aquarium at Scripps

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### Author

Belichesky, Heather

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**UTILIZATION OF FRONT-END EVALUATIONS FOR EXHIBIT CREATION:  
SEAPLEX CRUISE AND MARINE DEBRIS AT BIRCH AQUARIUM AT SCRIPPS**

**Heather Belichesky**

**CAPSTONE Project  
Center for Marine Biodiversity and Conservation  
Scripps Institution of Oceanography, UCSD**

**Committee Members  
Kristin Evans (Chair), Birch Aquarium at Scripps  
Dr. Ayelet Gneezy, UCSD  
Dr. James Leichter, Scripps Institution of Oceanography**



# **UTILIZATION OF FRONT-END EVALUATIONS FOR EXHIBIT CREATION: SEAPLEX CRUISE AND MARINE DEBRIS AT BIRCH AQUARIUM AT SCRIPPS**

**Heather Belichesky**

## **ABSTRACT**

Plastic marine debris accumulating in the North Pacific Ocean Gyre has the potential to negatively impact the marine ecosystem. The Scripps Environmental Accumulation of Plastics Expedition (SEXPLEX) investigated this accumulation of plastics in August 2009. The dissemination of this expedition and related research is conducted through an exhibit at Birch Aquarium at Scripps Institution of Oceanography. In order to create a successful exhibit a Front-End evaluation was conducted prior to exhibit creation. This evaluation assessed prior knowledge, experiences and interests of visitors to the aquarium. The evaluation incorporated a written survey and a card sorting activity in a free-choice learning setting. The results from the evaluation were used to shape the focus and content of the exhibit.

## INTRODUCTION

Many of the items that people use daily are made of plastic, ranging from bags to food and beverage containers. However, only five percent of the plastics used worldwide are recycled (Project Kaisei 2009). Even though some of the plastics are being recycled or properly disposed, there are still some plastic products that are not being properly disposed. These products have the potential to end up in the ocean, either directly by being deposited there or being indirectly washed out to sea by way of waterways on land (Ryan & Moloney 1993). The plastics found in the ocean include domestic materials such as shopping bags, Styrofoam cups, food and beverage containers, industrial materials and discarded or abandoned fishing gear (Coe & Rogers 1997). A concern with plastics is that these materials do not biodegrade, instead plastics photo-degrade. Photo-degrading is when plastics break down into small pieces as they are exposed to solar UV radiation (Andrady 2003). However, this process is slower in water where there is less UV radiation exposure. This characteristic means that plastic materials can persist in the marine environment for hundreds of years. These plastics in the ocean can have negative impacts on the ecosystem. One of the major issues with plastics in the ocean is the ingestion of the plastic items by sea animals. These items can be confused by the animals as their food source and can cause the animals to either choke or starve. This has been observed especially with larger pieces of plastics and albatrosses (Azzarello and Van Vleet 1987). Additionally, plastic marine debris can act like a magnet for other chemicals in the ocean and release chemicals into the marine environment (Teuten et al 2009). It is evident that plastic marine debris has the potential to cause serious impacts to the marine ecosystem.

Thousands of miles off of the western coast of the United States in the North Pacific Ocean Gyre there is a large compilation of plastic marine debris. Plastic marine debris gathers in this area

because of recirculating currents and weak winds. This is why the Scripps Environmental Accumulation of Plastics Expedition (SEAPLEX) embarked on an expedition in August 2009 to investigate this accumulation of plastics in the North Pacific Ocean Gyre. The SEAPLEX cruise gathered data on the composition, extent and effects of the debris on marine life. The dissemination of this research to the public will be done through Birch Aquarium at Scripps Institution of Oceanography. Birch Aquarium's mission is to provide ocean science education, interpret Scripps Institution of Oceanography research, and promote ocean conservation. The Birch Aquarium is planning on creating an exhibit, which will inform visitors of the research from the SEAPLEX cruise, the negative impacts of plastic marine debris and how people can help reduce plastic marine debris.

In order to create a successful exhibit, Birch Aquarium will need to address the interests of visitors. Free-choice learning centers, such as Birch Aquarium, attract visitors of various ages, backgrounds and experience levels (Falk 2003). This diversity among visitors will strongly affect what visitors learn and experience with an exhibit (Falk & Dierking 2000). This makes it important for exhibits at these centers to be adaptable for this wide range of audiences.

Conducting a visitor evaluation, prior to exhibit creation, would help designers to develop a successful exhibit for a variety of audiences. This type of evaluation is called a front-end evaluation. Front-end evaluations assess visitors' prior knowledge, experiences, interests and misconceptions with the exhibit subject during the initial exhibit planning (Korn 1994). For this study a front-end evaluation was conducted at the Birch Aquarium for the creation of an exhibit on plastic marine debris and the SEAPLEX cruise

## METHODS

The methods used for front-end evaluations may vary depending on the demographics of the visitors at the free-choice learning centers (Korn 1994). The Birch Aquarium has conducted a previous front-end evaluation for the *Feeling the Heat: The Climate Challenge* exhibit on climate change (see Appendix III). Since this exhibit is similar in message, human impacts on the natural environment, the same methods for evaluation were used.

