

**Final Assessment of the
“Changing Tides” Lecture Series**

**at the
National Museum of Natural History
in conjunction with the
Centers for Ocean Sciences Education Excellence**



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ABSTRACT

This report summarizes assessments from a series of eight lectures presented at the National Museum of Natural History (NMNH), in conjunction with Centers for Ocean Sciences Education Excellence (COSEE), and with funding from the National Science Foundation. The purpose of the grant to NMNH was to promote ocean literacy; disseminate information on recent ocean sciences research; and provide a forum for the public to discover the connection between human actions and ocean health. The Office of Policy and Analysis (OP&A) worked closely with NMNH to develop the surveys and adapt questions for use with “clickers” (audience response technology, ART) bought in conjunction with the series. On average, 104 individuals participated in each lecture, with a range from 53 to 190.

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PREFACE

This report summarizes assessments of a series of eight lectures presented at the National Museum of Natural History (NMNH), in conjunction with the Centers for Ocean Sciences Education Excellence (COSEE), and with funding from the National Science Foundation. The purpose of the grant to NMNH was to promote ocean literacy; disseminate information on recent ocean sciences research; and provide a forum for the public to discover the connection between human actions and ocean health. The Office of Policy and Analysis (OP&A) worked closely with NMNH to develop the surveys and adapt questions for use with “clickers” (audience response technology, ART) bought in conjunction with the series.

At NMNH, I would like to thank Elizabeth Ban, former Principle Investigator and Manager, NMNH/COSEE Partnership, who worked closely with OP&A in proposing the studies to NSF and ensuring their efficient implementation. Elizabeth was succeeded by Trish Mace, Ocean Education Specialist and Manager, NMNH/COSEE Partnership, who restarted the series and saw it to completion. Catherine Sutura, Ocean Educator, assisted throughout. At OP&A, the study was under the overall supervision of Zahava D. Doering, Senior Social Scientist, and Whitney Watriss, Acting Director, ably assisted by Lance Costello and Kelly Richmond.

Special thanks go to the audience at the various lectures for their enthusiastic cooperation with the data collection.

Whitney Watriss, Acting Director
Office of Policy and Analysis

INTRODUCTION

The Smithsonian Institution’s Office of Policy and Analysis (OP&A) assessed the programs of “Changing Tides: A Series of Ocean Discussions,” presented by leading marine scientists and researchers on ocean science and conservation. The eight installments of the lectures series, over two years, were held in the Baird Auditorium at the Smithsonian Institution’s National Museum of Natural History (NMNH), in partnership with the Center for Ocean Sciences Education Excellence (COSEE) and funded by the National Science Foundation (NSF). The series had several goals: promote public understanding of current issues in ocean science, such as climate change and its effects on the ocean, ocean biodiversity loss, the ocean and human health, and coastal hazards; advance ocean literacy; disseminate information on recent ocean science research; and provide a forum for the public to discover the connection between human actions and ocean health. Table 1 below gives the title and date of each lecture, as well as the number of attendees who participated in the data collection. Data were collected by means of audience response technology (ART, or “clickers”). This report is a final analysis of those data.

Table 1. Changing Tides: A Series of Ocean Discussions

Title	Date	Attendees
1. Brave New Ocean	Tuesday, June 8, 2010	167
2. Eye on the Storm: Predicting a Hurricane’s Path of Destruction	Thursday, October 7, 2010	85
3. Climate, Oceans, and Human Health: The Cholera Paradigm	Thursday, February 24, 2011	78
4. One Year After the Gulf Oil Spill	Tuesday, April 19, 2011	102
5. Ocean: A Multimedia Event Blending Art and Science	Sunday, June 3, 2012	190
6. The Deep Sea: Life in Extreme Environments and Exploitation of Natural Resources	Thursday, July 19, 2012	75
7. Drugs from the Deep	Wednesday, October 17, 2012	53
8. Bioluminescence in Art and Science	Thursday, November 8, 2012	78

BACKGROUND

In 1999, The Ocean Project,¹ which had been formed by a small number of North American aquariums, sponsored a national public opinion survey on ocean topics. The results indicated a massive gap in public awareness of ocean-related issues—most Americans did not understand the current condition of the ocean, nor did they see ocean issues as important. In contrast, surveys of visitors to an exhibit at NMNH conducted in December 2003 indicated that people appreciated the ocean and were more interested in it than in most other science-related topics.² Nevertheless, according to the data, visitors had only a superficial understanding of the ocean.

In response to these two surveys, NMNH felt a pressing need to contribute to creating a more ocean-literate society, consistent with the Smithsonian Institution's (SI) strategic goal of becoming a leader in the dissemination of scientific data and research. Toward that goal, the museum has undertaken a number of initiatives, including construction of the Sant Ocean Hall in 2008. One project, begun in June 2010 in conjunction with COSEE, was the two-year "Changing Tides" lecture series. Lecture topics included: climate change, ocean biodiversity, the ocean and human health, and coastal hazards. The program format combined lectures or panels with a question and answer period at the end of each lecture to further educate the public. Data were collected by means of audience response technology (ART, or "clickers"). The technology, described more fully below, allows for immediate compilation of the data and reporting the more straightforward results (frequency distributions) to the audience.

Study Goals

NMNH partnered with OP&A to collect data from attendees at each lecture and to "analyze the data to assess the success of the lecture series in achieving its goals"³ at the end of the two-year program. To get comparable data across all eight lectures, two of the content-related questions were asked in every survey, both pre- and post-lecture, whereas the other questions changed depending on the topic of the lecture. The two common questions are listed below:

¹ The Ocean Project was formed in the late 1990s to advance ocean conservation in partnership with zoos, aquariums, and museums (ZAMs). It has grown into a network of 1,000 partner ZAMs, plus conservation and education organizations, agencies, and other institutions in all 50 U.S. states and 85 other countries. (See <http://theoceanproject.org/index.php>.)

² http://www.mnh.si.edu/exhibits/ocean_hall/asking_the_audience.html.

³ Page 8, *Moving Beyond the Basics: An Ocean Sciences Lecture Series to Increase Ocean Literacy* (project proposal to the National Science Foundation), August 3, 2009.

1. Of the following five items, which ONE do you think most threatens the long-term health of the ocean?
 - a) Climate change and ocean acidification
 - b) Habitat transformation
 - c) Invasive species
 - d) Overfishing/destructive fishing techniques
 - e) Pollution

2. Of the following four statements about your role in ocean health, which ONE do you agree with most?
 - a) My personal actions have a great impact on the health of the ocean
 - b) My personal actions have some impact on the health of the ocean
 - c) My personal actions have little impact on the health of the ocean
 - d) My personal actions have no impact on the health of the ocean

As noted, this report presents an analysis of the data collected from attendees at the eight lectures. The purpose of this analysis is to determine if the lectures were in alignment with the project's stated goals of "promot[ing] ocean literacy, disseminat[ing] information on recent ocean science research and discoveries, and provid[ing] a forum for the public to discover how humans and the ocean are inextricably connected." ⁴

Methodology

To assess the effectiveness of the lectures, NMNH purchased audience response technology (ART, or "clickers") with which to conduct pre- and post-lecture surveys. These surveys, completed electronically at each lecture, included questions related to program attendees' opinions on ocean-related topics in general and specific to the particular lectures, as well as demographic information. As adult attendees entered the auditorium they were handed a credit card-sized "clicker." Respondent figures, shown in Table 1, page 2, of this document, reflect the total number of discreet respondents at each lecture. Each attendee who received a "clicker" was not compelled to respond to the survey questions, either pre- or post-lecture; hence the number of survey responses may vary from the respondent figures for each particular lecture, as well as potentially vary from the pre- and post-lecture conditions within each lecture. Attendees who chose to participate used their "clickers" to provide their demographic

⁴ Page 1, *Moving Beyond the Basics: An Ocean Sciences Lecture Series to Increase Ocean Literacy* (project proposal to the National Science Foundation), August 3, 2009.

information and responded to the questions on the lectures by selecting one of up to five possible responses.

The answers were sent via radio waves to a receiver in the lecture hall, and the simple results (frequencies) could be displayed in graphic form to the audience either during or after the lecture. That is, participants contributed their opinions in an interactive, multiple-choice, confidential way. The data were also collected instantly on a computer and organized into a spreadsheet format, eliminating the transcription errors that can occur when humans convert data from paper surveys into digital format. At the end of each lecture, NMNH sent the data to OP&A for analysis.^{5,6} While ART allows for immediate display of survey response results to the collected audience, this functionality was not systematically integrated into the lectures, so frequencies were not displayed. Thus, attendees did not have access to real-time results.

All presentations took place in Baird Auditorium, located on the ground floor of the museum. The majority of these events were held on weekday evenings starting between 5:30 and 6:30 pm; exceptions were the multimedia event held in June 2012, which took place on a Sunday and started at 3:00 pm; the July 2012 lecture on the deep sea, which took place from 3:00-4:00 pm; and the final talk in November 2012, which was from 4:00-5:00 pm. As the multimedia event was the least academically focused in the series and due to its day and time, many of the attendees were accompanied by small children, some of whom were disruptive. OP&A and NMNH staff assumed that the pool of individuals who would be drawn to the lectures would be essentially the same across the lecture series. Even though the lecture topics would be different, as all related to the health of the ocean and would be similarly promoted, the assumption was valid.

⁵ In this and subsequent reports, the percentages provided are “valid.” That is, the calculation of percentages excludes missing or incorrect data, which can result when participants accidentally push a button on their “clicker” that is not a valid option for a given question. For example, if the possible answers to a question are options A, B, C, and D, and a person accidentally clicks E, the datum is “unusable” and will be recoded as missing and not included in the calculation.

⁶ Chi-squared correlations are “statistically significant” at an alpha level of .05 or less.

RESULTS

Audience Characteristics

Attendees most commonly self-identified as either a *concerned citizen* (40%) or a *scientist or science-related professional working in the ocean arena* (25%). Nearly one-half of attendees learned about the lecture through electronic sources, such as an *e-mail, listserv, or NMNH website* (42%), while about a fourth (24%) learned via *word of mouth*. (The survey questions are found in Appendix A and the related frequency distributions in Appendix B.)

Over half (52%) of attendees held Masters or Doctoral degrees, while three in ten (28%) held Bachelor's degrees. More women (61%) attended the lectures than men. The two largest age groups were 46-64 year-olds (33%) and 18-30 (30%). Most attendees (71%) lived in the D.C. metropolitan area.

Breaking the data down by lecture yields similar results as a whole, but with a few key differences for each lecture.

June 8, 2010 *Brave New Ocean*

- One in three (33%) of people self-identified as *concerned citizens*, approximately 7% less than the lecture series average.
- 16% of attendees reported that they had completed *one or more years of college, no degree* compared to the overall average of 11%.
- Nearly one in five (18%) indicated that they were from *elsewhere in the U.S.* The average was 13%, although in five other lectures this category comprised between 3% and 10% of the attendees.
- Two in five attendees (39%) were aged 18-30, a larger segment of younger participants than in the subsequent lectures and in the series average (30%).

October 7, 2010 *Eye on the Storm: Predicting a Hurricane's Path of Destruction*

- More than four in ten (45%) of participants learned about the lecture via *e-mail or listserv*, compared to three in ten on average (32%).
- Nearly one-half (46%) of attendees were between the ages of 46 and 64, older than the series average (33%).
- Close to six in ten participants (59%) were from *the MD/VA suburbs*, the highest percentage for the series and higher than the average for the entire

series (44%).

February 24, 2011 *Climate, Oceans, and Human Health*

- Nearly one-half (47%) of participants lived within the D.C. city limits, not including the surrounding suburbs. When the suburbs are included, 92% of participants were from the D.C. metropolitan area, compared to an average of 82% across all lectures.
- Approximately one-half (48%) of attendees self-identified as *concerned citizens*, higher by nearly 10 percent than the series average (40%) and second highest for the series.
- About two-thirds of lecture attendees (65%) held graduate degrees compared to the series average of about half of attendees (52%).

April 19, 2011 *One Year After the Gulf Oil Spill*

- Two out of five participants (38%) were between the ages of 31 and 45. This age group represented between 15% and 26% of attendees in the three preceding lectures and 23% for the complete series averaged.
- The percentage of men (47%) who attended was higher than at any other session and almost 10 percent higher than the series average (39%).
- Just over two-thirds of lecture attendees (67%) held graduate degrees compared to the series average of about half of attendees (52%).

June 3, 2012 *Ocean: A Multimedia Event Blending Art and Science*

- Only ten percent of participants were *scientists or science-related professionals working in the ocean arena*, the lowest number in the series (the average was 25%).
- More than half of participants (52%) were self-identified as *concerned citizens*, the highest percentage reported.
- Two out of five attendees (41%) learned about the lecture through a *poster or flyer*, while an average of one in five participants became aware by this method for the series as a whole (19%).

July 19, 2012 *The Deep Sea: Life in Extreme Environments and Exploitation of Natural Resources*

- Almost half of lecture participants (48%) were *scientists or science-related professionals working in the ocean arena*, compared to the series average (25%).

October 17, 2012 *Drugs from the Deep*

- About two-fifths of participants (39%) were *scientists or science-related professionals working in the ocean arena*, compared to the series average (25%).
- One in two attendees (50%) found out about the lecture via *e-mail* or *listserv* while the series average was 18 percent lower, at 32%.
- Two-fifths of attendees were aged 46-64 (40%), which was 7 percent higher than the series average (33%) and the second largest population of this age group attending the series.

November 3, 2012 *Bioluminescence in Art and Science*

- Almost two in five (37%) were 18-30, younger than the subsequent lectures and lower than the average (30%).
- Almost one half of lecture attendees (49%) were at the lecture solo compared to the series average of about a third of attendees (32%). Note that who the respondent was with was only asked of attendees to the final four lectures, not the entire series of eight lectures.

Data Analysis

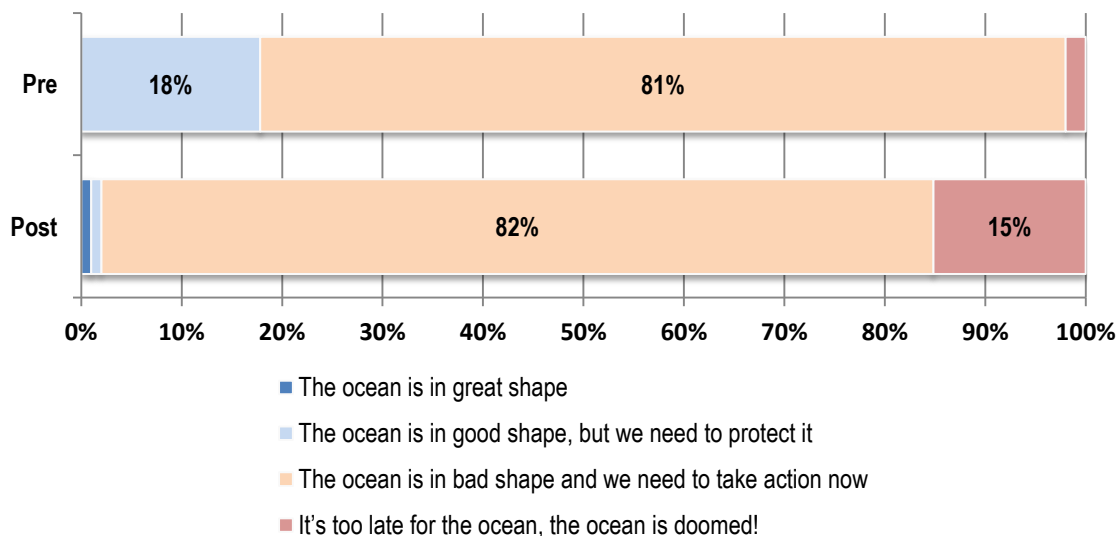
June 8, 2010 Lecture *Brave New Ocean*

Dr. Jeremy Jackson, a senior scientist at the Smithsonian Tropical Research Institute in the Republic of Panama, gave the inaugural lecture, *Brave New Ocean*. His talk, which took place on *World Oceans Day*, provided a “kick-off” overview of the overall health of the ocean today, the challenges it faces, and its future.

Health of the Ocean

Attendees were asked before and after the lecture to select which of four characterizations of the health of the ocean they agreed with most. Before the lecture, four in five respondents selected, *the ocean is in bad shape and we need to take action now* (81%); about one in five were more optimistic, selecting *the ocean is in good shape, but we need to protect it* (18%). Following the lecture, respondents were less optimistic. While four in five attendees again characterized the ocean’s health as *bad and in need of action*, about one in seven marked *It’s too late for the ocean, the ocean is doomed* (15%). Overall, about three in ten attendees (29%) were more pessimistic about the ocean’s health after the lecture than before (there was a 15% shift from *good* to *bad* and 12% from *bad* to *doomed*). (See Figure 1.)

Figure 1. Health of the Ocean

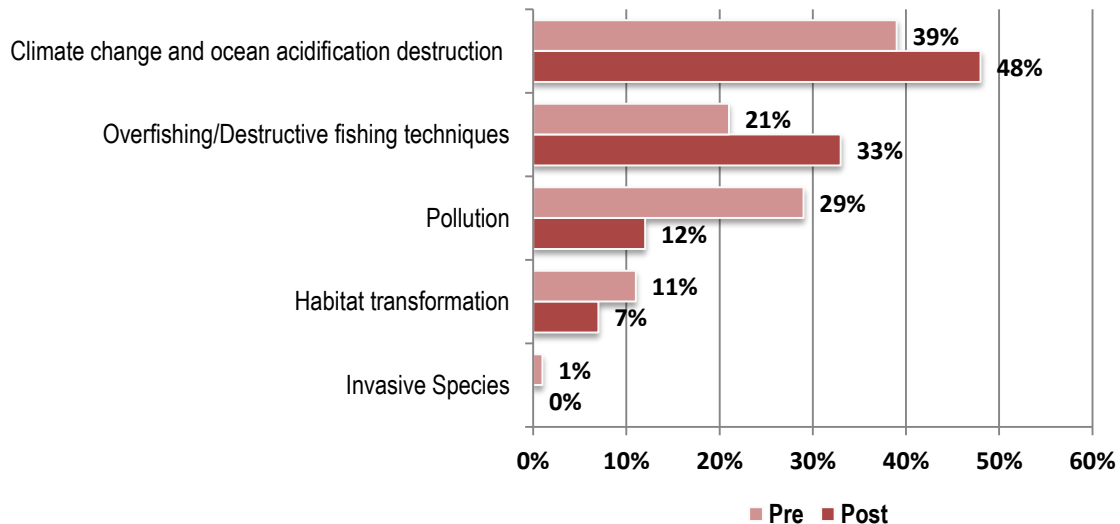


Threats to the Long-Term Health of the Ocean

Attendees were asked before and after the lecture to select which of five options—climate change and ocean acidification, habitat transformation, invasive

species, overfishing/destructive fishing techniques, and pollution—was the greatest threat to the long-term health of the ocean. Before the lecture, four in ten (39%) attendees chose climate change, whereas after the lecture the percentage increased by nearly 10% to roughly half the audience (48%). Eight out of ten participants (81%) chose the same threat both before and after the lecture, while three out of four (74%) selected a different threat in the post-lecture survey.⁷ (See Figure 2, next page.)

Figure 2. Threats to the Long-Term Health of the Ocean

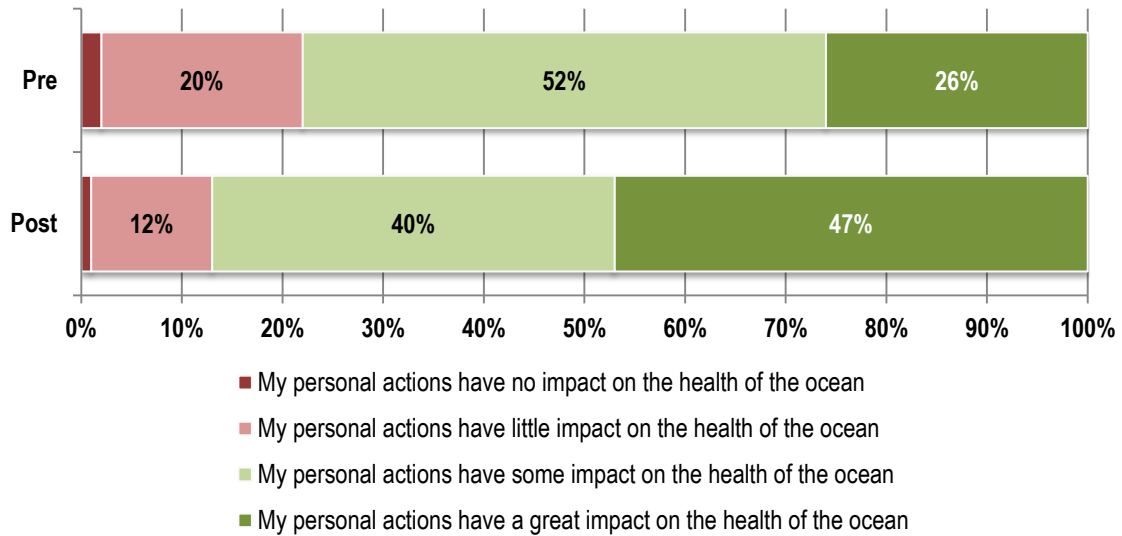


Personal Impact on the Health of the Ocean

Attendees were asked before and after the lecture to select from a list of four statements that characterized to what extent they personally can affect the ocean’s health—*great*, *some*, *little*, or *no*. Overall, respondents seemed to agree that their actions had some direct impact on the health of the ocean, although they varied in the severity of that impact. Before the lecture, 26% chose a *great* impact and 52% *some* impact. These percentages increased in the post-lecture survey: 47% chose *great* and 40% *some* impact. Overall, after the lecture about two in three attendees (65%) selected the same level of impact as before, whereas 32% concluded that they had a greater role (20% went from *some* to *great*; 8% from *little* to *some*.) (See Figure 3, next page.)

⁷ When the report notes that a certain percentage selected the same response before and after the lecture, this does not mean that the same people held with their same choices, but that the percentages for the two options did not change. When the reference is explicitly that the same people selected the same response, this is the case. Except for the multimedia presentation in June 2012, there was a high retention rate between pre- and post-lecture questions (between 75% and 95%) and the distribution of respondent attrition was similar across responses to pre-lecture questions.

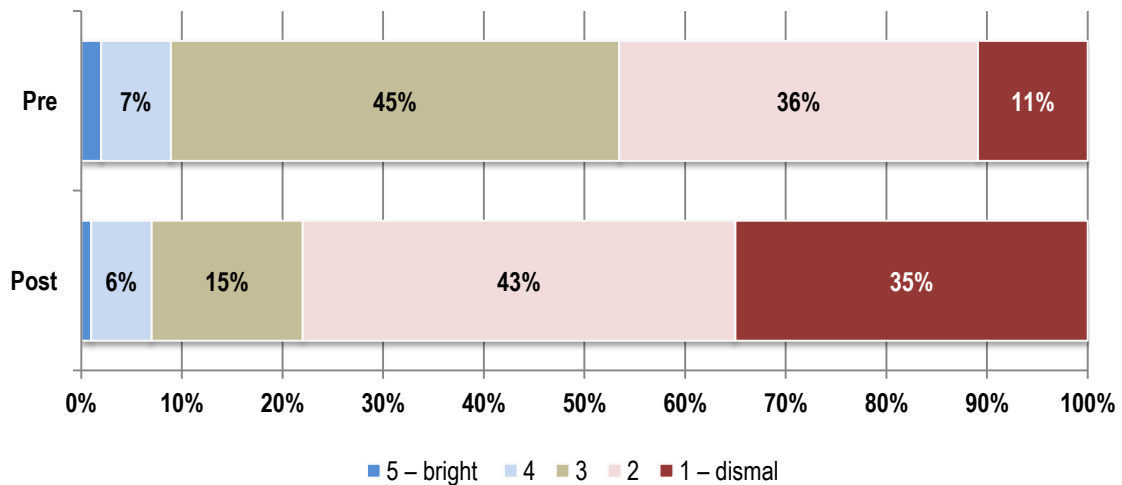
Figure 3. Personal Impact on the Health of the Ocean



The Ocean’s Future

Attendees were asked both before and after the lecture: “On a scale of 1-5, where 1 is ‘dismal’ and 5 is ‘bright,’ where would you place the Ocean’s future?” Before the lecture, 92% ranked the Ocean’s future at 3 or less, with nearly one-half (45%) selecting “3.” In the post-lecture survey, they were even less optimistic about the future of the ocean: 78% chose a ranking of “1/dismal” or “2,” and only 15% marked “3.” Just 1% of attendees chose “5/bright.” Overall, two in five (42%) held the same opinion of the ocean’s future both before and after the lecture, and more than half (53%) had a less optimistic view after the lecture. (See Figure 4.)

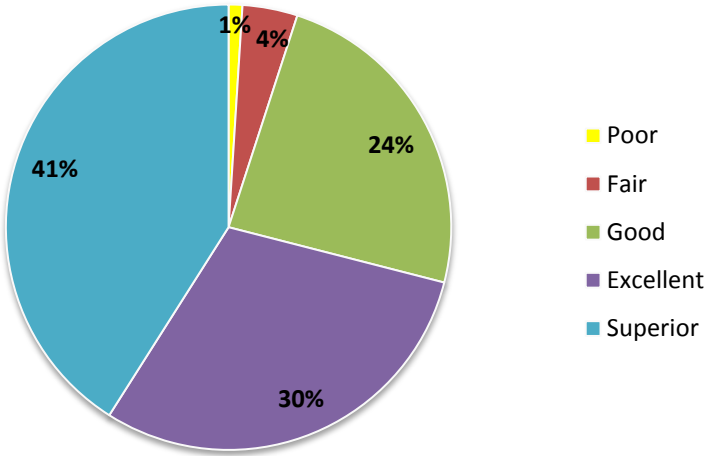
Figure 4. The Ocean’s Future



Overall Experience with the Lecture

Following the lecture, attendees were asked to rate their overall experience with the lecture on a five-point scale—*poor*, *fair*, *good*, *excellent*, or *superior*. Four in ten thought the lecture was *superior* (41%), and another three in ten selected *excellent* (30%). One in four respondents chose *good* (24%), and few rated it *fair* (4%) or *poor* (1%). (See Figure 5, next page.)

Figure 5. Overall Experience Rating with the Lectures



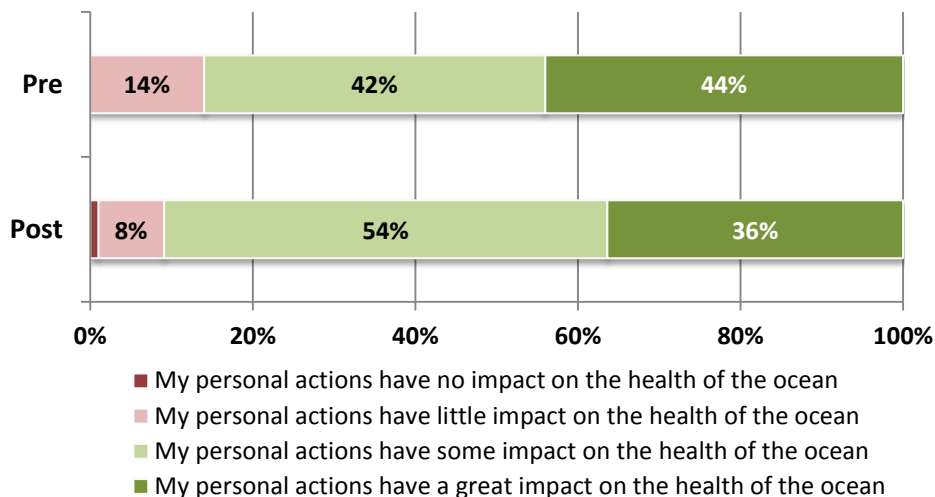
October 7, 2010 Lecture: *Eye of the Storm: Predicting a Hurricane’s Path of Destruction*

The second lecture, *Eye on the Storm: Predicting a Hurricane’s Path of Destruction*, was given by Dr. Isaac Ginis, a professor of oceanography at the University of Rhode Island. His focus was how scientists observe, model, and forecast hurricanes around the world, and how climate change affects the frequency and intensity of hurricanes.

Personal Impact on the Health of the Ocean

As with the first lecture, attendees were asked before and after the lecture to choose one of four characterizations of the impact of their personal actions on the ocean’s health—*great*, *some*, *little*, or *no*. Before the lecture more than two in five of the group’s respondents (44%) chose *great* impact, four in ten (42%) went with *some*, one in seven (14%) selected *little*, and no one chose *no* impact. After the lecture one in three attendees (36%) selected a *great* impact, over one-half (54%) marked *some*, about one in ten chose *little*, and just one in a hundred or 1% saw their actions having *no* impact. After the lecture, seven in ten attendees (76%) thought their impact was the same as it had been before the lecture, whereas 10% moved to a greater role (9% reduced their impact from *great* to *some*; 9% went from *little* to *some*). (See Figure 6.)

Figure 6. Personal Impact on the Health of the Ocean



Threats to the Long-Term Health of the Ocean

Attendees were asked before and after the lecture to select which of five options posed the greatest threat to the long-term health of the ocean: *climate change and ocean acidification*, *habitat transformation*, *invasive species*, *overfishing/destructive*

fishing techniques, and pollution. Before the lecture, over one in three attendees (36%) chose climate change as the main threat, a percentage that increased by 23% to roughly six in ten (59%) after the lecture. Overall, approximately three out of five participants (61%) chose the same threat both before and after the lecture, while the remaining two out of five (39%) selected a different threat. (See Figure 7, next page.)

Effect of Climate Change on Hurricanes

Attendees were asked before and after the lecture to select one of five statements about how climate change affects hurricanes: *increase the number of hurricanes and tropical cyclones, increase the intensity of hurricanes and tropical cyclones, increase the number AND intensity of hurricanes and tropical cyclones, have minimal or no effects, or I don't know.* (The lecture speaker designated the correct response to “What effect will climate change have on hurricanes?” as *climate change will increase the intensity of hurricanes and tropical cyclones.*) Upon entrance to the lecture, nearly three in four attendees (72%) thought climate change would *increase the number AND intensity* of hurricanes, whereas upon exit almost seven out of ten (69%) thought it would only *increase the intensity*. Overall, more than three-quarters of respondents (78%) selected a new response post-lecture and only one in five participants (22%) chose the same answer both before and after the lecture (55% moved from *hurricane intensity* to *hurricane number AND intensity*). (See Figure 8, next page.)

Figure 7. Threats to the Long-Term Health of the Ocean

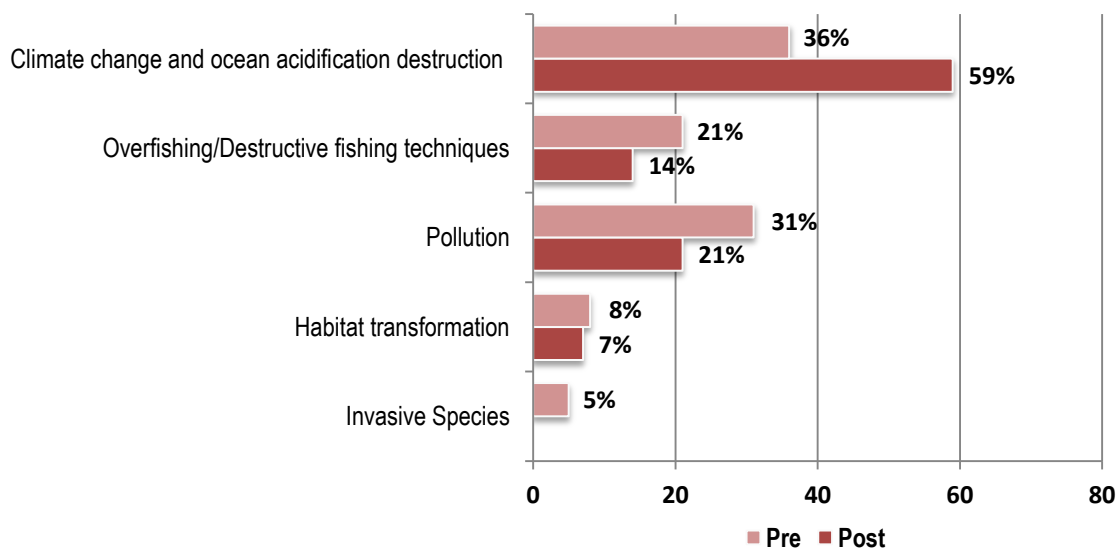
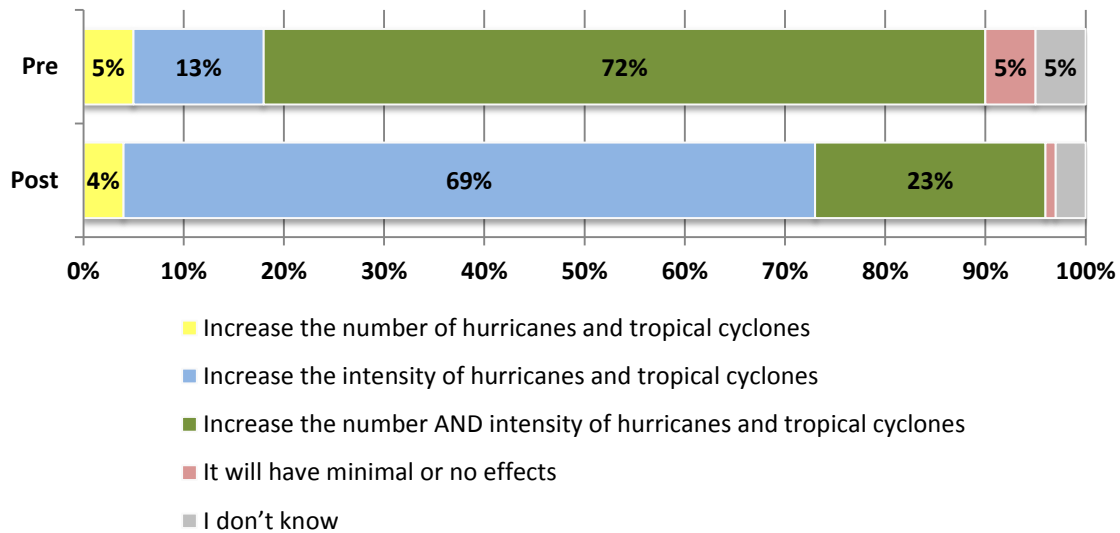


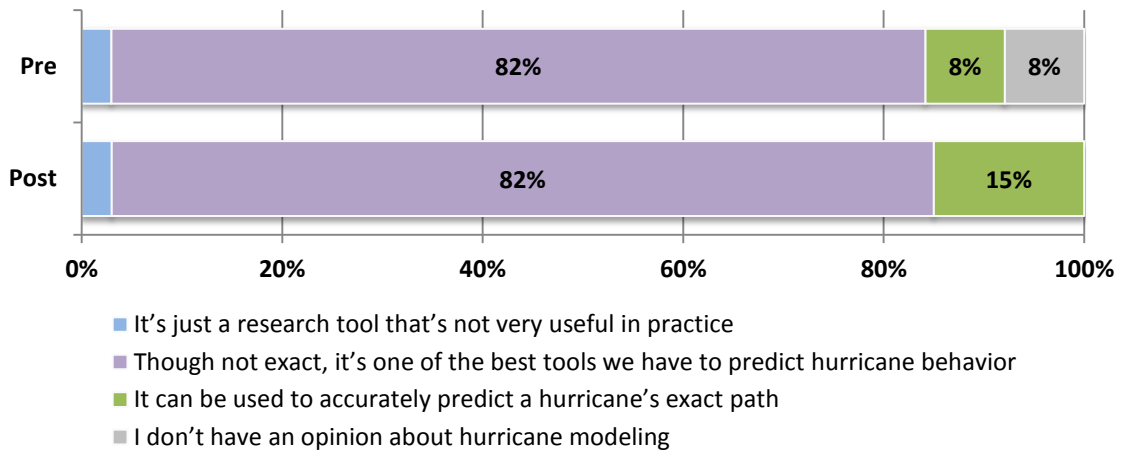
Figure 8. Effect of Climate Change on Hurricanes



Value of Hurricane Modeling

Attendees were asked before and after the lecture to choose one of four statements that corresponded with their opinion of the value of hurricane modeling: *it's just a research tool that's not very useful in practice; though not exact, it's one of the best tools we have to predict hurricane behavior, it can be used to accurately predict a hurricane's exact path; and I don't have an opinion on hurricane modeling.* (The speaker hoped that attendees would be of the opinion that the value of hurricane modeling is, *though not exact, one of the best tools available to predict hurricane behavior.*) Before the lecture, eight in ten participants (82%) chose *though not exact, [hurricane modeling] is one of the best tools we have to predict hurricane behavior.* This percentage remained unchanged following the lecture, at 82%. The percentage that agreed with the statement that hurricane modeling *can be used to accurately predict a hurricane's exact path* doubled from 8% at the start of the lecture to 15% at the end. More than three-quarters of participants (77%) selected the same response both before and after the lecture, while the remainder (23%) chose another response (9% changed their answer on the value of hurricane modeling from *though not exact, one of the best tools available to can be used to accurately predict a hurricane's path*) . (See Figure 9.)