### Participants

The participants for this evaluation were adult visitors at Birch Aquarium. The participants were self-selected for the evaluation through a verbal invitation. This evaluation included 125 participants.

### Environment and Materials

The evaluation was conducted in the gallery of Birch Aquarium on weekdays and weekends from April 5 through April 17, 2010. The amount of visitors to Birch Aquarium is highest during the hours of 10AM and 12PM, which is when the evaluation was conducted. The evaluation was conducted at a table, which included two simple signs explaining the evaluation and subject matter (Image 1).

### Design and Procedure

The design for this evaluation was developed using the same methods use in previous front-end evaluations at Birch Aquarium. The *Feeling the Heat: The Climate Challenge* exhibit front-end evaluation used two separate methods to assess visitor interest and prior knowledge. Since the new exhibit has a similar message of human impacts and conservation the same methods were

**Image 1: Evaluation Table with Signs**



used. These two methods were used to assess visitors' interests and prior knowledge. In order to assess visitors' prior knowledge the written survey was used, which allowed for visitors to answer questions on the topic without any influence from the evaluator. The card sorting activity was used to gauge visitor interest in the topics. This method was used because it allowed more face-to-face interactions with the visitors, which solicited comments. Also this activity was did not test visitor's knowledge and therefore was less intimidating. In order to evaluate a wide range of visitors, both methods of evaluation were available for visitors to choose to participate.

## Surveys

### *Objectives*

The written survey was created to assess visitors' prior knowledge of the plastic debris accumulation in the North Pacific Ocean Gyre and the recent SEAPLEX cruise. This survey assessed prior knowledge in order to determine misconceptions that visitors may have about the science behind plastic marine debris such as the size and composition of the debris in the North

Pacific Ocean Gyre (Table 1). For this assessment visitors were asked if they were familiar with the Pacific Ocean garbage patch and to rank their agreement with several statements. The next portion of the survey addressed the

**TABLE 1: Statements for Agreement on Written Survey**

|             |                                                                                |
|-------------|--------------------------------------------------------------------------------|
| Statement 1 | Plastics in the ocean act like magnets for toxins in the water                 |
| Statement 2 | The Pacific Ocean Garbage Patch looks like a floating island of plastic debris |
| Statement 3 | The Pacific Ocean Garbage Patch can be seen from space                         |
| Statement 4 | Most of the plastics in the ocean come from ships at sea                       |
| Statement 5 | In the ocean plastics break down into small pieces                             |

conservation aspects of the subject/topic. This included asking visitors what actions they can take to limit marine debris. The final portion of the survey explored the visitors' interests in learning more about the topic and the frequency of their visits to Birch Aquarium. A copy of the survey is included in Appendix I.

### *Administration*

The visitors who participated in this activity were verbally asked if they would like to assist in the creation of an exhibit. They were then provided with a hard copy of the survey to complete while at Birch Aquarium. Following completion of the survey visitors were provided with a giveaway.

### Card Sorting Activity

#### Objective

The second method of evaluation used was a card sorting activity. Visitors were asked to sort four cards in order of their personal interests. The four cards included topics about the science of the SEAPLEX cruise, plastic marine debris and conservation. Table 2 shows the text for each of the cards.

**TABLE 2: Information Provided During the Card Sorting Activity**

|        |                                                                                                                                                                                                                                                                                                                                                         |
|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CARD A | IMPACTS ON FISH <ul style="list-style-type: none"><li>• Scripps Scientist are studying whether fish are ingesting the plastics</li><li>• These fish are small but are consumed by larger predatory fish that humans eat</li></ul>                                                                                                                       |
| CARD B | CHEMICAL POLLUTION ASSOCIATED WITH DEBRIS <ul style="list-style-type: none"><li>• Plastics in the ocean will leach chemicals</li><li>• Also, Plastics in the ocean are magnets for other pollutants</li><li>• When animals ingest plastics they increase the amount of pollutants they eat</li></ul>                                                    |
| CARD C | WHY IS THE PLASTIC IN THIS ONE SPOT <ul style="list-style-type: none"><li>• This area is called a gyre which means there are recirculating currents and low winds allowing the plastic debris to gather here</li><li>• There are other gyres in the oceans, the one in the northern Atlantic Ocean is also known to have plastic debris in it</li></ul> |
| CARD D | HOW CAN WE HELP LIMIT THE AMOUNT OF PLASTICS GOING INTO THE OCEAN <ul style="list-style-type: none"><li>• Reduce the amount of plastics that you use</li><li>• Properly dispose of and recycle plastics</li><li>• 60% of plastics in the ocean are from land</li></ul>                                                                                  |

### *Administration*

The visitors who participated in this activity were verbally asked prior to participation if they knew about the accumulation of plastic debris in the North Pacific Ocean Gyre, if so they were asked how extensive is their knowledge. Visitors were then asked to rank the cards on the table

in order of interest. Following completion of the activity visitors were asked how often they visit Birch Aquarium.

## RESULTS

### Written Survey

The first portion of the written survey asked visitors to rank their agreement with several statements. The data from this section was analyzed by considering the percentage of participants that selected each option for each statement (see Graph 1).