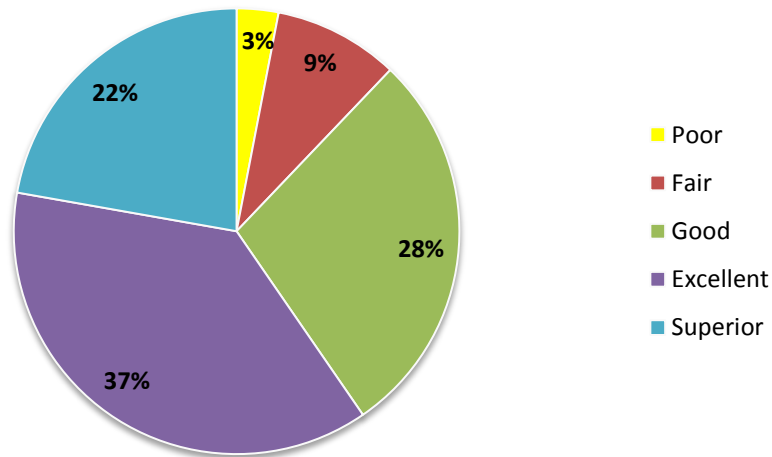
Figure 9. Value of Hurricane Modeling



Overall Experience with the Lecture

Following the lecture, attendees were asked to rate their *overall experience* with the lecture on a five-point scale—*poor*, *fair*, *good*, *excellent*, and *superior*. Overall, people were modestly satisfied. Two in ten respondents thought it was *superior* (22%), and another four in ten selected *excellent* (37%). One in four chose *good* (28%), and a few rated it *fair* (9%) or *poor* (3%). (See Figure 10.)

Figure 10. Overall Experience Rating



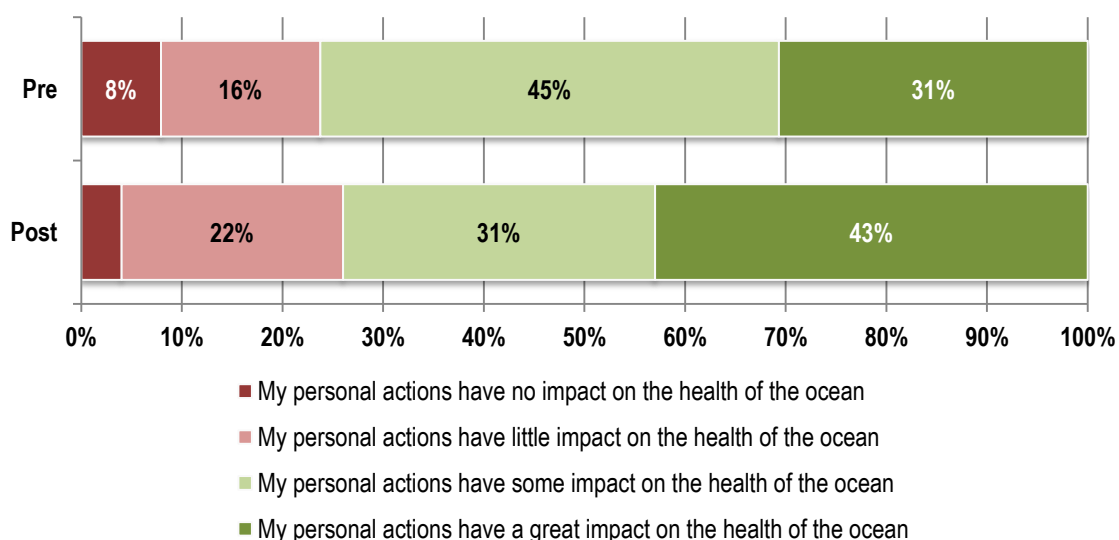
February 24, 2011 Lecture: Climate, Oceans, and Human Health: The Cholera Paradigm

The third lecture, *Climate, Oceans, and Human Health: The Cholera Paradigm*, was given by Dr. Rita Colwell, former director of the National Science Foundation and Distinguished University Professor at the University of Maryland and at the Johns Hopkins University's Bloomberg School of Public Health. Her lecture presented results of her research on the connection between ocean and human health, and on waterborne infectious diseases generally and cholera specifically.

Personal Impact on the Health of the Ocean

Attendees were asked before and after the lecture to select one of four statements about the extent of the impact their personal actions have on the ocean's health—*great*, *some*, *little*, or *no* impact. Prior to the lecture almost one half (45%) selected *some* impact, while three in ten (31%) chose *great*. After the lecture, more than four in ten attendees (43%) saw their actions as having a *great* impact, and about a third of attendees (31%) chose *some* impact. Over seven in ten (73%) of attendees indicated the same impact before and after the lecture, while after the lecture 17% came away thinking they had a greater role. (See Figure 11.)

Figure 11. Personal Impact on the Health of the Ocean



Threats to the Long-Term Health of the Ocean

Attendees were asked before and after the lecture to select which of five options represented the greatest threat to the long-term health of the ocean: *climate change*

and ocean acidification, habitat transformation, invasive species, overfishing/destructive fishing techniques, and pollution. Before the lecture, four in ten (43%) attendees responded *climate change*, while after the lecture this percentage increased nearly 16% to roughly six in ten (59%). Overall, approximately two out of three participants (66%) chose the same threat both before and after the lecture, and the remaining one-third (34%) went with a different threat. (See Figure 12.)

Climate Change and Human Health

Attendees were asked before and after the lecture to select one from a list of four statements about how climate change will affect human health: *climate change will have a dramatic impact on human health*, *climate change will have some impact on human health*, *climate change will have minimal or no impact on human health*, and *I don't know because not enough is known about the impact of climate change on human health*. (The speaker hoped that those listening to the talk would agree that *climate change will have a dramatic effect on human health*.) Before the lecture, three out of four respondents (73%) indicated that they thought *climate change will have a dramatic impact*, and one in five (17%) chose *some impact*. One in ten marked that they did not know. After the lecture, four out of five participants (81%) selected a *dramatic impact*, and one in five (18%) selected *some impact*. After the lecture, only 1% marked that they did not know. Overall, eight in ten (83%) chose the same impact before and after the lecture. Slightly more than one in ten (12%) came away after the lecture thinking the impact will be greater (6% went from *some* to *dramatic*, 6% went from *unsure* to *dramatic*, and 3% went from *unsure* to *dramatic*). (See Figure 13.)

Figure 12. Threats to the Long-Term Health of the Ocean

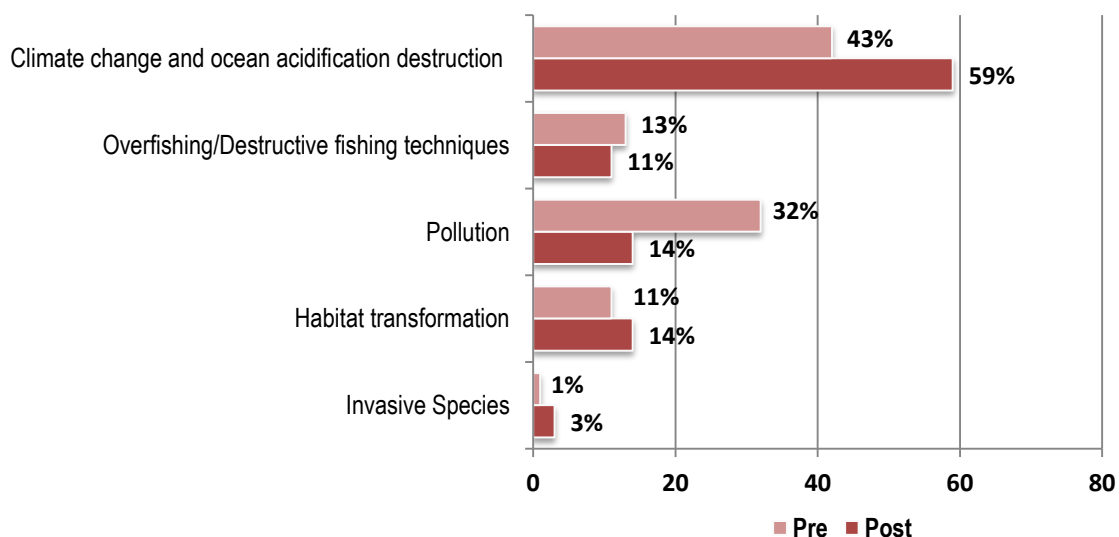
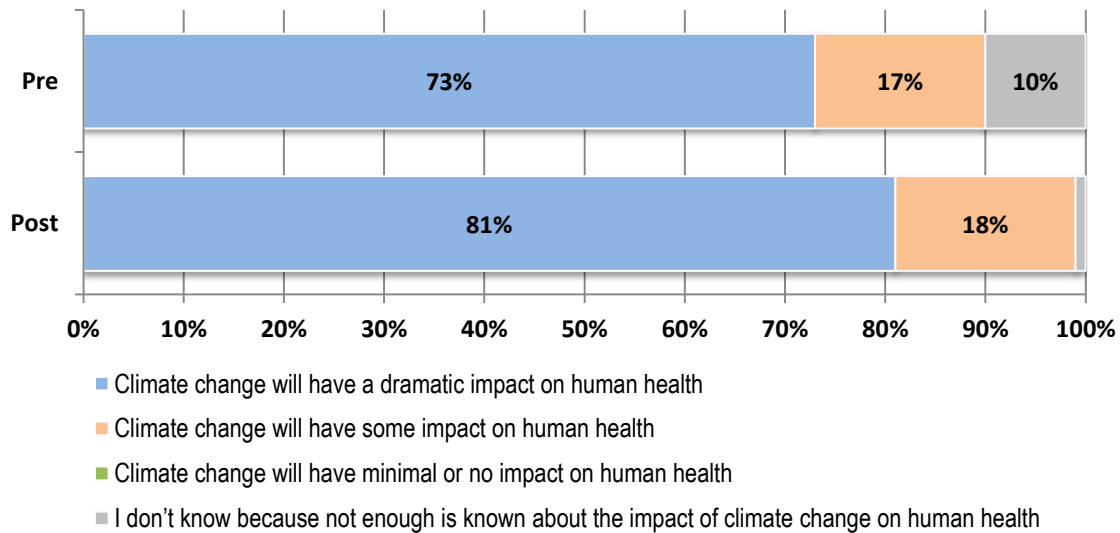


Figure 13. Climate Change and Human Health



Ocean and Human Health

Attendees were asked both before and after the lecture to select which of four statements best represented their opinion about the connection between the ocean and human health: *closely connected*, *somewhat connected*, *minimally connected*, or *not connected*. (The presenter hoped that lecture attendees would be of the opinion that *the ocean and human health are closely connected*.) Before the lecture, nearly nine in ten attendees (86%) chose *the ocean and human health are closely connected*. This percentage remained approximately the same following the lecture, with nine in ten (90%) choosing that option. Overall, eight in ten (82%) selected the same relationship before and after the lecture. Slightly over one in ten (13%) went with a stronger connection after the lecture (10% went from *somewhat* to *closely connected*). (See Figure 14, next page.)

Overall Experience with the Lecture

Following the lecture, attendees rated their *overall experience* with the lecture on a five-point scale—*poor*, *fair*, *good*, *excellent*, and *superior*. Overall, people were modestly satisfied—one in four (25%) thought the lecture was *superior*, and another four in ten (38%) selected *excellent*. One in three chose *good* (32%), and a few rated it *fair* (3%) or *poor* (3%). (See Figure 15, next page.)

Figure 14. The Ocean and Human Health

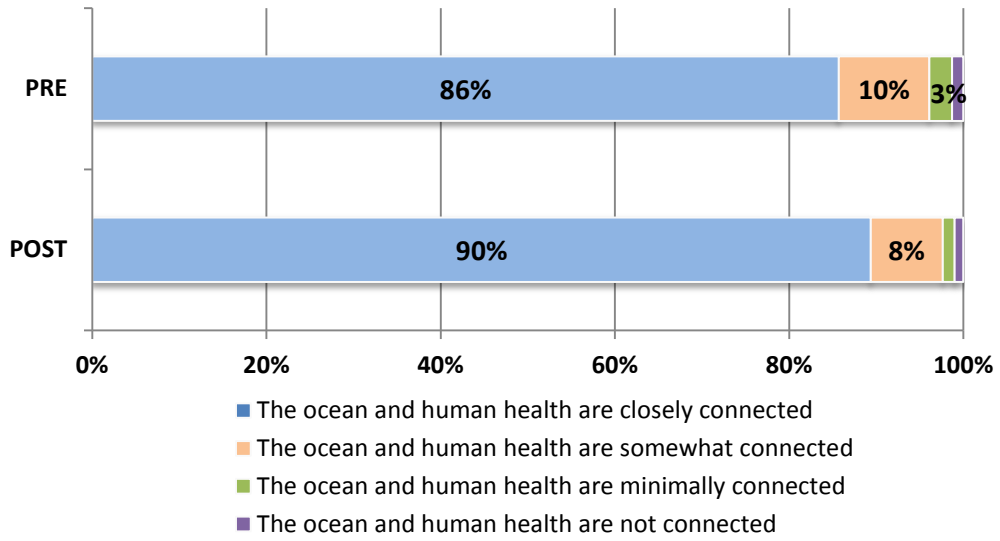
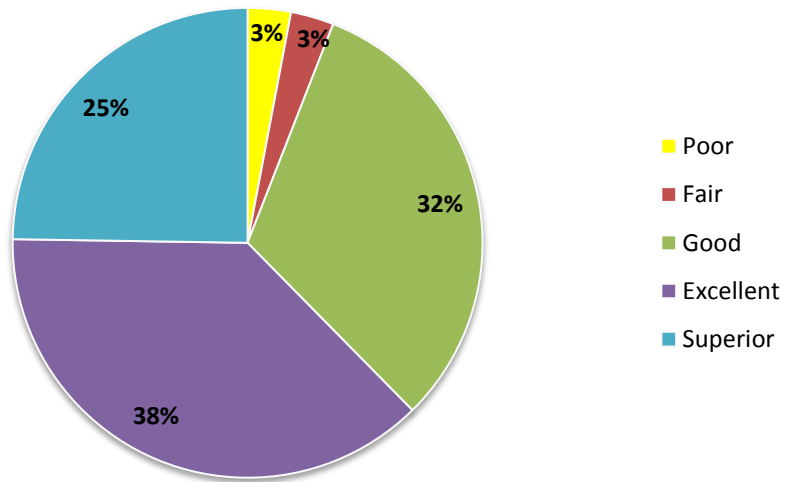


Figure 15. Overall Experience Rating



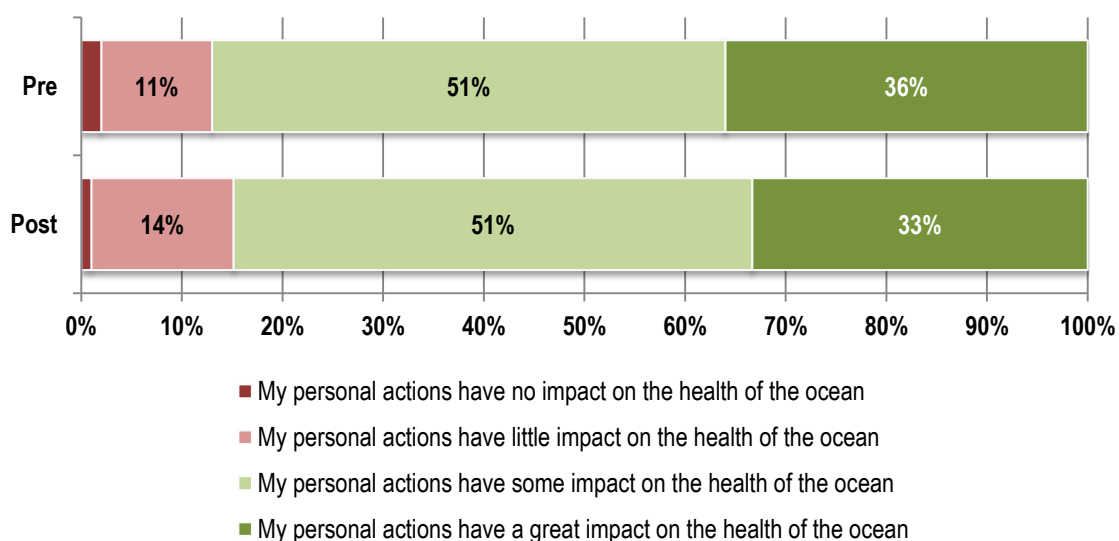
April 19, 2011 Lecture: One Year After the Gulf Oil Spill

The fourth lecture, *One Year After the Gulf Oil Spill*, involved a panel of four experts: Dr. David Hollander, Chemical Oceanographer from University of South Florida; Dr. Judilee Marrow, Veterinarian at Smithsonian National Zoological Park; Dr. John Stein, Acting Science and Research Director of the Northwest Fisheries Science Center of the National Oceanic and Atmospheric Administration (NOAA); and Dr. James Bonner, Professor of Civil and Environmental Engineering at Clarkson University. The discussion addressed the Deepwater Horizon oil spill in the Gulf of Mexico, the clean-up, and the effects on wildlife and consumption of seafood from the Gulf. The panelists talked about what happened, what has been learned, and the current status of the clean-up.

Personal Impact on the Health of the Ocean

Attendees were asked both before and after the lecture to select which of four statements best represented their opinion about the role of their personal actions on ocean health: *great*, *some*, *little*, or *no* impact. Before the lecture, three in ten attendees (36%) chose *great*, and just over one-half (51%) selected *some*. These percentages remained approximately the same after the lecture: one-third (33%) chose *great* impact and just over one-half (51%) again chose *some* impact. Nearly nine in ten attendees (87%) selected the same impact response before and after the lecture. Less than one in ten (6%) came away thinking they had a greater role (3% went from *some* to *great*, 3% went from *little* to *some*). (See Figure 16.)

Figure 16. Personal Impact on the Health of the Ocean



Threats to the Long-Term Health of the Ocean

Attendees were asked before and after the lecture which of five options was the greatest threat to the long-term health of the ocean: *climate change and ocean acidification, habitat transformation, invasive species, overfishing/destructive fishing techniques, and pollution*. Before the lecture, nearly one-half of attendees (48%) chose *climate change*, a percentage that remained essentially the same after the lecture (47%). Overall, approximately three out of four (76%) participants chose the same threat both before and after the lecture. The remaining 24% selected a different threat following the lecture than they did in the initial survey. (See Figure 17, next page.)

Present Location of the Remaining Oil

Before and after the lecture attendees were asked to choose one of four responses to the question: “Of the oil that wasn’t removed by burning, skimming, and direct recovery, where do you think the oil from the Deepwater Horizon spill went?” The four responses were: *It’s all still in the environment: in the marsh, buried in sand and sediments, and in the water of the Gulf and beyond; It’s all gone, evaporated dissolved, or eaten by microbes; A combination of the above answers; and We still don’t know exactly where it has all gone*. (The lecturer sought to share the idea that *We still don’t know exactly where [the oil] has all gone*.) Before the lecture, just over four in ten (42%) selected *we still don’t know*, but this percentage decreased to about one-fourth (26%) after the lecture. In the post-lecture survey, six out of ten attendees (61%) selected the same reply as in the initial survey, while four out of ten (39%) changed their answer (20% went from *we still don’t know* or *it’s all still in the environment* to *a combination of above answers*, 15% changed from *we still don’t know* or *a combination of above answers* to *it’s all still in the environment*). (See Figure 18, next page.)

Use of Dispersants

Attendees were asked before and after the lecture which of four statements best captured their opinion about the use of oil dispersants during the Gulf oil spill: *Dispersants are okay for the environment and it was good to use them; Dispersants aren’t the best for the environment, but it was necessary in the Gulf; Dispersants are bad for the environment and should not have been used; or More research needs to be done to determine the impact that dispersants combined with oil has on the environment*. (The lecture content hoped to illicit the response that *more research needs to be done to determine the impact that dispersants combined with oil has on the environment*.) Before the lecture, somewhat more than half the attendees (54%) chose *more research needs to be done*. After the lecture, nearly one-half (52%) selected *Dispersants aren’t the best for the environment, but it was necessary in the Gulf*.

Figure 17. Threats to the Long-Term Health of the Ocean

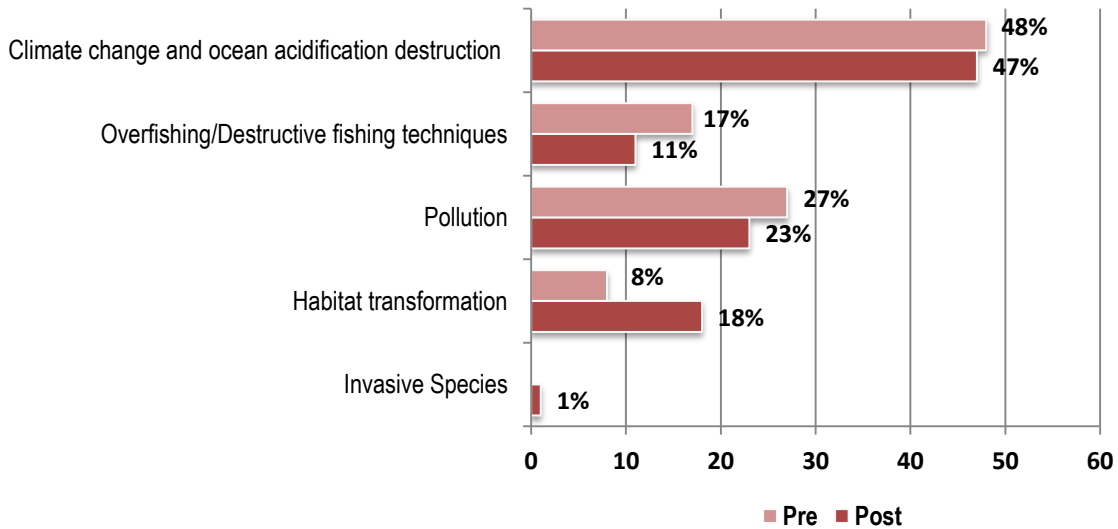
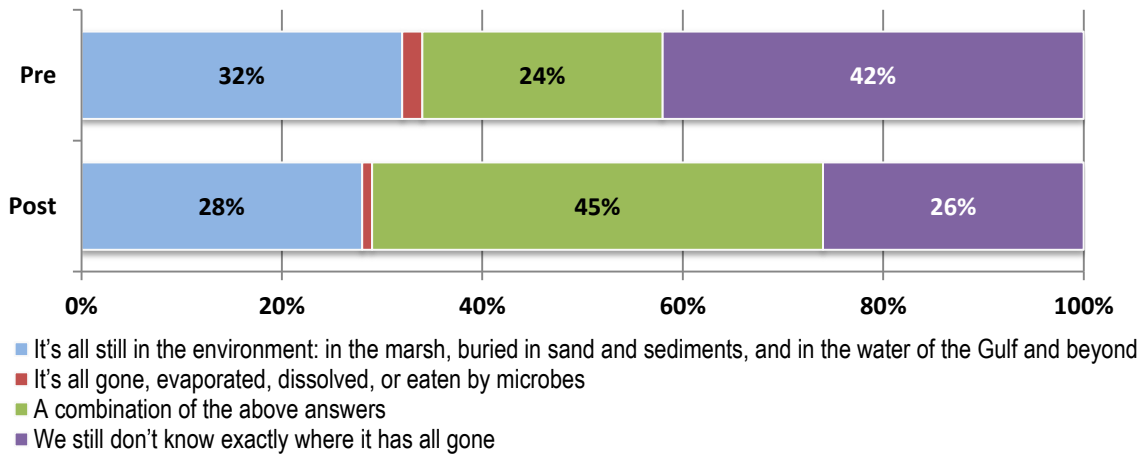
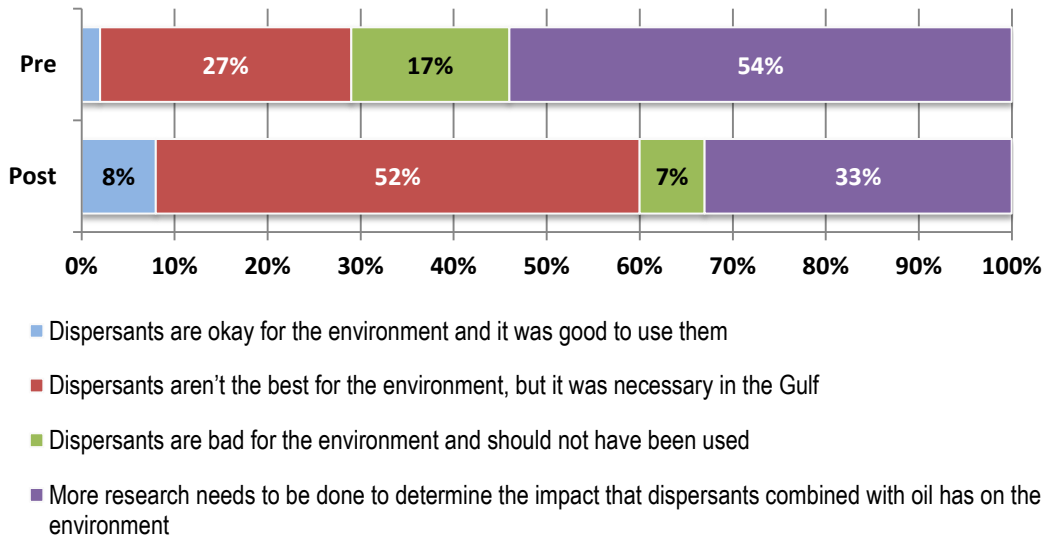


Figure 18. Present Location of Remaining Oil



Overall, one-half of attendees (54%) selected the same response before and after the lecture. The remaining 46% changed their responses in the post-lecture survey (24% who initially said *more research needs to be done* selected *dispersants aren't the best, but necessary in the Gulf* after the lecture). (See Figure 19, next page.)

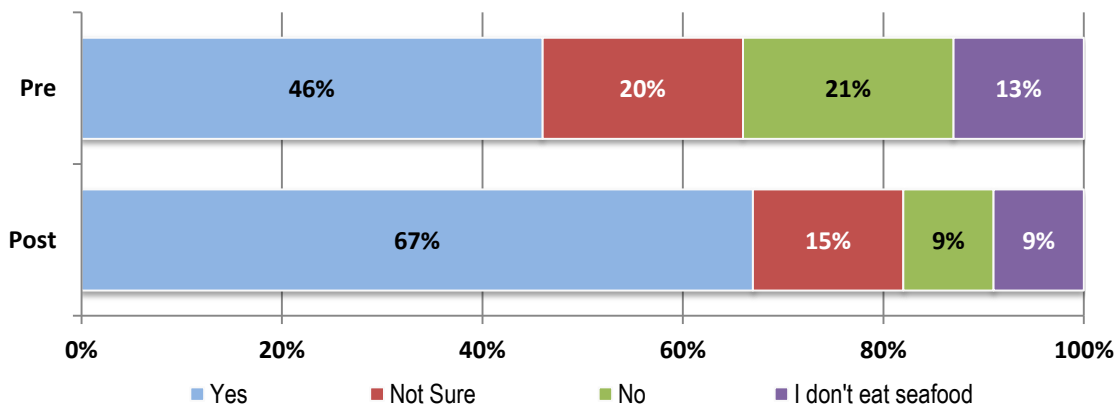
Figure 19. Use of Dispersants



Consumption of Seafood

Attendees were asked before and after the lecture whether they would eat seafood from the Gulf of Mexico; the options were *yes*, *not sure*, *no*, or *I don't eat seafood*. Initially, approximately half (46%) of attendees chose *yes*, one in five (20%) was *not sure*, and one in five (21%) marked *no*. Following the lecture, two out of three (67%) chose *yes*, and 15% were *not sure*. Overall, seven in ten (72%) marked the same answer before and after the lecture. However, one in ten respondents (11%) who selected *not sure* chose *yes* in the post-lecture survey. (See Figure 20.)

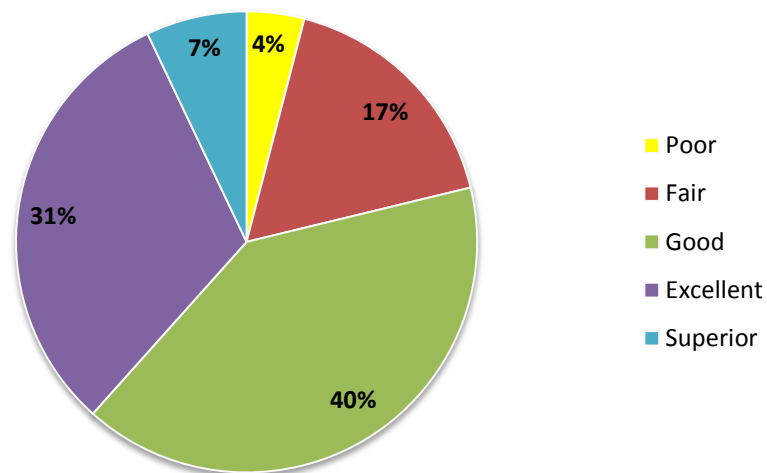
Figure 20. Consumption of Seafood



Overall Experience with the Lecture

Following the lecture, attendees were asked to rate their overall experience with the lecture on a five-point scale—*poor*, *fair*, *good*, *excellent*, or *superior*. Less than one in ten (7%) rated the lecture *superior*, while around three-quarters chose scale *excellent* (31%) or *good* (40%), and a combined total of one in five (21%) chose either *fair* or *poor*. (See Figure 21.)

Figure 21. Overall Experience with the Lecture



June 3, 2012 Lecture: *Ocean: A Multimedia Event Blending Art and Science*

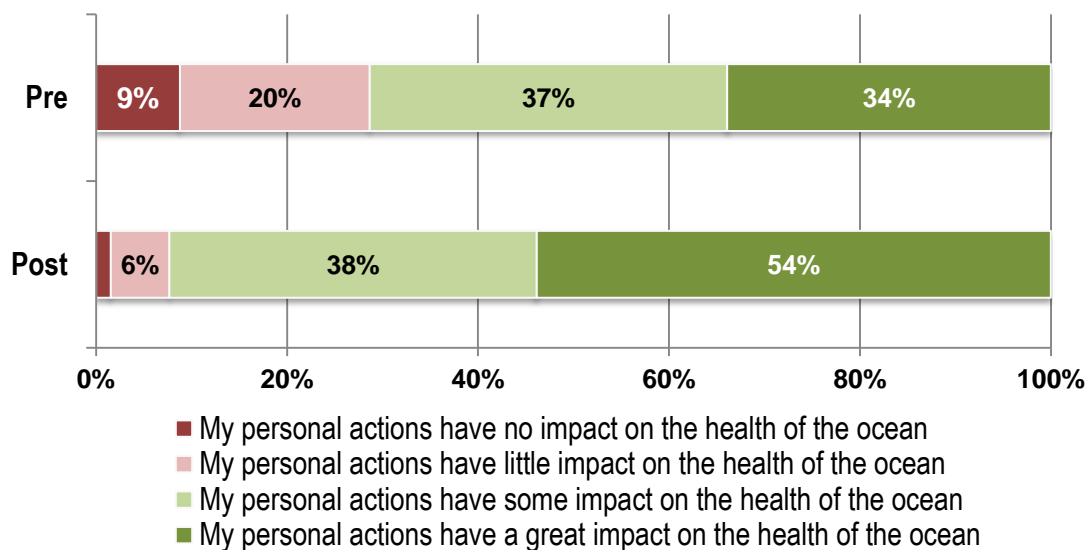
The fifth lecture, *Ocean: A Multimedia Event Blending Art and Science*, took place on a Sunday afternoon. To examine the state of the ocean, this event featured a blend of original music and dance by the SpectorDance company based in Monterey, CA, remarks by Dr. George Matsumoto, Monterey Bay Aquarium Research Institute, high definition underwater film, and interviews with ocean scientists.

Personal Impact on the Health of the Ocean

Attendees were asked both before and after the lecture to select which of four statements best represented their opinion about the level of impact their personal actions had on ocean health: *great*, *some*, *little*, or *no* impact. Respondents tended to see their actions as having more impact on ocean health after the lecture than before it. Before the lecture, three in ten attendees (34%) chose a *great* impact, just over one-third (37%) selected *some* impact, and one-fifth (20%) selected *little*. These percentages changed dramatically after the lecture: over half (54%) chose *great* impact, just over one-third (38%) again chose *some* impact, but very few chose *little* (6%). Forty-nine attendees (77%) selected the same impact response before and after the

lecture, while 11 attendees (17%) selected a higher impact response (14% went from *some* to *great*).⁸ (See Figure 22.)

Figure 22. Personal Impact on the Health of the Ocean

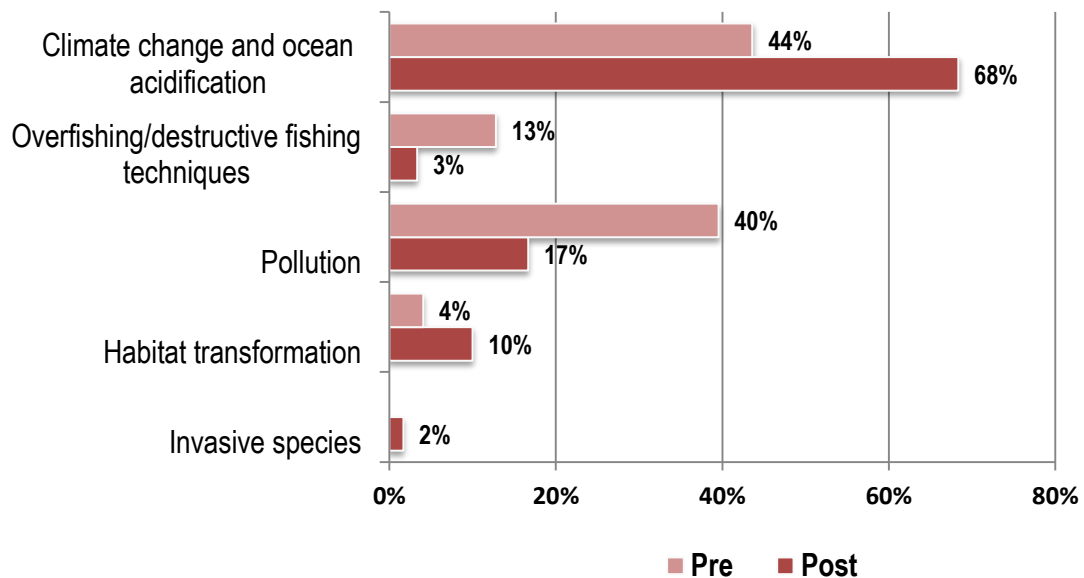


Threats to the Long-Term Health of the Ocean

Attendees were asked before and after the lecture which of five options was the greatest threat to the long-term health of the ocean: *climate change and ocean acidification, habitat transformation, invasive species, overfishing/destructive fishing techniques, and pollution*. Before the lecture, nearly one-half of attendees (44%) chose *climate change*, a percentage that grew by a quarter to almost seven in ten participants (68%) after the lecture. Overall, six out of ten participants (60%) chose the same threat both before and after the lecture. The remaining 40% selected a different threat following the lecture than they did in the initial survey. (See Figure 23, next page.)

⁸ Only 64 of the 171 respondents who answered this question on the pre-lecture survey continued on to answer this question on the post-lecture survey. Notably, those selecting *personal actions have great impact* on the pre-lecture survey continued on to the post-lecture survey. Considering the high correlation of answers by the same respondent across the two timeframes, the increase in the overall percentage should be discounted.

Figure 23. Threats to the Long-Term Health of the Ocean



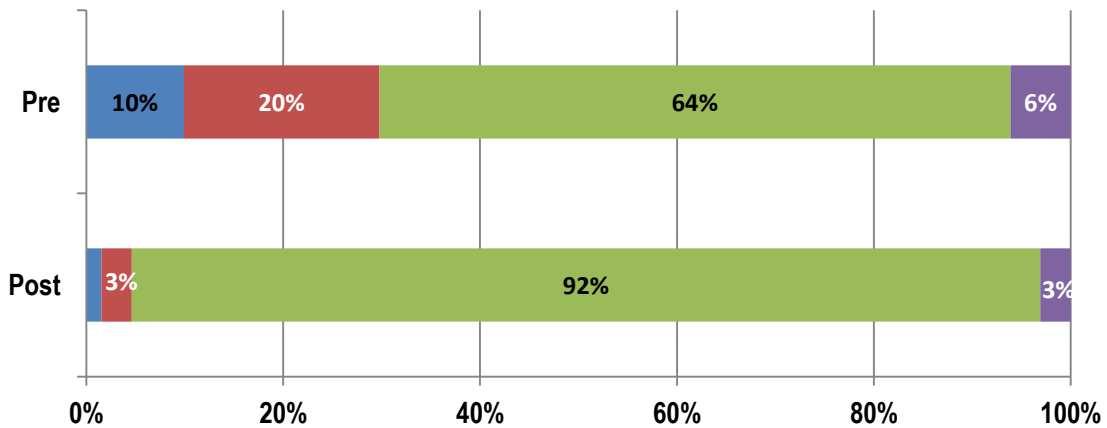
Understanding of Ocean Acidification

Closely linked to the topic of the lecture, respondents were asked to describe their understanding of ocean acidification by selecting one of these four statements: *just as acid rain damages buildings and statues, ocean acidification will damage ships; ocean acidification is primarily a concern in shallow bays, where the impact is not as diluted as in the open ocean; ocean acidification will make it hard for some ocean animals to make their skeletons/shells; and the anticipated change in ocean pH is so slight, there will be minimal harm to ocean life.* (The presenters hoped that after seeing the performance the audience would understand that *ocean acidification will make it hard for some ocean animals to make their skeletons/shells.*) As shown in Figure 24, next page, there was a dramatic shift in understanding, with an increase from 64% to 92% in *ocean acidification will make it hard for some ocean animals to make their skeletons/shells* and a reduction in all the other response categories. More than eight out of ten respondents (82%) selected the same response before and after the lecture, while 18% of respondents selected a different response. (See Figure 24, next page.)