*Statement 1: Plastics in the ocean act like magnets for toxins in the water.*

- The majority of visitors (60%) indicated that they agree with this statement while four percent disagreed, 12% selected neutral and 24% were unsure.
- It appears that a majority of visitors agree with this statement showing that they understand that this statement is true. Only a small percentage of visitors disagreed with this statement, which implies that most visitors do not have a misconception about this subject.

*Statement 2: The Pacific Ocean Garbage Patch looks like a floating island of plastic debris.*

- The majority of visitors (56%) stated that they agree with this statement and 12% indicated that they disagree while four percent selected neutral and 28% were unsure.
- These results indicate that a majority of visitors agree with this statement, which is false. This highlights that these visitors have a misconception about the topic while only a small percentage of visitors understand this topic.

*Statement 3: The Pacific Ocean Garbage Patch can be seen from space.*

- Equal amounts (36%) of visitors indicated agree or unsure for this statement. Sixteen percent of visitors selected disagree and 12% selected neutral.

- The 16% of visitors that selected disagree understand this statement, which is false. Most visitors seem to either be unfamiliar with this topic or hold a misconception about the topic based on the percentage of visitors that indicated unsure or agree.

*Statement 4: Most of the plastics in the ocean come from ships.*

- The majority of visitors (52%) indicated that they disagree with this statement while only eight percent agree, 16% selected neutral and 24% were unsure.
- These results indicate that most visitors understand that this statement is false. Only a small portion of visitors indicated that they agree showing that they have a misconception about the topic.

*Statement 5: In the ocean plastics break down into small pieces.*

- Only 12% of visitors indicated that they agree with this statement. Most visitors (68%) disagree with this statement while four percent selected neutral and 16% are unsure.
- The majority of visitors disagree with this statement even though it is true. Therefore, this data highlights that most visitors have a misconception about this topic. Only a small amount of the visitors surveyed understood this topic well enough to indicate the correct response.

The data analysis also considered differences between the participants' prior knowledge and frequency of visitation on their interest ranks (Tables 3 & 4). However no significant differences were noted.

**TABLE 3: Percentage of Agreement for Visitors Based on Prior Knowledge**

|                    | Disagree | Agree | Neutral | Unsure |
|--------------------|----------|-------|---------|--------|
| <b>STATEMENT 1</b> |          |       |         |        |
| OVERALL            | 4        | 60    | 12      | 24     |
| NOT FAMILIAR       | 8.3      | 66.7  | 16.7    | 8.3    |
| FAMILIAR           | 0        | 53.8  | 7.6     | 38.4   |
| <b>STATEMENT 2</b> |          |       |         |        |
| OVERALL            | 12       | 56    | 4       | 28     |
| NOT FAMILIAR       | 8.3      | 58.3  | 8.3     | 25     |
| FAMILIAR           | 15.3     | 53.8  | 0       | 30.7   |
| <b>STATEMENT 3</b> |          |       |         |        |
| OVERALL            | 16       | 36    | 12      | 36     |
| NOT FAMILIAR       | 8.3      | 33.3  | 8.3     | 50     |
| FAMILIAR           | 23       | 38.4  | 15.3    | 23     |
| <b>STATEMENT 4</b> |          |       |         |        |
| OVERALL            | 52       | 8     | 6       | 24     |
| NOT FAMILIAR       | 50       | 8.3   | 8.3     | 33.3   |
| FAMILIAR           | 53.8     | 7.6   | 23      | 15.3   |
| <b>STATEMENT 5</b> |          |       |         |        |
| OVERALL            | 68       | 12    | 4       | 16     |
| NOT FAMILIAR       | 75       | 16.6  | 8.3     | 0      |
| FAMILIAR           | 61.5     | 7.6   | 0       | 30.7   |

The second portion of the survey that was analyzed focused on conservation and if visitors wanted to learn more about the topic. The question asking participants to choose three ways they can reduce plastic marine debris was analyzed by taking the percentage of visitors that selected each option (Table 5). The data from the remaining questions showed an unanimous agreement among all visitors (Table 6).