Personal Role in Ocean Acidification

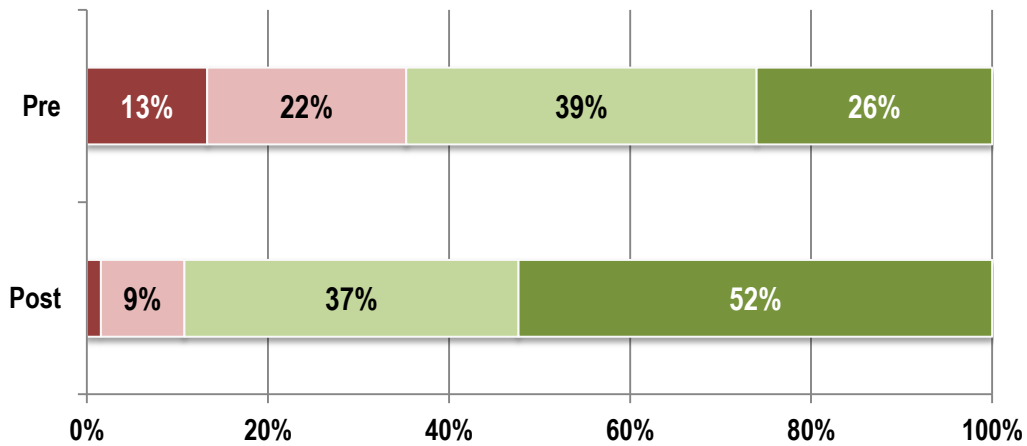
Attendees were asked before and after the lecture to select which of four statements best represented the extent to which their personal actions affect ocean acidification: *great, some, little, or no impact.* Respondents overall tended to see their actions as having much more impact after the lecture than before it (Figure 25, next page). Before

Figure 24. Understanding of Ocean Acidification



- Just as acid rain damages buildings and statues, ocean acidification will damage ships.
- Ocean acidification is primarily a concern in shallow bays, where the impact is not as diluted as in the open ocean.
- Ocean acidification will make it hard for some ocean animals to make their skeletons/shells.
- The anticipated change in ocean pH is so slight, there will be minimal harm to ocean life.

Figure 25. Personal Role in Ocean Acidification



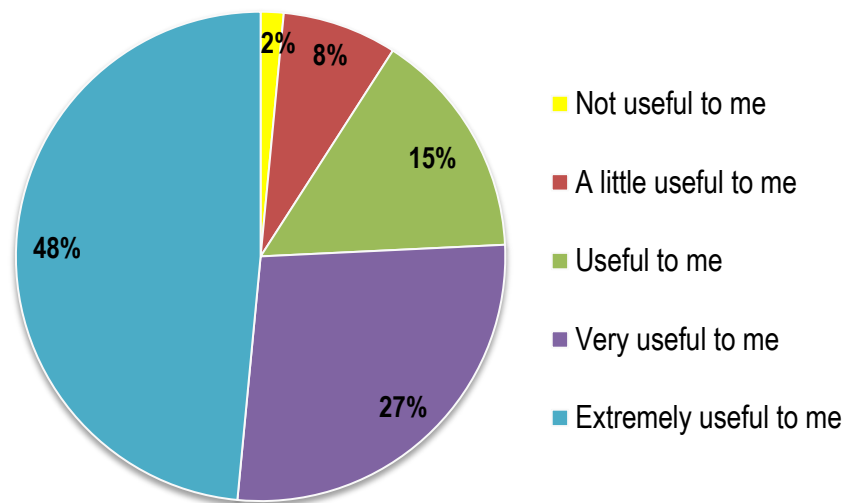
- My personal actions have no impact on ocean acidification
- My personal actions have little impact on ocean acidification
- My personal actions have some impact on ocean acidification
- My personal actions have a great impact on ocean acidification

the lecture, about one-fourth (26%) chose a *great* impact, four in ten (39%) selected *some*, and less than a fourth (22%) selected *little*. These percentages changed dramatically after the lecture: over half (52%) chose a *great* impact, again just over one-third (37%) chose *some*, but less than a tenth chose *little* (9%). More than seven out of ten attendees (72%) selected the same impact response before and after the lecture, while almost three in ten (28%) selected a higher impact response (16% went from *some* to *great* and 8% went from *little* to *some* impact). (See Figure 25.)

Usefulness of Combination of Dance, Film, and Lecture to Present Ocean Issues

In the exit survey, attendees were asked *How useful did you find the combination of dance, film, and lecture in this presentation of ocean issues?* As shown in Figure 26, the multi-platform presentation was very well received. Just about half (48%) indicated that it was *extremely useful* to them, and another fourth (27%) that it was *very useful*.

Figure 26. Utility of Multi-Platform Presentation



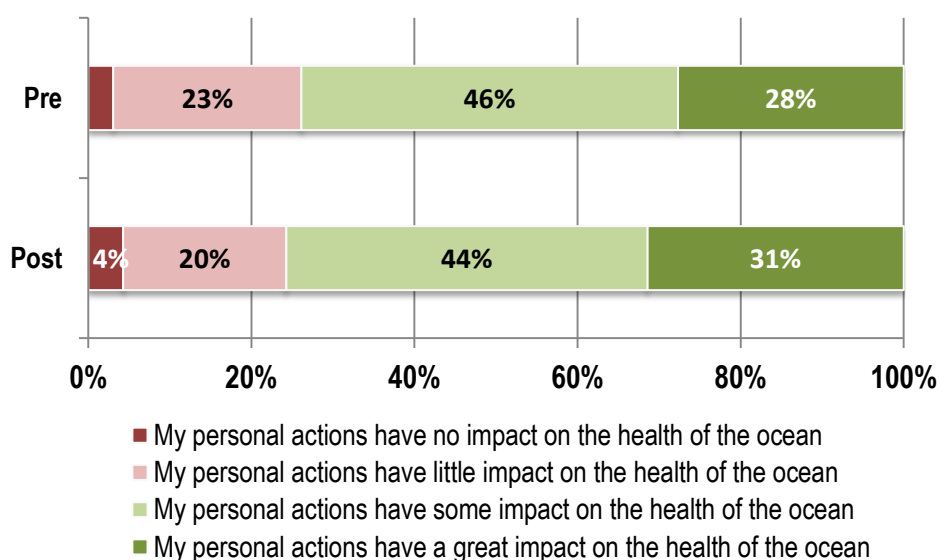
July 19, 2012 Lecture: *The Deep Sea: Life in Extreme Environments*

The sixth lecture in the series used an interview format and underwater visuals of extreme deep sea environments. NMNH staff member Dr. Dave Pawson interviewed Dr. Charles Fisher, Penn State University, about his exploration of deep sea hydrothermal vents and hydrocarbon seeps. Dr. Fisher described the adaptations of some of the unique animals that live in these habitats around the world, while Dr. Pawson got to the stories behind the explorations. Dr. Fisher also addressed the impending mining of mineral deposits from vent communities, and some of the latest findings on the impact of the Deepwater Horizon oil spill on deep sea corals in the Gulf of Mexico.

Personal Impact on the Health of the Ocean

Attendees were asked both before and after the lecture to select which of four statements best represented their opinion about the role of their personal actions on ocean health: *great*, *some*, *little*, or *no* impact. Before the lecture, three in ten attendees (28%) chose a *great* impact, and almost half (46%) selected *some* impact. These percentages remained approximately the same after the lecture: 31% of participants chose *great* impact and 44% of them chose *some* impact. Eight in ten attendees (82%) selected the same impact response before and after the lecture. Very few came away thinking they had a greater role. (See Figure 27.)

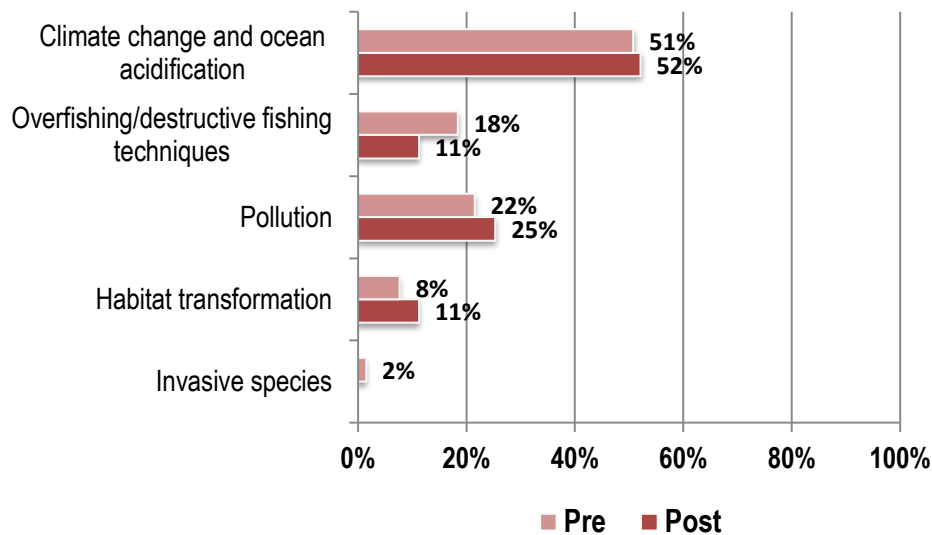
Figure 27. Personal Impact on the Health of the Ocean



Threats to the Long-Term Health of the Ocean

Attendees were asked before and after the lecture which of five options was the greatest threat to the long-term health of the ocean: *climate change and ocean acidification*, *habitat transformation*, *invasive species*, *overfishing/destructive fishing techniques*, and *pollution*. Before the lecture, one-half of attendees (51%) chose *climate change*, a percentage that remained the same after the lecture (52%). Overall, approximately seven out of ten participants (68%) chose the same threat both before and after the lecture. The remaining 32% selected a different threat following the lecture than they did in the pre-survey. (See Figure 28, next page.)

Figure 28. Threats to the Long-Term Health of the Ocean



Challenges of Deep Sea Environments to Life

Attendees were asked, both before and after the interview with Dr. Fisher, to choose which of four options corresponded to whether they believed life in deep sea environments faced challenges: *yes, because there is no light*; *yes, because there is no food*; *no, because it is a constant and predictable environment*; and *no, because there are no predators*. There was a dramatic shift between the pre- and post-survey responses. *No, because it is a constant and predictable environment* more than tripled (from 24% to 76%). At the same time, *high pressure* and *lack of light* decreased from 29% to 18% and 35% to 3%, respectively (22% went from *high pressure* to *constant environment* and 29% went from *lack of light* to *constant environment*). (See Figure 29, next page.)

Deep Sea Mineral Mining

Before and after the lecture attendees were asked about their understanding of *when mining minerals from the deep sea (at depths greater than 1000 meters) will become a reality*. The time ranges on the questionnaire were: *within a year, the technology and demand exist now*; *within a decade, the technology is being developed now*; *between 20 and 30 years from now when land-based mines are likely to be largely depleted*; and *probably never, as the cost to retrieve rocks and minerals from the deep sea floor is prohibitive*. The *within a year* choice rose dramatically by almost half, from 26% prior to the lecture to 83% after it, while the *within ten years* option experienced more than a threefold reduction (from 50% to 13%); *between 20 and 30 years from now* was selected by a less than one in six (16%) before the lecture and close to one in thirty

(3%) after (47% went from *within a decade* to *within a year* and 12% went from *between 20 and 30 years* to *within a year*). (See Figure 30.)

Figure 29. Challenges of Deep Sea Environments to Life

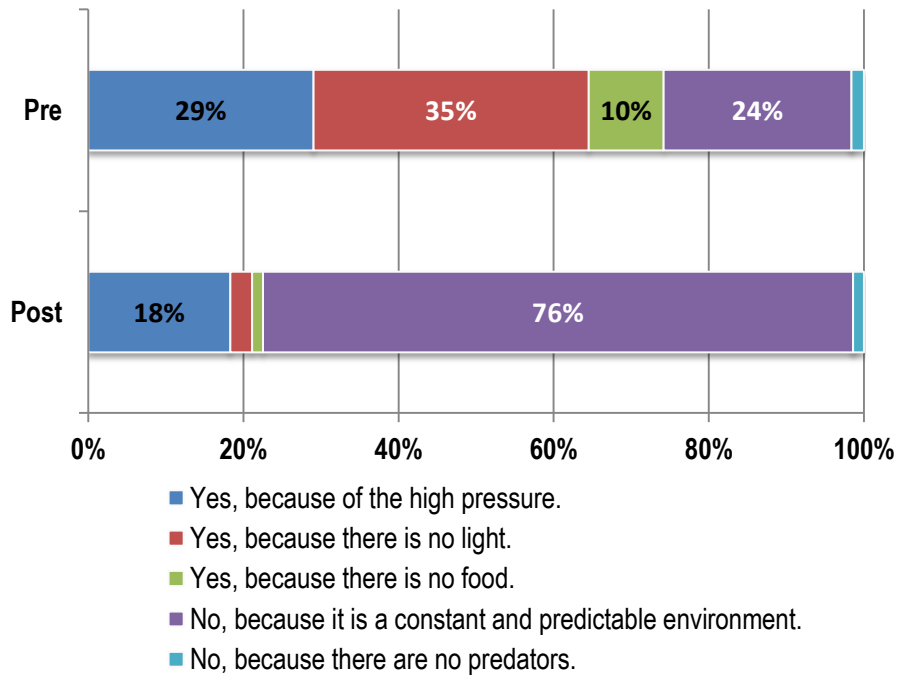
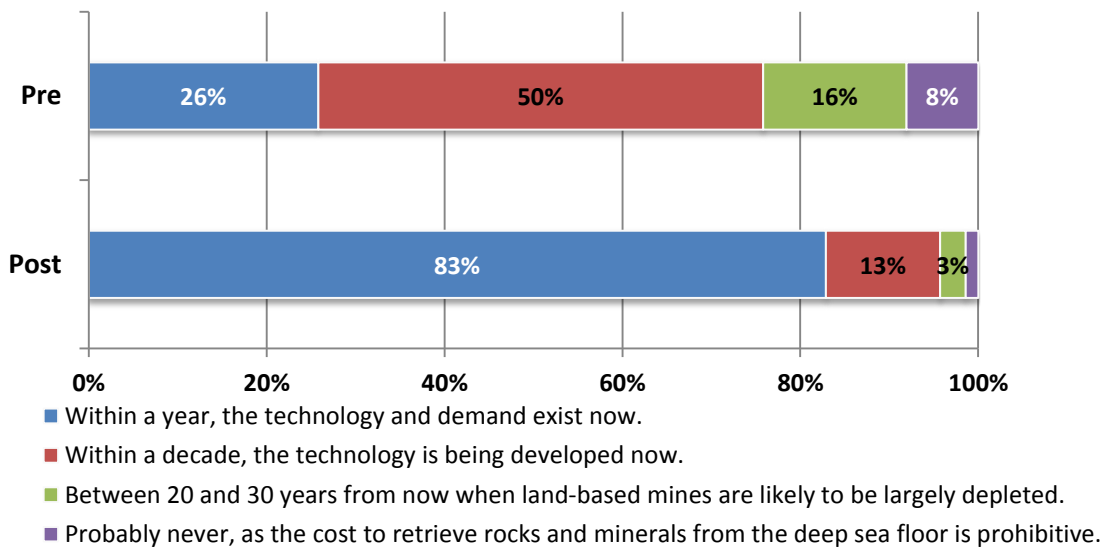


Figure 30. Timing for Deep Sea Mineral Mining



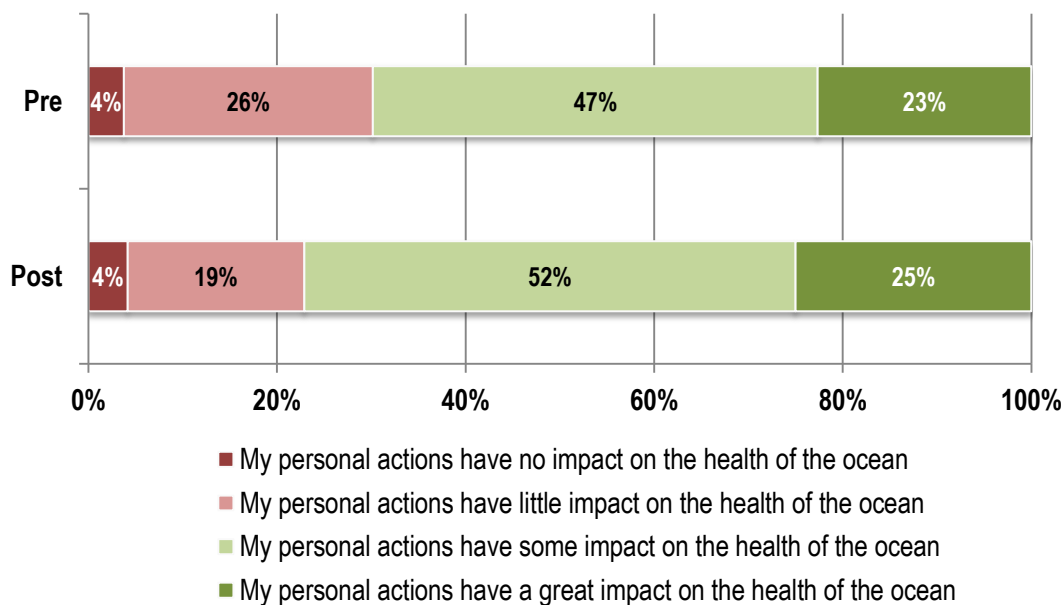
October 2012 Lecture: *Drugs from the Deep*

Dr. Shirley Pomponi, Research Professor and Executive Director of the NOAA Cooperative Institute for Ocean Exploration, Research and Technology (CIOERT) at Harbor Branch Oceanographic Institute, Florida Atlantic University in Fort Pierce, Florida, spoke in general about research that focuses on marine biotechnology, and more specifically on sponges that produce chemicals with pharmaceutical properties.

Personal Impact on the Health of the Ocean

Attendees were asked both before and after the lecture to select which of four statements best represented their opinion about the extent of the impact their personal actions have on ocean health: *great*, *some*, *little*, or *no* impact. Both before and after the lecture, nine out of ten attendees (90%) selected the same impact responses. One-fourth (23%) marked a *great* impact, and almost half (47%) *some* impact, before the lecture, while 25% chose *great* and about half (52%) *some* impact after the lecture (4% moved from *little* to *some* impact). (See Figure 31.)

Figure 31. Personal Impact on the Health of the Ocean

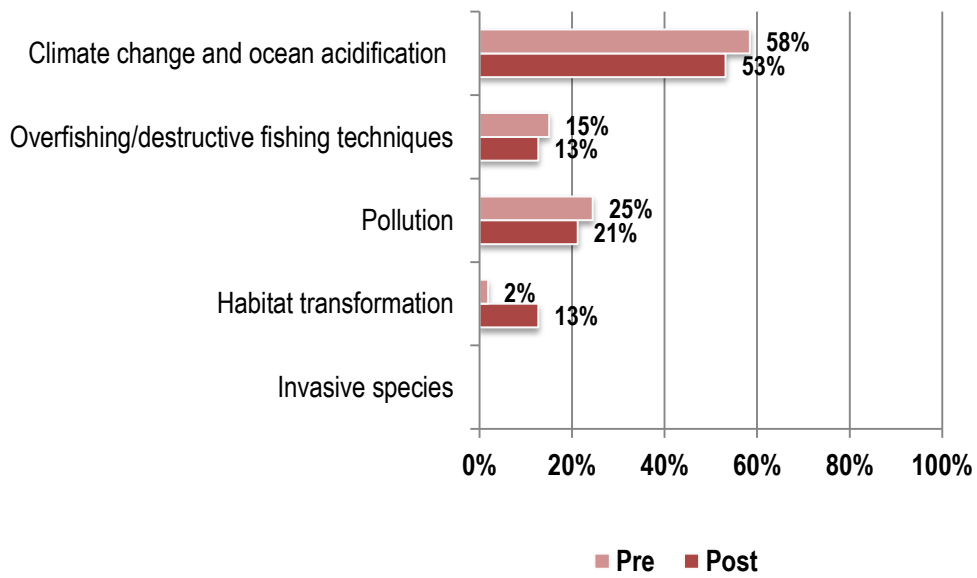


Threats to the Long-Term Health of the Ocean

Attendees were asked before and after the lecture which of five options was the greatest threat to the long-term health of the ocean: *climate change and ocean acidification*, *habitat transformation*, *invasive species*, *overfishing/destructive fishing techniques*, and *pollution*. Before the lecture, nearly six in ten attendees (58%) chose *climate change*, a percentage that decreased very slightly after the lecture (53%).

Overall, more than eight out of ten participants (83%) chose the same threat both before and after the lecture. The remaining 17% selected a different threat following the lecture than they did in the initial survey. (See Figure 32.)

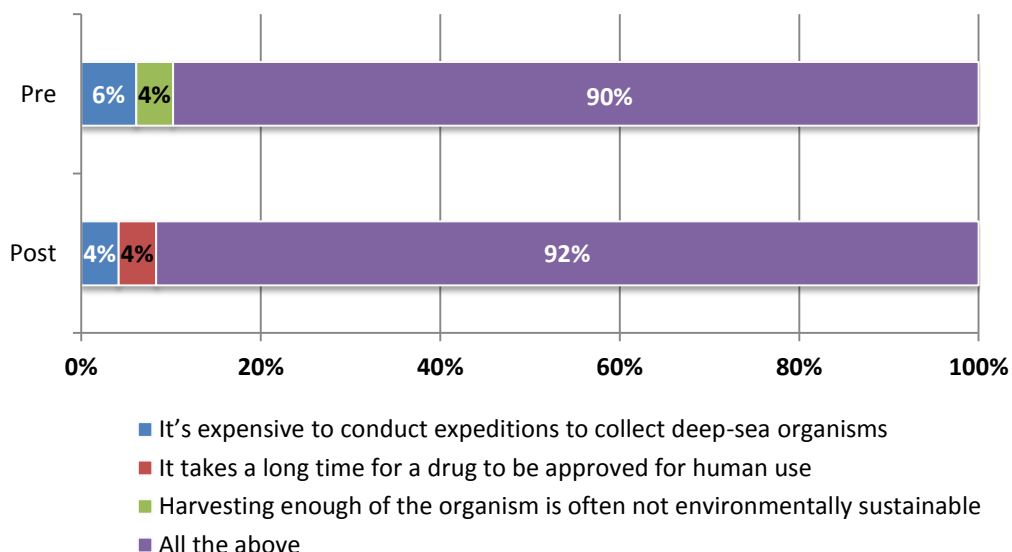
Figure 32. Threats to the Long-Term Health of the Ocean



Challenges to Discovery and Development of Marine Drugs

Dr. Pomponi indicated that multiple challenges existed to the discovery and development of marine drugs. Both before and after the lecture, respondents were given four choices and asked which they thought pertained: *it's expensive to conduct expeditions to collect deep-sea organisms; it takes a long time for a drug to be approved for human use; harvesting enough of the organism is often not environmentally sustainable; or all of the above.* (The lecturer wanted attendees to understand that *ALL of the above* were challenges contributing to marine drug discovery and development.) There was virtually no change between the results of the pre- and post- surveys. Both times, nine out of ten attendees (90% and 92%, respectively) indicated that all the reasons were challenges. (See Figure 33, next page.)

Figure 33. Challenges of Marine Drugs



Production Methods of Marine-Derived Chemicals

Attendees were asked about *the most common and preferred current method for producing marine-derived chemicals for clinical trials*. Both before and after the lecture, they were presented with four options: *aquaculture*, *chemical synthesis*, *cell culture*, and *genetic modification*. (The goal for the lecture was to have attendees understand that the most common and preferred current method for producing marine-derived chemicals is via *chemical synthesis*.) The lecture clearly shifted attendees' knowledge of production methods. *Chemical synthesis* almost doubled (from 48% before the lecture to 96% after). Selection of the other three methods (*aquaculture*, *cell culture*, and *genetic modification*), was at 13%, 29% and 10%, respectively, before the lecture and was reduced to 2%, 0%, and 2%, respectively, after the lecture (30% moved from *cell culture* to *chemical synthesis* after hearing the presentation). (See Figure 34, next page.)

Overall Experience with the Lecture

Following the lecture, attendees were asked to rate their overall experience with the lecture on a five-point scale—*poor*, *fair*, *good*, *excellent*, and *superior*. A quarter of respondents (25%) rated the lecture *superior*, and three out of four (73%) chose *excellent* (54%) or *good* (19%). No one chose *fair*, while a very small number (2%) found the lecture *poor*. (See Figure 35.)

Figure 34. Marine-Derived Chemical Production

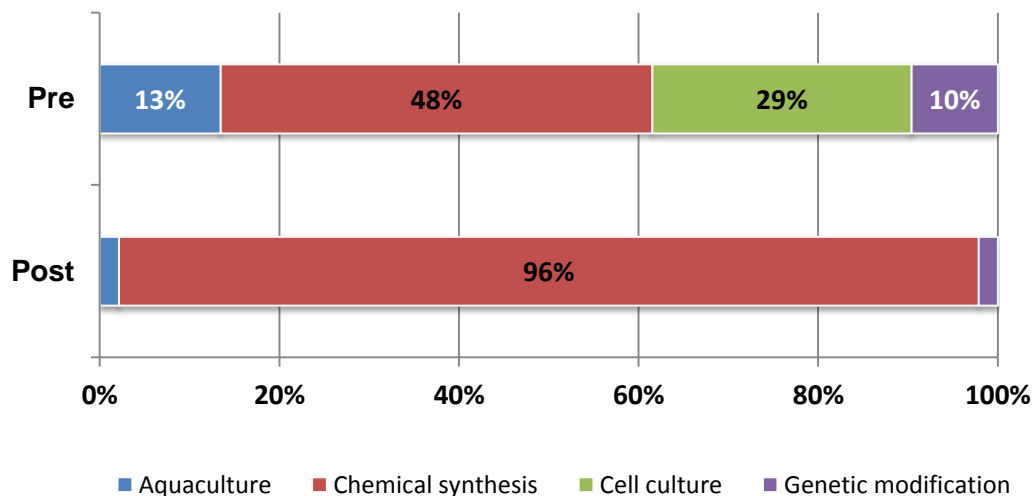
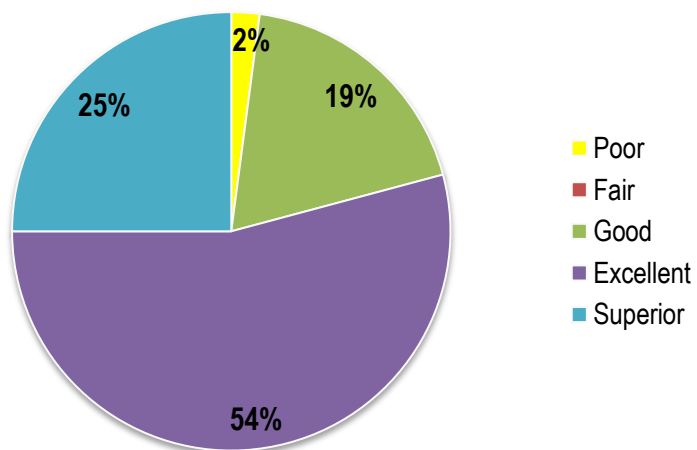


Figure 35. Overall Experience with the Lecture



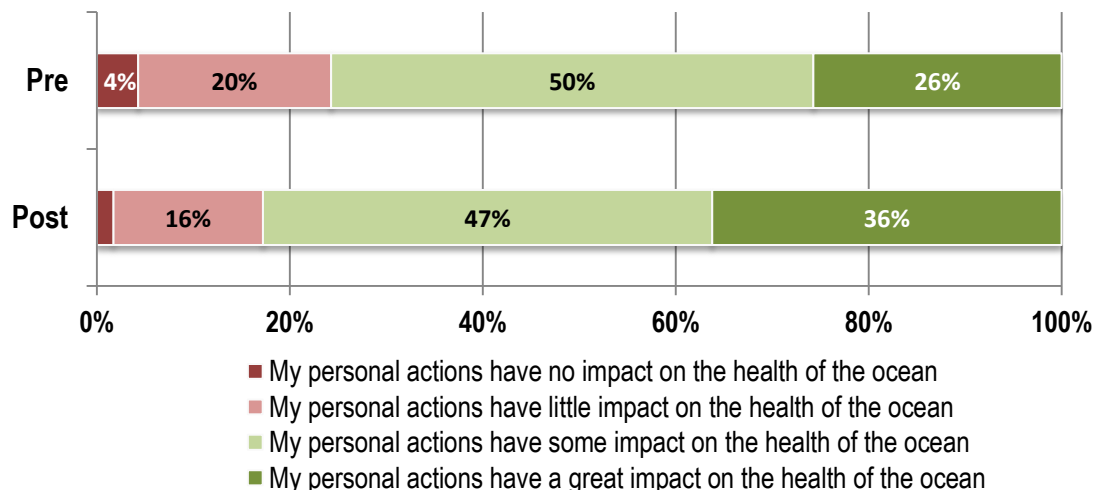
November 8, 2012 Lecture: *Bioluminescence in Art and Science*

The last lecture of the series was presented in the afternoon by Dr. Edith A. Widder, an internationally recognized expert in bioluminescence, deep-sea explorer, MacArthur Fellow, and CEO, President, and Co-Founder of Ocean Research & Conservation Association. Dr. Widder examined the intersection of science and art in bioluminescence and described how science inspires art and art illuminates science. The presentation was followed by an opportunity for the audience to ask Dr. Widder questions about bioluminescence and the intersection of science and art.

Personal Impact on the Health of the Ocean

Attendees were asked both before and after the lecture to select which of four statements best represented their opinion about the extent to which their personal actions affect ocean health: *great*, *some*, *little*, or *no* impact. Before the lecture, about one-fourth of attendees (26%) chose a *great* impact, and half (50%) selected *some*. The percentage that selected a *great* impact rose slightly to over one-third (36%), while *some* remained at approximately the same level after the lecture (47%). More than eight in ten attendees (83%) selected the same impact responses before and after the lecture. About two in ten attendees (17%) came away thinking they had a greater role (8% went from *some* to *great*, 4% went from *little* to *some*, 4% went from *no impact* to *some impact*). (See Figure 36.)

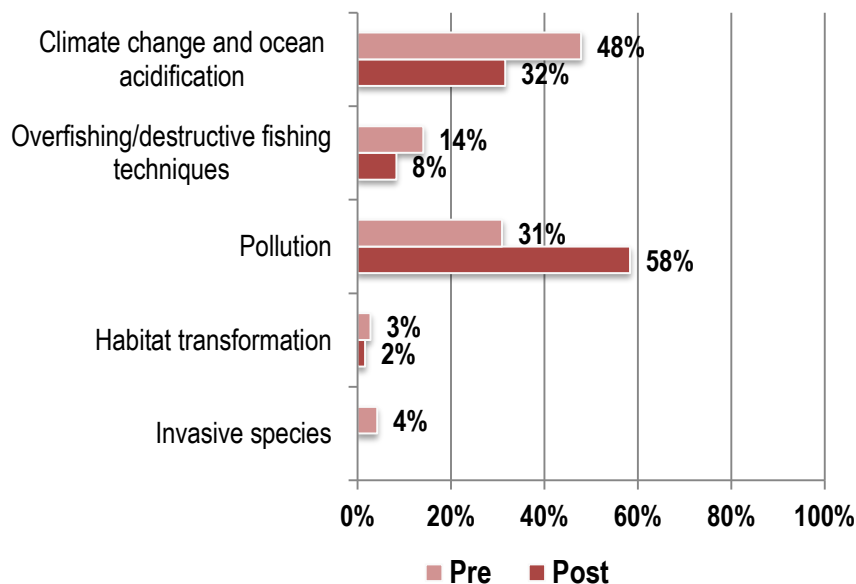
Figure 36. Personal Impact on the Health of the Ocean



Threats to the Long-Term Health of the Ocean

Attendees were asked before and after the lecture which of five options was the greatest threat to the long-term health of the ocean: *climate change and ocean acidification*, *habitat transformation*, *invasive species*, *overfishing/destructive fishing techniques*, and *pollution*. Before the lecture, nearly one-half of attendees (48%) chose *climate change*, a percentage that decreased to one-third after the lecture (32%). The major change in responses occurred with *pollution*, which went from 31% before the lecture to 58% after. Overall, seven out of ten participants (71%) chose the same threat both before and after the lecture. The remaining 29 % selected a different threat following the lecture than before it (7% went from *overfishing* to *pollution*, 6 % went from *invasive species* to *pollution*, and 15% went from *climate change/acidification* to *pollution*). (See Figure 37.)

Figure 37. Threats to the Long-Term Health of the Ocean

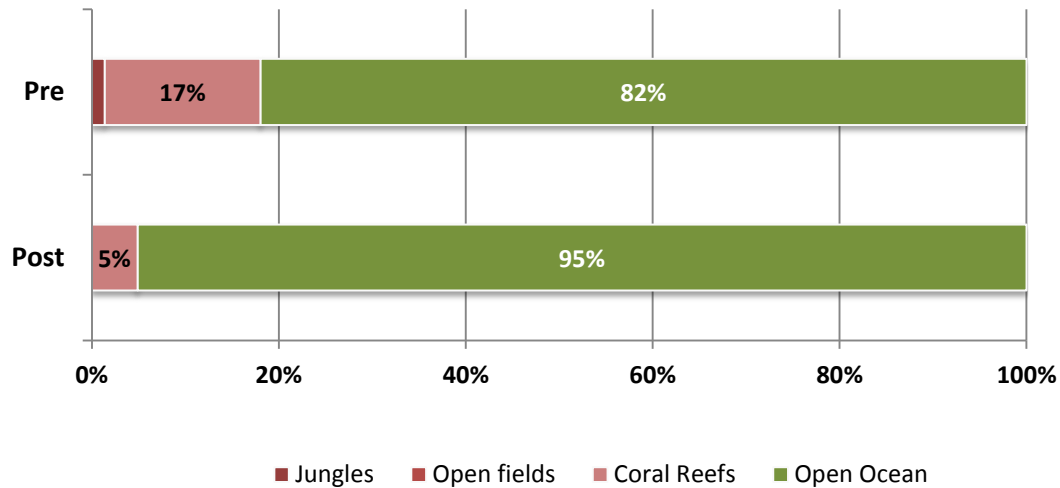


Location of Bioluminescence

Two questions on both the pre- and post- surveys focused on bioluminescence. The first asked where bioluminescence was most commonly found, the second for an alternate description. Four options were given for location: *jungles*, *open fields*, *coral reefs*, and the *open ocean*. (The correct response was that bioluminescence is most commonly located in the *open ocean*.) Before the lecture, more than 8 in ten respondents (82%) identified the *open ocean* as the major location, followed by less than two in ten (17%) who selected in *coral reefs*. After the lecture the *open ocean*

increased to almost all the attendees (95%), with a very small group (5%) identifying *coral reefs* as the location for bioluminescence. Overall, eight out of ten participants (82%) chose the same response both before and after the lecture. The remaining 18% selected a different response following the lecture than before it (16% moved from *coral reefs* to *open ocean* as the location of bioluminescence). (See Figure 38.)

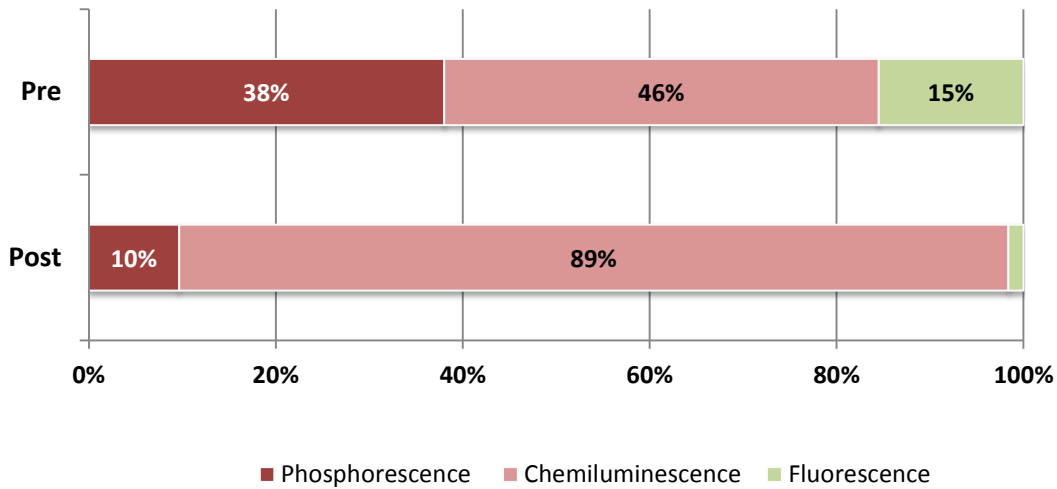
Figure 38. Location of Bioluminescence



Describing Bioluminescence

Attendees were shown three ways to describe bioluminescence and to choose which was the most correct. There was also a change in how attendees identified *another way to describe bioluminescence* before and after the lecture. (The correct alternate term for this phenomenon is *chemiluminescence*.) Initially the largest percentage chose *chemiluminescence* (46%), following by *phosphorescence* (38%), and *fluorescence* (15%). After the lecture, there was a major shift to *chemiluminescence* (89%), and major decreases in the other two descriptors (*phosphorescence* to 10% and *fluorescence* to 2%). Overall, five out of ten participants (49%) chose the same response both before and after the lecture. The remaining 51% selected a different response following the lecture than before it (40% moved from *phosphorescence* to *chemiluminescence* as another way to describe bioluminescence). (See Figure 39, next page.)