**TABLE 4: Percentage of Agreement for Visitors Based on Visits per Year**

|                    | Disagree | Agree | Neutral | Unsure |
|--------------------|----------|-------|---------|--------|
| <b>STATEMENT 1</b> |          |       |         |        |
| OVERALL            | 4        | 60    | 12      | 24     |
| FIRST VISIT        | 6.7      | 73.3  | 6.7     | 13.3   |
| LESS THAN 2/YR     | 0        | 100   | 0       | 0      |
| 2-5 VISITS A YEAR  | 0        | 20    | 20      | 60     |
| MORE THAN 5        | 0        | 33.3  | 33.3    | 33.3   |
| <b>STATEMENT 2</b> |          |       |         |        |
| OVERALL            | 12       | 56    | 4       | 28     |
| FIRST VISIT        | 20       | 40    | 6.7     | 33.3   |
| LESS THAN 2/YR     | 100      | 0     | 0       | 0      |
| 2-5 VISITS A YEAR  | 0        | 80    | 0       | 20     |
| MORE THAN 5        | 0        | 66.7  | 0       | 33.3   |
| <b>STATEMENT 3</b> |          |       |         |        |
| OVERALL            | 16       | 36    | 12      | 36     |
| FIRST VISIT        | 20       | 20    | 13.3    | 46.7   |
| LESS THAN 2/YR     | 0        | 100   | 0       | 0      |
| 2-5 VISITS A YEAR  | 0        | 80    | 0       | 20     |
| MORE THAN 5        | 33.3     | 0     | 33.3    | 33.3   |
| <b>STATEMENT 4</b> |          |       |         |        |
| OVERALL            | 52       | 8     | 6       | 24     |
| FIRST VISIT        | 53.3     | 6.7   | 6.7     | 33.3   |
| LESS THAN 2/YR     | 100      | 0     | 0       | 0      |
| 2-5 VISITS A YEAR  | 40       | 20    | 20      | 20     |
| MORE THAN 5        | 33.3     | 0     | 66.7    | 0      |
| <b>STATEMENT 5</b> |          |       |         |        |
| OVERALL            | 68       | 12    | 4       | 16     |
| FIRST VISIT        | 73.3     | 13.3  | 6.7     | 6.7    |
| LESS THAN 2/YR     | 0        | 0     | 0       | 100    |
| 2-5 VISITS A YEAR  | 20       | 80    | 0       | 0      |
| MORE THAN 5        | 66.7     | 0     | 0       | 33.3   |

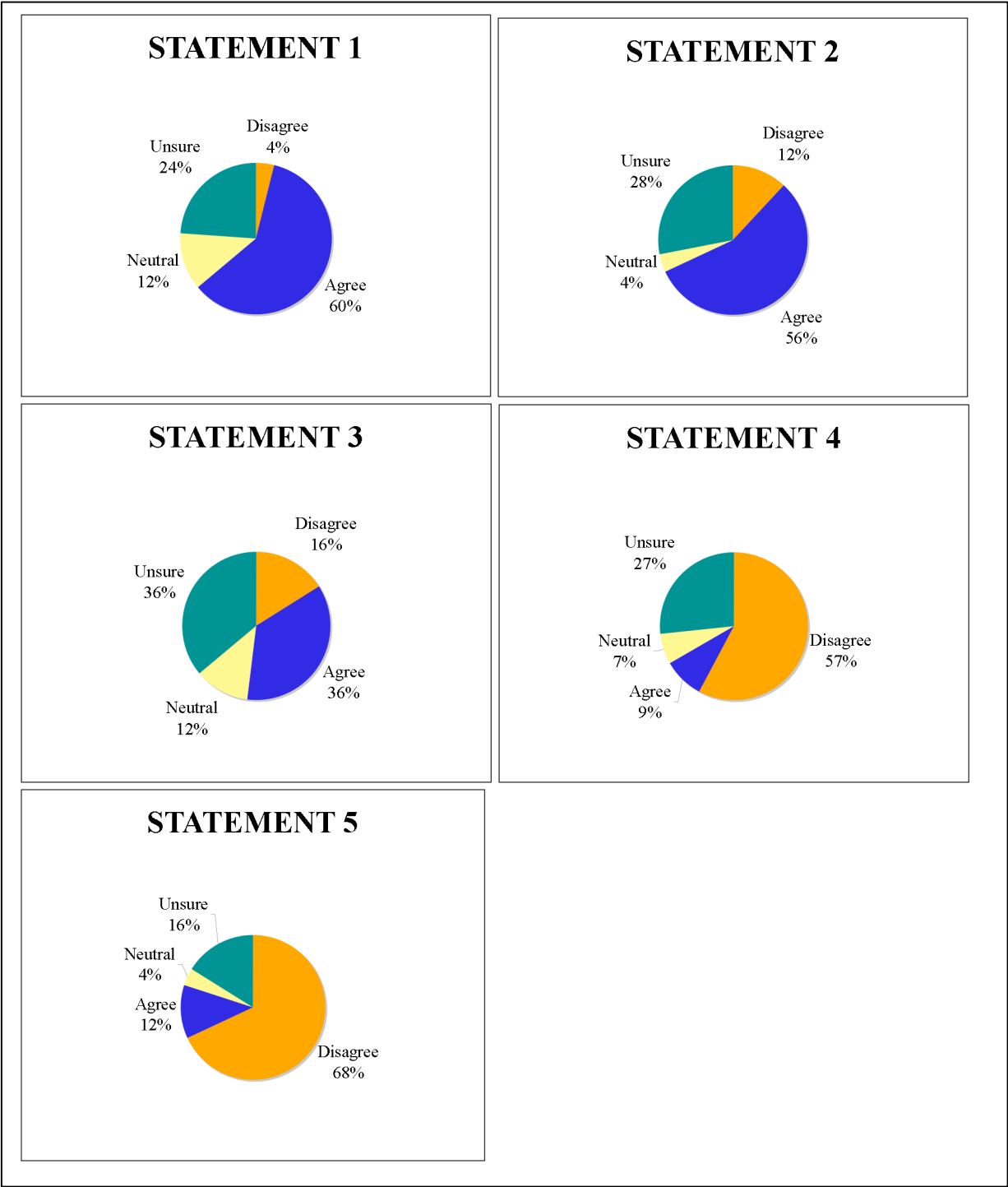
**TABLE 5: Percentage of Visitors that Selected Methods for Recycling**

|                                               |     |
|-----------------------------------------------|-----|
| Reducing the amount of plastic products I use | 40% |
| Properly disposing of all trash               | 48% |
| Recycling                                     | 44% |
| Picking up trash off the beach                | 36% |
| Picking up trash in parks and roads           | 4%  |
| Choosing reusable products                    | 32% |
| Selected All                                  | 20% |