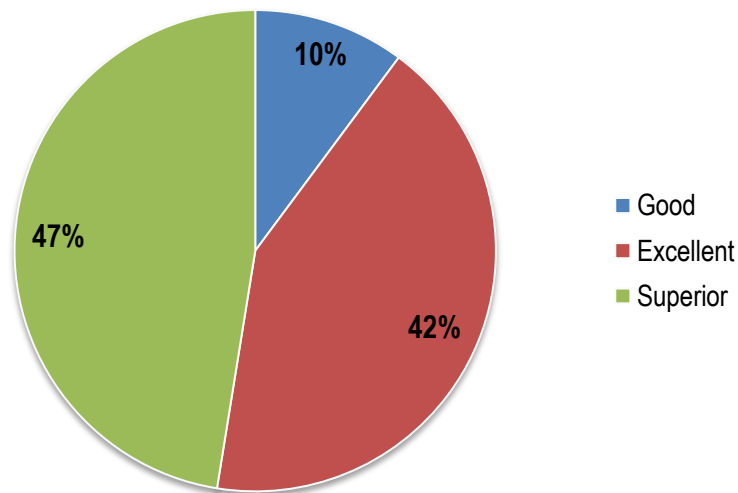
Figure 39. Describing Bioluminescence



Overall Experience with the Lecture

Following the lecture, attendees were asked to rate their overall experience with the lecture on a five-point scale—*poor*, *fair*, *good*, *excellent*, and *superior*. A very high percentage, close to half (47%), rated the lecture *superior*, while just over half *excellent* (42%) or *good* (10%); none of the respondents chose either *fair* or *poor*. (See Figure 40, next page.)

Figure 40. Overall Experience with the Lecture



OBSERVATIONS

Several issues relating to data analysis for each lecture on its own and across all the lectures require discussion before proceeding to OP&A's observations:

- Key variables differed across the lectures, such as the presentation content, targeted audience, time and day of the week offered, and level and nature of marketing (e.g., scientists at a conference were invited to the first lecture, teachers attending an “Educators Night” were invited to attend the second, etc.).
- The audiences at all the lectures characterized themselves as well-educated and knowledgeable or very interested in the ocean/environment, which most likely left less room for shifting opinions or gaining information than would have been the case with the general public. There was no response option for the general public, and these people had to fit themselves into one of five categories of “ocean-interested” or not respond to the question.
- A goal of the project was to increase general literacy of ocean issues, which presumed an audience with a low level of knowledge, but that was not the case with the audiences at the series.
- There were no standards against which to measure success or accomplishment of intended outcomes. For example, what percentage shift from an incorrect to a correct opinion constituted success?
- Some lectures did not directly address the overarching topics of main threats to ocean health and personal connection to amelioration of such threats—the common questions asked across all lectures—and therefore could not be expected to produce a change in opinion.
- The lectures were webcast, which enabled NMNH to reach a far larger audience, but this study deals only with the audiences physically present at the museum.

The lecture series had three main goals—promote ocean literacy, disseminate information on recent ocean science research, and provide a forum for the public to discover the connection between human action and ocean health. The shifts in responses before and after the lectures show that some participants' awareness and knowledge shifted as a result of the lecture, at least immediately afterwards, but more specifically around the particular lecture subject, and perhaps less so in relation to the overarching challenges to ocean health more broadly.

Given the goals of the lecture series and the demographic characteristics, it might be said that the lecture series did not reach its target population—people who do not have a lot of knowledge about the ocean—although the data do not permit an explanation of *why*, beyond what is known about attendance at the museum lectures. Considering the data on how attendees found out about the lecture, the largest percentage of people across all lectures learned about the series via electronic sources, such as an e-mail, listserv, or NMNH website (42%), while one-fourth of participants (24%) learned about it via word of mouth. Doing a better job of advertising the series with the general public already in the museum might reduce the bias and allow for a better gauge of success.

Another interesting set of findings was how often participants chose the same answer both before and after each lecture. For some questions, such as the one regarding the effect of climate change on hurricanes in the October 2010 lecture, very few people chose the same answer before and after the lecture. However, answers on other questions, like the ones regarding the relationships between climate change and the ocean on human health, remained fairly constant. Perhaps it is worth further exploring which questions people most often changed their minds about as a way of selecting topics for future lectures.

Based on the “Moving Beyond the Basics” project proposal submitted to the National Science Foundation (NSF) by COSEE and NMNH, lecture organizers made special overtures to area educators to attend an early lecture in the Ocean Lecture Series. This special effort took place with the second lecture in the series (October 2010). A joint NMNH/COSEE “Educators Night” was held for local teachers and school administrators. Educational materials on topics related to the lecture series were distributed at this event. An assumption could be drawn that this lecture’s audience was more “educator-heavy” than other lectures. However, the lecture survey question “Which of the following BEST describes you?” did not provide an educator/teacher or more specifically a science educator/teacher response option. This seems to miss a significant opportunity to track educators in the lectures’ audiences over time and understand if the initial special event for educators contributed to any sustained interest and attendance by this targeted segment over the length of the series. In summary, the lecture series found an audience already primed for the subject matter, rather than necessarily making in-roads to reaching out to new, less-knowledgeable populations on the topic of ocean literacy.

The use of ART or “clickers,” while seemingly innovative, was not properly utilized to its full potential, specifically, the display of real-time responses so that attendees could track their learning. Additionally, if lecture subjects and speakers had

been more tightly and thoughtfully linked to the central ocean literacy theme and to one another, this would have allowed the series of lectures to truly function as a series that promoted connections and progressive, deeper knowledge among its attendees, rather than how it actually operated—discrete chunks of information provided by experts who had an existing relationship to COSEE or the museum.

APPENDIX A

Surveys

Entrance Survey – JUNE 2010

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. How did you hear or learn about this lecture?

- A. Ad in local DC paper
- B. Email or through Listserv
- C. NMNH website/Flyers/Posters
- D. Word of Mouth
- E. Other

2. Of the following four statements about the health of the ocean, which ONE do you agree with most?

- A. The ocean is in great shape
- B. The ocean is in good shape, but we need to protect it
- C. The ocean is in bad shape and we need to take action now
- D. It's too late for the ocean, the ocean is doomed!

3. Of the following five items, which ONE do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive Species
- D. Overfishing/Destructive fishing techniques
- E. Pollution

4. Of the following four statements about your role in ocean health, which ONE do you agree with most?

- A. My personal actions have a great impact on the health of the ocean
- B. My personal actions have some impact on the health of the ocean
- C. My personal actions have little impact on the health of the ocean
- D. My personal actions have no impact on the health of the ocean

5. On a scale of 1-5, where 1 is 'dismal' and 5 is 'bright,' where would you place the Ocean's future?

- A. 1 – dismal
- B. 2
- C. 3
- D. 4
- E. 5 – bright

6. Which of the following BEST describes you?

- A. Concerned citizen, interested in learning more
- B. Ocean enthusiast
- C. Natural sciences major
- D. Non-science professional working in the Ocean arena
- E. Scientist or science-related professional working in the Ocean arena

7. What is your age?

- A. 17 and under
- B. 18-30
- C. 31-45
- D. 46-64
- E. 64 and over

8. What is the highest degree or level of school you have completed?

- A. High school graduate or less
- B. One or more years of college, no degree
- C. Associate degree
- D. Bachelor's degree
- E. Graduate degree

9. What is your sex?

- A. Male
- B. Female

Exit Survey – JUNE 2010

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. Please rate your overall experience at this lecture.

- A. Poor
- B. Fair
- C. Good
- D. Excellent
- E. Superior

2. Thinking of this lecture, of the following five items, which ONE do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive Species
- D. Overfishing/destructive fishing techniques
- E. Pollution

3. Thinking of this lecture, of the following four statements about your role in ocean health, which ONE do you agree with most?

- A. My personal actions have a great impact on the health of the ocean
- B. My personal actions have some impact on the health of the ocean
- C. My personal actions have little impact on the health of the ocean
- D. My personal actions have no impact on the health of the ocean

4. Thinking of this lecture, of the following four statements about the health of the ocean, which ONE do you agree with most?

- A. The ocean is in great shape
- B. The ocean is in good shape, but we need to protect it
- C. The ocean is in bad shape and we need to take action now
- D. It's too late for the ocean, the ocean is doomed!

5. On a scale of 1-5, where 1 is 'dismal' and 5 is 'bright,' where would you now place the Ocean's future?

- A. 1 – dismal
- B. 2
- C. 3
- D. 4
- E. 5 – bright

6. Have you ever attended a public lecture in this Natural History Museum before today?

- A. No
- B. Yes

Now, a few more questions about you...

8. Are you of Hispanic descent?

- A. No
- B. Yes

9. What race/ethnicity do you consider yourself to be (Mark one or more)?

- A. African American/Black
- B. American Indian/Native American
- C. Asian (Chinese, Indian, Japanese, etc.)
- D. Native Hawaiian/Pacific Islander
- E. White

10. Where do you live?

- A. Washington DC
- B. VA/MD suburbs
- C. East Coast
- D. Elsewhere in the US
- E. Outside the US

Entrance Survey – OCTOBER 2010

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. How did you hear or learn about this lecture?
 - A. Ad in local paper, Flyer, or Poster
 - B. Email, Listserv, NMNH website
 - C. Word of Mouth
 - D. Invited to Teacher Reception
 - E. Other

2. Have you attended a Changing Tides Ocean Science Lecture at the National Museum of Natural History previously?
 - A. No
 - B. Yes, I attended the lecture in June on ocean biodiversity loss

3. Of the following five items, which ONE do you think most threatens the long-term health of the ocean?
 - A. Climate change and ocean acidification
 - B. Habitat transformation
 - C. Invasive Species
 - D. Overfishing/Destructive fishing techniques
 - E. Pollution

4. Of the following four statements about your role in ocean health, which ONE do you agree with most?
 - A. My personal actions have a great impact on the health of the ocean
 - B. My personal actions have some impact on the health of the ocean
 - C. My personal actions have little impact on the health of the ocean
 - D. My personal actions have no impact on the health of the ocean

5. What effect do you think climate change will have on hurricanes?
 - A. Increase the number of hurricanes and tropical cyclones
 - B. Increase the intensity of hurricanes and tropical cyclones
 - C. Increase the number AND intensity of hurricanes and tropical cyclones
 - D. It will have minimal or no effects
 - E. I don't know

6. Which of the following statements best describes your opinion about the value of hurricane modeling?
 - A. It's just a research tool that's not very useful in practice
 - B. Though not exact, it's one of the best tools we have to predict hurricane behavior
 - C. It can be used to accurately predict a hurricane's exact path
 - D. I don't have an opinion about hurricane modeling

7. Which of the following BEST describes you?
- A. Concerned citizen, interested in learning more
 - B. Ocean enthusiast
 - C. Natural sciences student/major
 - D. Non-science professional working in the Ocean arena
 - E. Scientist or science-related professional working in the Ocean arena
8. What is your age?
- A. 17 and under
 - B. 18-30
 - C. 31-45
 - D. 46-64
 - E. 65 and over
9. What is your sex?
- A. Male
 - B. Female
10. What is the highest degree or level of school you have completed?
- A. High school graduate or less
 - B. One or more years of college, no degree
 - C. Associate degree
 - D. Bachelor's degree
 - E. Graduate degree
11. Where do you live?
- A. Washington DC
 - B. VA/MD suburbs
 - C. East Coast
 - D. Elsewhere in the US
 - E. Outside the US

Exit Survey – OCTOBER 2010

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. Please rate your overall experience at this lecture.

- A. Poor
- B. Fair
- C. Good
- D. Excellent
- E. Superior

2. Of the following five items, which ONE do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive Species
- D. Overfishing/Destructive fishing techniques
- E. Pollution

3. Of the following four statements about your role in ocean health, which ONE do you agree with most?

- A. My personal actions have a great impact on the health of the ocean
- B. My personal actions have some impact on the health of the ocean
- C. My personal actions have little impact on the health of the ocean
- D. My personal actions have no impact on the health of the ocean

4. What effect do you think climate change will have on hurricanes?

- A. Increase the number of hurricanes and tropical cyclones
- B. Increase the intensity of hurricanes and tropical cyclones
- C. Increase the number AND intensity of hurricanes and tropical cyclones
- D. It will have minimal or no effects
- E. I don't know

5. Which of the following statements best describes your opinion about the value of hurricane modeling?

- A. It's just a research tool that's not very useful in practice
- B. Though not exact, it's one of the best tools we have to predict hurricane behavior
- C. It can be used to accurately predict a hurricane's exact path
- D. I don't have an opinion about hurricane modeling

Entrance Survey – FEBRUARY 2011

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. How did you first learn about this lecture?

- A. Ad in local DC paper
- B. Email or through Listserv
- C. NMNH website/Flyer/Poster
- D. Word of Mouth
- E. Other

2. Have you attended a Changing Tides Ocean Science Lecture at the National Museum of Natural History previously?

- A. No
- B. Yes, I attended the lecture in June 2010 on ocean biodiversity loss
- C. Yes, I attended the lecture in October 2010 on the impact of climate change on hurricanes
- D. Yes, I attended both the lecture in June and October

3. Of the following five items, which ONE do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive Species
- D. Overfishing/Destructive fishing techniques
- E. Pollution

4. Of the following four statements about your role in ocean health, which ONE do you agree with most?

- A. My personal actions have a great impact on the health of the ocean
- B. My personal actions have some impact on the health of the ocean
- C. My personal actions have little impact on the health of the ocean
- D. My personal actions have no impact on the health of the ocean

5. Which of the following statements best describes your opinion about the connection between the ocean and human health?

- A. The ocean and human health are closely connected
- B. The ocean and human health are somewhat connected
- C. The ocean and human health are minimally connected
- D. The ocean and human health are not connected

6. How much impact do you think climate change will have on human health?

- A. Climate change will have a dramatic impact on human health
- B. Climate change will have some impact on human health
- C. Climate change will have minimal or no impact on human health

- D. I don't know because not enough is known about the impact of climate change on human health

7. Which of the following BEST describes you?

- A. Concerned citizen, interested in learning more
- B. Ocean enthusiast
- C. Natural sciences student/major
- D. Non-science professional working in the Ocean arena
- E. Scientist or science-related professional working in the Ocean arena

8. What is your age?

- A. 17 and under
- B. 18-30
- C. 31-45
- D. 46-64
- E. 65 and over

9. What is your sex?

- A. Male
- B. Female

10. What is the highest degree or level of school you have completed?

- A. High school graduate or less
- B. One or more years of college, no degree
- C. Associate degree
- D. Bachelor's degree
- E. Graduate degree

11. Where do you live?

- A. Washington DC
- B. VA/MD suburbs
- C. East Coast
- D. Elsewhere in the US
- E. Outside the US

Exit Survey – FEBRUARY 2011

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. Please rate your overall experience at this lecture.
 - A. Poor
 - B. Fair
 - C. Good
 - D. Excellent
 - E. Superior

2. Of the following five items, which ONE do you think most threatens the long-term health of the ocean?
 - A. Climate change and ocean acidification
 - B. Habitat transformation
 - C. Invasive Species
 - D. Overfishing/Destructive fishing techniques
 - E. Pollution

3. Of the following four statements about your role in ocean health, which ONE do you agree with most?
 - A. My personal actions have a great impact on the health of the ocean
 - B. My personal actions have some impact on the health of the ocean
 - C. My personal actions have little impact on the health of the ocean
 - D. My personal actions have no impact on the health of the ocean

4. Which of the following statements best describes your opinion about the connection between the ocean and human health?
 - A. The ocean and human health are closely connected
 - B. The ocean and human health are somewhat connected
 - C. The ocean and human health are minimally connected
 - D. The ocean and human health are not connected

5. How much impact do you think climate change will have on human health?
 - A. Climate change will have a dramatic impact on human health
 - B. Climate change will have some impact on human health
 - C. Climate change will have minimal or no impact on human health
 - D. I don't know because not enough is known about the impact of climate change on human health

Entrance Survey – APRIL 2011

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. How did you first learn about this lecture?

- A. Ad in local DC paper
- B. Email or through Listserv
- C. NMNH website/Flyer/Poster
- D. Word of Mouth
- E. Other

2. Have you attended a Changing Tides Ocean Science Lecture at the National Museum of Natural History previously?

- A. No
- B. Yes, I attended the lecture in June 2010 on ocean biodiversity loss
- C. Yes, I attended the lecture in October 2010 on the impact of climate change on hurricanes
- D. Yes, I attended the lecture in February 2011 on climate change and human health
- E. Yes, I attended two or more of the previous lectures

3. Of the following five items, which ONE do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive Species
- D. Overfishing/Destructive fishing techniques
- E. Pollution

4. Of the following four statements about your role in ocean health, which ONE do you agree with most?

- A. My personal actions have a great impact on the health of the ocean
- B. My personal actions have some impact on the health of the ocean
- C. My personal actions have little impact on the health of the ocean
- D. My personal actions have no impact on the health of the ocean

5. Of the oil that wasn't removed by burning, skimming, and direct recovery, where do you think the oil from the Deepwater Horizon spill went?