**TABLE 6: Percentage of Responses to Survey Questions**

| Survey Question:                                                                       | Agree | Disagree | Unsure |
|----------------------------------------------------------------------------------------|-------|----------|--------|
| People have the ability to limit the amount of plastics entering the ocean             | 96    | 0        | 4      |
| I feel that by doing what I can to reduce plastics that I will be making a difference  | 92    | 0        | 8      |
| I can limit plastics in the ocean by reducing and recycling the plastics I use on land | 92    | 0        | 8      |
|                                                                                        | Yes   | No       | Blank  |
| I would like to take part in reducing plastic debris in the ocean                      | 96    | 4        | 0      |
| I would like to learn more about how this is affecting the oceans                      | 96    | 4        | 0      |
| I would like to learn more about how we can help                                       | 64    | 0        | 36     |

**GRAPH 1: Overall Agreement with Written Survey Statements**



## Card Sorting

Each of the participants ranked the four cards in order from most interesting to least interesting.

The results were recorded using a ranking of one to four, one being the most interesting to four being the least interesting. Additionally, the participants were asked about their level of

familiarity with the topic ranging from limited, moderate to

extensive and how often they visit Birch Aquarium. The mean and

mode for each card topic (Graph 2) was taken and then an overall

rank was created (Table 7). The data analysis also considered

differences between the participants' prior knowledge and

frequency of visitation on their interest ranks (Graphs 3 & 4).

The overall the mean for Card A was 2.21, 2.53 for Card B, 2.58 for Card C and 2.68 for Card D.

The results for each card were analyzed looking at the percentage of visitors that ranked each

card at each level. For Card A 25 percent of visitors ranked it most interesting and 5 percent

ranked it as least interesting. For Card B 14 percent of visitors ranked it most interesting and 20

percent ranked it as least interesting. Thirty-four percent of visitors ranked Card C most

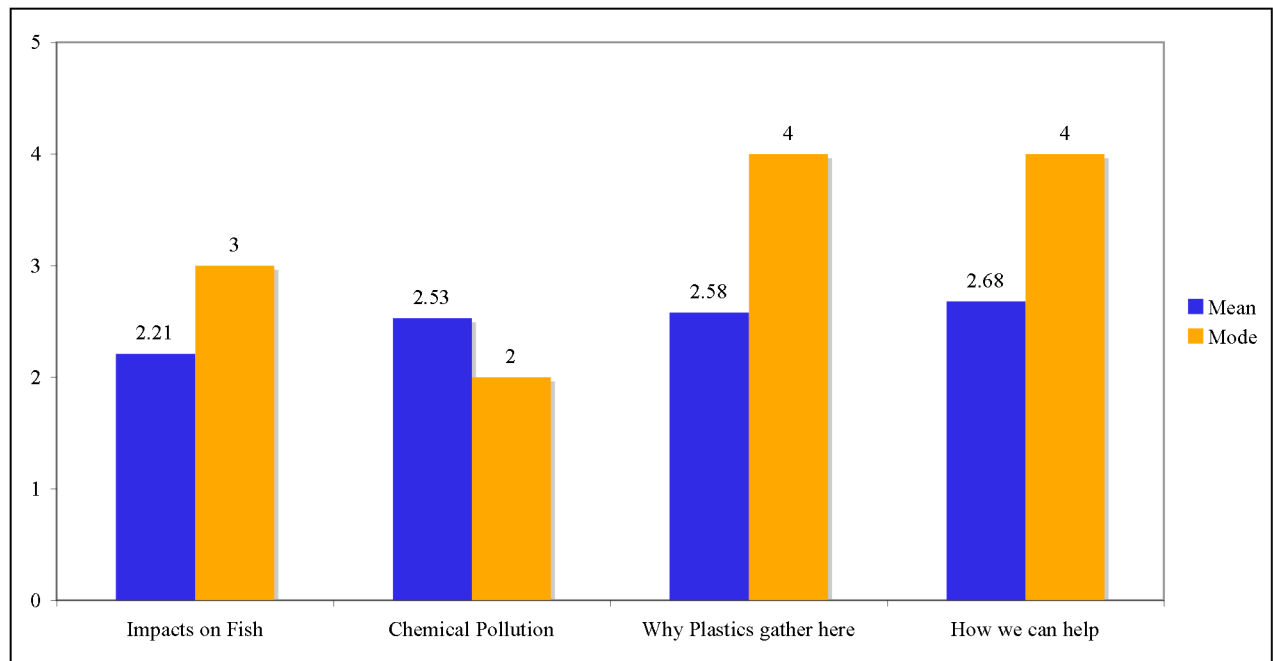
interesting and 38 percent ranked it least interesting. Twenty –seven percent of visitors ranked

Card D as most interesting and 37 percent ranked it as least interesting (Graph 5).

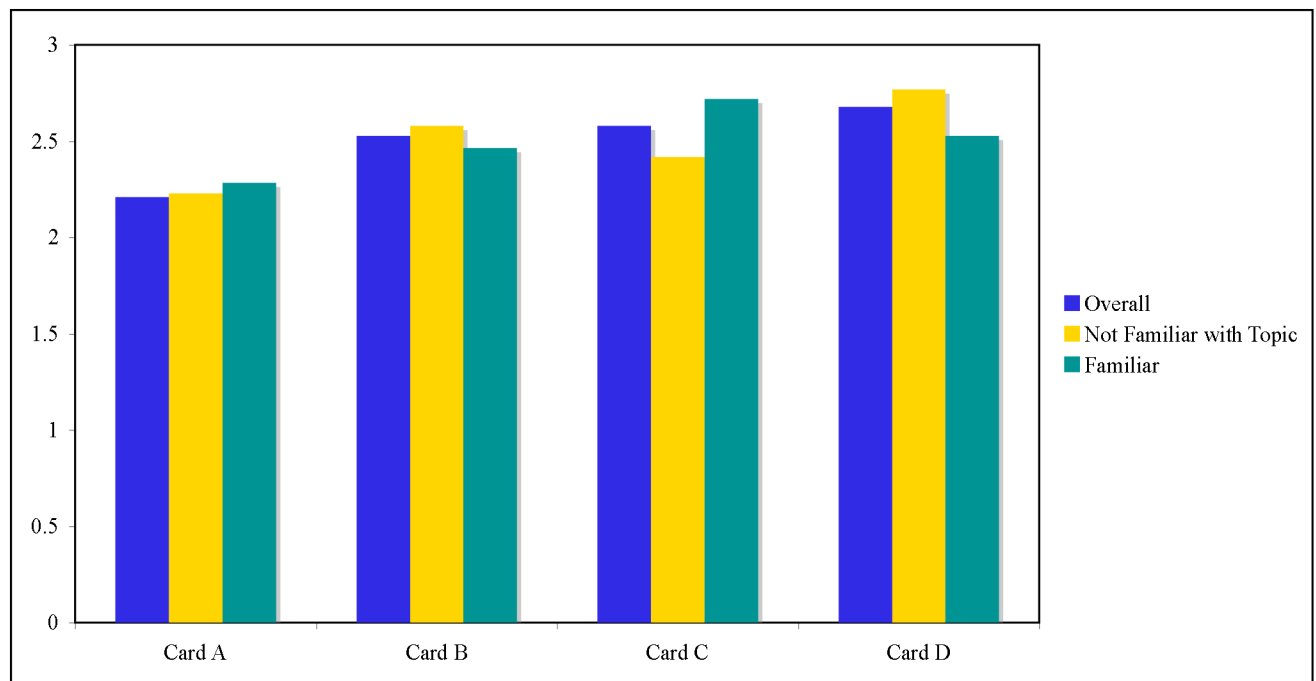
TABLE 7: Overall Rank of Card Sorting Activity

|        |        |
|--------|--------|
| CARD A | First  |
| CARD B | Second |
| CARD C | Third  |
| CARD D | Fourth |

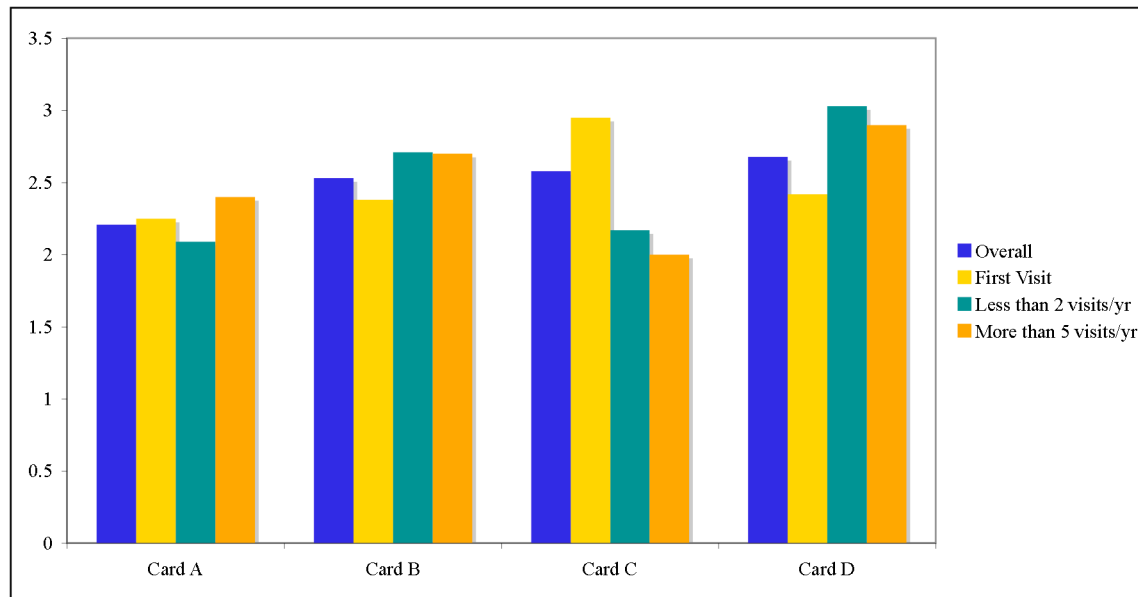
GRAPH 2: Mean and Mode for Card Sorting Activity



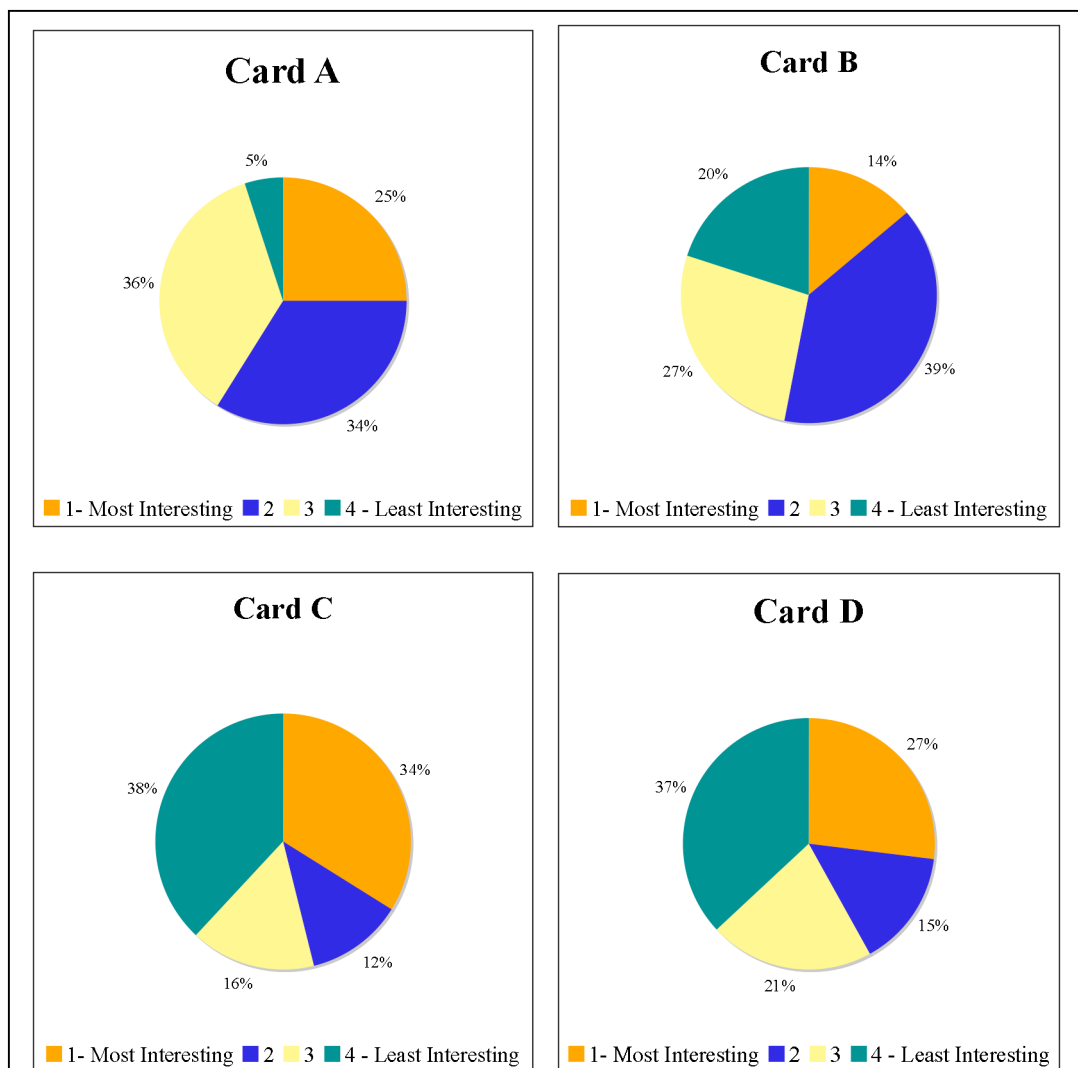
GRAPH 3: Mean for Card Sorting Activity Based on Frequency of Visits and Prior Knowledge



Graph 4: Mean for Card Sorting Activity Based on Frequency of Visits



Graph 5: Percentage Breakdown of Overall Ranking



## **DISCUSSION & CONCLUSIONS**

### **Front-End Evaluation Design**

The written survey was successful at highlighting some of the main visitor misconceptions about how plastics break down in water and the content of the plastic debris in the North Pacific Ocean Gyre. However, the overall participation in the survey by visitors was very low. Most visitors choose to participate in the card sorting activity instead of the written survey. This is why there were only 25 participants for the survey compared to 100 participants for the card sorting. Eventually participation in the survey increased when giveaways such as free child with adult coupons and reusable grocery bags were used.

The card sorting activity was very popular among the visitors that stopped at the table. The simple nature of the activity appealed to visitors and required only a small amount of their time. Also, this activity did not test visitors' knowledge and therefore was not viewed as intimidating. The design of this activity allowed for more conversation among visitors and encouraged all visitors in groups to participate. However, the activity only allowed for one visitor at a time to actually sort the cards. Thus there was some congestion at the table and this seemed to discourage other visitors from participating. It would be beneficial for this type of activity to have several versions available to maximize visitor participation. Unlike the written survey, the card sorting activity did not include false statements. Although the card sorting method did not quantitatively highlight any misconceptions the activity was useful for documenting visitors' interests and providing some educational benefits. Additionally, the results from this activity showed trends among visitors' interests and disinterests. These trends were utilized in creating the content for the exhibit, which is discussed later in this section.

## **Exhibit Development**

The development of the exhibit at Birch Aquarium was influenced by the results from this front-end evaluation. Prior to conducting the front-end evaluation the general design of the exhibit was known (see Appendix II). The exhibit was designed to be viewed from both sides, one representing information on the SEAPLEX cruise and the other discussing marine debris and conservation issues. The results from the survey showed that there was a common misconception held by the visitors about how plastics in the ocean degrade. Statement five of the survey, “In the ocean plastics break down into small pieces” was correct and should have been ranked as “agree”. However, sixty-eight percent of the visitors surveyed disagreed with this statement. Additionally, fifty-six percent of visitors agreed with the statement “The Pacific Ocean Garbage Patch looks like a floating island of plastic debris” which is false and should have been ranked as disagree. Based on this data and several visitor statements reinforcing these common misconceptions a segment of the exhibit was dedicated to explaining the size of most plastics in the North Pacific Ocean Gyre.

The card sorting activity provided very useful information for how to address the concept of conservation in the exhibit. The results from the card sorting activity showed that visitors held various opinions about which topic they preferred. The results showed that Card D had the highest mean at 2.68 compared to the lowest mean of 2.21 for Card A. The percentage of visitors that selected Card D as least interesting was 37 compared to 5 for Card A and 20 for Card B. Only Card C had a higher percentage of selection at 38 percent but this card also had the highest percentage of visitors ranking it as most interesting (34%). Even though all topics presented in the card sorting activity are discussed in the exhibit, this activity helped to focus the exhibit more on the science rather than conservation. Some of the visitors commented that they already knew how they could help prevent plastic marine debris therefore it was not interesting

to include this topic. Using this data, the discussion of conservation methods in the exhibit focuses on methods that may not be as well known as recycling, which in the written survey 44 percent of visitors selected as a way to help. The exhibit focused more on picking reusable products and reducing the amount of plastics used, which 32 percent and 40 percent of visitors surveyed selected, respectively (Table 4).

### **Future of Front-end Evaluations at Birch Aquarium**

In general, the front-end evaluation was successful at assessing the previous knowledge and interests of the visitors. However there were some important observations to note about the methods of this type of evaluation at Birch Aquarium. First of all, the addition of a simple informative sign really helped to draw visitors to the table and facilitated any additional

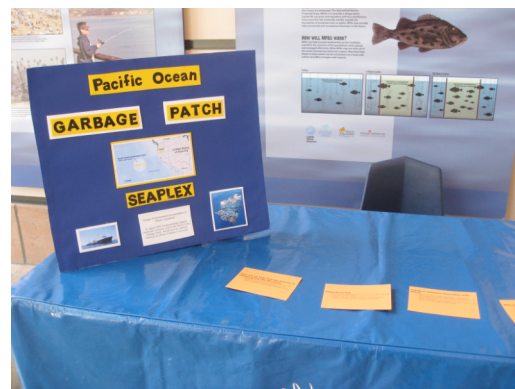
questions (Image 2). The sign was created and used following the first day of data collection.

The amount of visitors participating in the activity did not change after the implementation of the sign, however the frequency of visitors stopping by the table did increase. The second issue with this format for evaluation was with

the apathy of the visitors. Many visitors were

uninterested in participating in either of the activities. Visitors with small children were the least likely to stop at the table and participate. Also, this evaluation may have slightly skewed data based on the fact that it was designed with a free-choice format. Such a format tends to include participants that already had an interest in the topic. However, since this assessment was being used to create a free-choice learning exhibit, this may correctly reflect the types of visitors that will view the exhibit. In addition to the quantitative data collected through the written survey

Image 2: Sign for Table



and the card sorting activities, data was collected from visitor statements. These comments were utilized in the development of the exhibit content.

Another method to improve future front-end evaluations at Birch Aquarium would be to incorporate an evaluation method for children. This was a demographic that was not included in this study but is one of the main visitor groups. Such an assessment should incorporate an activity that would enable the assessor to gauge interests and knowledge levels. Although this front-end evaluation did not eliminate any topics for the exhibit, it did alter the focus of the exhibit. It is important for Birch Aquarium to assess the interests of visitors in order to create exhibits that will enhance their knowledge and experiences. The results from this evaluation should be used by Birch Aquarium to ensure that at least some simple evaluations are conducted before the content of exhibits is created. The focus of this exhibit was altered due to the results from this evaluation in order to best suit visitors interests, which will hopefully create a more interesting and effective exhibit.

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## **Appendix I**

### **Written Survey**

## **Appendix II**

### **Exhibit Design**

**Appendix III**  
***Feeling the Heat: A Climate Challenge***  
**Front-End Evaluation**

## **Appendix IV**

### **IRB**