- A. It's all still in the environment: in the marsh, buried in sand and sediments, and in the water of the Gulf and beyond
- B. It's all gone, evaporated, dissolved, or eaten by microbes
- C. A combination of the above answers
- D. We still don't know exactly where it has all gone

6. Which of the following statements best describes your opinion about the use of oil dispersants during the Gulf Oil Spill?
- A. Dispersants are okay for the environment and it was good to use them
 - B. Dispersants aren't the best for the environment, but it was necessary in the Gulf
 - C. Dispersants are bad for the environment and should not have been used
 - D. More research needs to be done to determine the impact that dispersants combined with oil has on the environment
7. Would you eat seafood from the Gulf?
- A. Yes
 - B. Not sure
 - C. No
 - D. I don't eat seafood
8. Which of the following BEST describes you?
- A. Concerned citizen, interested in learning more
 - B. Ocean enthusiast
 - C. Natural sciences student/major
 - D. Non-science professional working in the Ocean arena
 - E. Scientist or science-related professional working in the Ocean arena
9. What is your age?
- A. 17 and under
 - B. 18-30
 - C. 31-45
 - D. 46-64
 - E. 65 and over
10. What is your sex?
- A. Male
 - B. Female
11. What is the highest degree or level of school you have completed?
- A. High school graduate or less
 - B. One or more years of college, no degree
 - C. Associate degree
 - D. Bachelor's degree
 - E. Graduate degree
12. Where do you live?
- A. Washington DC
 - B. VA/MD suburbs
 - C. East Coast
 - D. Elsewhere in the US
 - E. Outside the US

Exit Survey – APRIL 2011

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. Please rate your overall experience at this lecture.

- A. Poor
- B. Fair
- C. Good
- D. Excellent
- E. Superior

2. Of the following five items, which ONE do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive Species
- D. Overfishing/Destructive fishing techniques
- E. Pollution

3. Of the following four statements about your role in ocean health, which ONE do you agree with most?

- A. My personal actions have a great impact on the health of the ocean
- B. My personal actions have some impact on the health of the ocean
- C. My personal actions have little impact on the health of the ocean
- D. My personal actions have no impact on the health of the ocean

4. Of the oil that wasn't removed by burning, skimming, and direct recovery, where do you think the oil from the Deepwater Horizon spill went?

- A. It's all still in the environment: in the marsh, buried in sand and sediments, and in the water of the Gulf and beyond
- B. It's all gone, evaporated, dissolved, or eaten by microbes
- C. A combination of the above answers
- D. We still don't know exactly where it has all gone

5. Which of the following statements best describes your opinion about the use of oil dispersants during the Gulf Oil Spill?

- A. Dispersants are okay for the environment and it was good to use them
- B. Dispersants aren't the best for the environment, but it was necessary in the Gulf
- C. Dispersants are bad for the environment and should not have been used
- D. More research needs to be done to determine the impact that dispersants combined with oil has on the environment

6. Would you eat seafood from the Gulf?

- A. Yes
- B. Not sure
- C. No
- D. I don't eat seafood

Entrance Survey – JUNE 2012

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. How did you first learn about this lecture?

- A. Poster or flyer while in the Natural History Museum
- B. Email or through Listserv
- C. NMNH website/social media
- D. Word of mouth
- E. Other

2. How many of the following lectures have you attended (distinguished by the use of clickers)?

- Ocean biodiversity loss (June 2010)
 - Climate change and the Impact on hurricanes (October 2010)
 - Climate change and the impact of human health (February 2011)
 - The impact of the Gulf oil spill one year later (April 2011)
- A. I did not attend any
 - B. I attended one
 - C. I attended two
 - D. I attended three
 - E. I attended all four

3. Which ONE of the following do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive species
- D. Overfishing/destructive fishing techniques
- E. Pollution

4. Which ONE do you agree with most?

My personal actions have...

- A. ... a **great** impact on the health of the ocean
- B. ... **some** impact on the health of the ocean
- C. ... **little** impact on the health of the ocean
- D. ... **no** impact on the health of the ocean

5. Which of these four statements best describes your understanding of ocean acidification?

- A. Just as acid rain damages buildings and statues, ocean acidification will damage ships.
- B. Ocean acidification is primarily a concern in shallow bays, where the impact is not as diluted as in the open ocean.
- C. Ocean acidification will make it hard for some ocean animals to make their skeletons/shells.
- D. The anticipated change in ocean pH is so slight, there will be minimal harm to ocean life.

6. Of the following four statements about your role in ocean acidification, which ONE do you agree with most?

My personal actions have...

- A. ...a **great** impact on ocean acidification
- B. ...**some** impact on ocean acidification
- C. ... a **little** impact on ocean acidification
- D. ... **no** impact on ocean acidification

7. Which of the following comes closest to describing your decision to attend this event?

- A. Schedule was convenient
- B. Dance/film/lecture combination
- C. Appropriate for children
- D. Companion(s) persuaded me to come
- E. None of the above

8. Which of the following BEST describes you (leave blank if none describes you)?

- A. Concerned citizen, interested in learning more
- B. Ocean enthusiast
- C. Natural sciences student/major
- D. Non-science professional working in the Ocean arena
- E. Scientist or science-related professional working in the Ocean arena

9. With whom are you here?

- A. I am alone
- B. I am with other adults (18 and over)
- C. I am with other adults and youth (17 and under)
- D. I am with youth (17 and under)

10. What is your age?

- A. 17 and under
- B. 18-30
- C. 31-45

- D. 46-64
- E. 65 and over

11. What is your sex?

- A. Male
- B. Female

12. What is the highest degree or level of school you have completed?

- A. High school graduate or less
- B. One or more years of college, no degree
- C. Associate degree
- D. Bachelor's degree
- E. Graduate degree

13. Where do you live?

- A. Washington DC
- B. VA/MD suburbs
- C. East Coast
- D. Elsewhere in the US
- E. Outside the US

Exit Survey – JUNE 2012

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. Which ONE of the following do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive species
- D. Overfishing/destructive fishing techniques
- E. Pollution

2. Which ONE do you agree with most?

My personal actions have...

- A. ... a **great** impact on the health of the ocean
- B. ... **some** impact on the health of the ocean
- C. ... **little** impact on the health of the ocean
- D. ... **no** impact on the health of the ocean

3. Which of these four statements best describes your understanding of ocean acidification?

- A. Just as acid rain damages buildings and statues, ocean acidification will damage ships.
- B. Ocean acidification is primarily a concern in shallow bays, where the impact is not as diluted as in the open ocean.
- C. Ocean acidification will make it hard for some ocean animals to make their skeletons/shells.
- D. The anticipated change in ocean pH is so slight, there will be minimal harm to ocean life.

4. Of the following four statements about your role in ocean acidification, which ONE do you agree with most?

My personal actions have...

- A. ...a **great** impact on ocean acidification
- B. ...**some** impact on ocean acidification
- C. ... a **little** impact on ocean acidification
- D. ... **no** impact on ocean acidification

5. How useful did you find the combination of dance, film, and lecture in this presentation of ocean issues?

- A. Extremely useful to me
- B. Very useful to me
- C. Useful to me
- D. A little useful to me
- E. Not useful to me

Entrance Survey – JULY 2012

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. How did you first learn about this lecture?

- A. Poster or flyer while in the Natural History Museum
- B. Email or through Listserv
- C. NMNH website/social media
- D. Word of mouth
- E. Other

2. How many of the following lectures have you attended (distinguished by the use of clickers)?

- Ocean biodiversity loss (June 2010)
 - Climate change and the Impact on hurricanes (October 2010)
 - Climate change and the impact of human health (February 2011)
 - The impact of the Gulf oil spill one year later (April 2011)
 - *Ocean: A Multimedia Event Blending Art and Science* (June 2012)
- A. I did not attend any
 - B. I attended one or two
 - C. I attended three
 - D. I attended four
 - E. I attended five

3. Which ONE of the following do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive species
- D. Overfishing/destructive fishing techniques
- E. Pollution

4. Which ONE do you agree with most?

My personal actions have...

- A. ... a **great** impact on the health of the ocean
- B. ... **some** impact on the health of the ocean
- C. ... **little** impact on the health of the ocean
- D. ... **no** impact on the health of the ocean

5. Is the deep sea a challenging environment for life?

- A. Yes, because of the high pressure.
- B. Yes, because there is no light.
- C. Yes, because there is no food.
- D. No, because it is a constant and predictable environment.
- E. No, because there are no predators.

6. When will mining minerals from the deep sea (at depths greater than 1000 meters) become a reality?

- A. Within a year, the technology and demand exist now.
- B. Within a decade, the technology is being developed now.
- C. Between 20 and 30 years from now when land-based mines are likely to be largely depleted.
- D. Probably never, as the cost to retrieve rocks and minerals from the deep sea floor is prohibitive.

7. Which of the following BEST describes you (leave blank if none describes you)?

- A. Concerned citizen, interested in learning more
- B. Ocean enthusiast
- C. Natural sciences student/major
- D. Non-science professional working in the Ocean arena
- E. Scientist or science-related professional working in the Ocean arena

8. With whom are you here?

- A. I am alone
- B. I am with other adults (18 and over)
- C. I am with other adults and youth (17 and under)
- D. I am with youth (17 and under)

9. What is your age?

- A. 17 and under
- B. 18-30
- C. 31-45
- D. 46-64
- E. 65 and over

10. What is your sex?

- A. Male
- B. Female

11. What is the highest degree or level of school you have completed?

- A. High school graduate or less
- B. One or more years of college, no degree
- C. Associate degree
- D. Bachelor's degree

E. Graduate degree

12. Where do you live?

- A. Washington DC
- B. VA/MD suburbs
- C. East Coast
- D. Elsewhere in the US
- E. Outside the US

Exit Survey – JULY 2012

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. Which ONE of the following do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive species
- D. Overfishing/destructive fishing techniques
- E. Pollution

2. Which ONE do you agree with most?

My personal actions have...

- A. ... a **great** impact on the health of the ocean
- B. ... **some** impact on the health of the ocean
- C. ... **little** impact on the health of the ocean
- D. ... **no** impact on the health of the ocean

3. Is the deep sea a challenging environment for life?

- A. Yes, because of the high pressure.
- B. Yes, because there is no light.
- C. Yes, because there is no food.
- D. No, because it is a constant and predictable environment.
- E. No, because there are no predators.

4. When will mining minerals from the deep sea (at depths greater than 1000 meters) become a reality?

- A. Within a year, the technology and demand exist now.
- B. Within a decade, the technology is being developed now.
- C. Between 20 and 30 years from now when land-based mines are likely to be largely depleted.
- D. Probably never, as the cost to retrieve rocks and minerals from the deep sea floor is prohibitive.

Entrance Survey – OCTOBER 2012

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. How did you first learn about this lecture?

- A. Poster or flyer while in the Natural History Museum
- B. Email or through Listserv
- C. NMNH website/social media
- D. Word of mouth
- E. Other

2. How many of the following lectures have you attended (distinguished by the use of clickers)?

- Ocean biodiversity loss (June 2010)
 - Climate change and the Impact on hurricanes (October 2010)
 - Climate change and the impact of human health (February 2011)
 - The impact of the Gulf oil spill one year later (April 2011)
 - *Ocean: A Multimedia Event Blending Art and Science* (June 2012)
 - The Deep Sea: Life in Extreme Environments (July 2012)
- A. I did not attend any
 - B. I attended one or two
 - C. I attended three or four
 - D. I attended five or six

3. Which ONE of the following do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive species
- D. Overfishing/destructive fishing techniques
- E. Pollution

4. Which ONE do you agree with most?

My personal actions have...

- A. ... a **great** impact on the health of the ocean
- B. ... **some** impact on the health of the ocean
- C. ... **little** impact on the health of the ocean
- D. ... **no** impact on the health of the ocean

5. Discovery and development of drugs from the deep are challenging because

- A. It's expensive to conduct expeditions to collect deep-sea organisms

- B. It takes a long time for a drug to be approved for human use
- C. Harvesting enough of the organism is often not environmentally sustainable
- D. All the above

6. The most common and preferred CURRENT method for producing marine-derived chemicals for clinical trials is by

- A. Aquaculture
- B. Chemical synthesis
- C. Cell culture
- D. Genetic modification

7. Which of the following BEST describes you (leave blank if none describes you)?

- A. Concerned citizen, interested in learning more
- B. Ocean enthusiast
- C. Natural sciences student/major
- D. Non-science professional working in the Ocean arena
- E. Scientist or science-related professional working in the Ocean arena

8. With whom are you here?

- A. I am alone
- B. I am with other adults (18 and over)
- C. I am with other adults and youth (17 and under)
- D. I am with youth (17 and under)

9. What is your age?

- A. 17 and under
- B. 18-30
- C. 31-45
- D. 46-64
- E. 65 and over

10. What is your sex?

- A. Male
- B. Female

11. What is the highest degree or level of school you have completed?

- A. High school graduate or less
- B. One or more years of college, no degree
- C. Associate degree
- D. Bachelor's degree
- E. Graduate degree

12. Where do you live?

- A. Washington DC
- B. VA/MD suburbs
- C. East Coast
- D. Elsewhere in the US
- E. Outside the US

Exit Survey – OCTOBER 2012

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. Please rate your overall experience at this lecture.

- A. Poor
- B. Fair
- C. Good
- D. Excellent
- E. Superior

2. Which ONE of the following do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive species
- D. Overfishing/destructive fishing techniques
- E. Pollution

3. Which ONE do you agree with most?

My personal actions have...

- A. ... a **great** impact on the health of the ocean
- B. ... **some** impact on the health of the ocean
- C. ... **little** impact on the health of the ocean
- D. ... **no** impact on the health of the ocean

4. Discovery and development of drugs from the deep are challenging because

- A. It's expensive to conduct expeditions to collect deep-sea organisms
- B. It takes a long time for a drug to be approved for human use.
- C. Harvesting enough of the organism is often not environmentally sustainable.
- D. All the above

5. The most common and preferred CURRENT method for producing marine-derived chemicals for clinical trials is by

- A. Aquaculture
- B. Chemical synthesis
- C. Cell culture
- D. Genetic modification

Entrance Survey – NOVEMBER 2012

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. How did you first learn about this lecture?

- A. Poster or flyer while in the Natural History Museum
- B. Email or through Listserv
- C. NMNH website/social media
- D. Word of mouth
- E. Other

2. How many of the following lectures have you attended (distinguished by the use of clickers)?

- Ocean biodiversity loss (June 2010)
 - Climate change and the Impact on hurricanes (October 2010)
 - Climate change and the impact of human health (February 2011)
 - The impact of the Gulf oil spill one year later (April 2011)
 - *Ocean: A Multimedia Event Blending Art and Science* (June 2012)
 - The Deep Sea: Life in Extreme Environments (July 2012)
 - Drugs from the Deep (October 2012)
- A. I did not attend any
 - B. I attended one or two
 - C. I attended three or four
 - D. I attended five or six
 - E. I attended seven

3. Which ONE of the following do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive species
- D. Overfishing/destructive fishing techniques
- E. Pollution

4. Which ONE do you agree with most?

My personal actions have...

- A. ... a **great** impact on the health of the ocean
- B. ... **some** impact on the health of the ocean
- C. ... **little** impact on the health of the ocean
- D. ... **no** impact on the health of the ocean

5. Bioluminescence is most common in
- A. Jungles
 - B. Open fields
 - C. Coral Reefs
 - D. Open Ocean
6. Another way to describe bioluminescence is as
- A. Phosphorescence
 - B. Chemiluminescence
 - C. Fluorescence
7. Which of the following BEST describes you (leave blank if none describes you)?
- A. Concerned citizen, interested in learning more
 - B. Ocean enthusiast
 - C. Natural sciences student/major
 - D. Non-science professional working in the Ocean arena
 - E. Scientist or science-related professional working in the Ocean arena
8. With whom are you here?
- A. I am alone
 - B. I am with other adults (18 and over)
 - C. I am with other adults and youth (17 and under)
 - D. I am with youth (17 and under)
9. What is your age?
- A. 17 and under
 - B. 18-30
 - C. 31-45
 - D. 46-64
 - E. 65 and over
10. What is your sex?
- A. Male
 - B. Female
11. What is the highest degree or level of school you have completed?
- A. High school graduate or less
 - B. One or more years of college, no degree
 - C. Associate degree
 - D. Bachelor's degree
 - E. Graduate degree
12. Where do you live?
- A. Washington DC

- B. VA/MD suburbs
- C. East Coast
- D. Elsewhere in the US
- E. Outside the US

Exit Survey – NOVEMBER 2012

Note: In this survey, we refer to Ocean as the interconnected world ocean as well as the life and ecosystem services that it supports.

1. Please rate your overall experience at this lecture.

- A. Poor
- B. Fair
- C. Good
- D. Excellent
- E. Superior

2. Which ONE of the following do you think most threatens the long-term health of the ocean?

- A. Climate change and ocean acidification
- B. Habitat transformation
- C. Invasive species
- D. Overfishing/destructive fishing techniques
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- D. ... **no** impact on the health of the ocean

4. Bioluminescence is most common in

- A. Jungles
- B. Open fields
- C. Coral Reefs
- D. Open Ocean

5. Another way to describe bioluminescence is as

- A. Phosphorescence
- B. Chemiluminescence
- C. Fluorescence

APPENDIX B Frequencies

Characteristics of Lecture Series Attendees

	8-Jun-10	7-Oct-10	24-Feb-11	19-Apr-11	3-Jun-12	19-Jul-12	17-Oct-12	8-Nov-12	Total
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Which of the following BEST describes you?

Concerned citizen, interested in learning more	33%	43%	48%	41%	52%	23%	31%	43%	40%
Scientist or science-related professional working in the Ocean arena	28%	18%	21%	29%	10%	48%	39%	30%	25%
Ocean enthusiast	15%	20%	10%	15%	25%	7%	10%	9%	16%
Natural sciences major	17%	15%	14%	6%	11%	15%	10%	13%	13%
Non-science professional working in the Ocean arena	8%	5%	6%	9%	2%	8%	10%	4%	6%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Responses sorted in descending order of Total.

What is your age?

17 and under	2%	10%	3%	2%	3%	0%	0%	3%	3%
18-30	39%	19%	34%	23%	27%	29%	29%	37%	30%
31-45	19%	15%	23%	38%	22%	26%	21%	19%	23%
46-64	29%	46%	34%	29%	32%	31%	40%	36%	33%
64 and over	12%	11%	6%	8%	16%	13%	10%	5%	11%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

What is your sex?

Male	39%	35%	36%	47%	36%	42%	46%	36%	39%
Female	61%	65%	64%	53%	64%	58%	54%	64%	61%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Characteristics of Lecture Series Attendees (cont.)

8-Jun-10	7-Oct-10	24-Feb-11	19-Apr-11	3-Jun-12	19-Jul-12	17-Oct-12	8-Nov-12	Total
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What is the highest degree or level of school you have completed?

	100%	100%	100%	100%	100%	100%	100%	100%	100%
Graduate degree	50%	51%	65%	67%	37%	64%	71%	41%	52%
Bachelor's degree	31%	26%	26%	25%	28%	23%	21%	37%	28%
One or more years of college, no degree	16%	12%	6%	2%	15%	12%	6%	12%	11%
High school graduate or less	1%	10%	1%	4%	12%	2%	0%	7%	5%
Associate degree	2%	1%	1%	2%	7%		2%	4%	3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Responses sorted in descending order of Total.

Where do you live?

VA/MD suburbs	39%	59%	45%	51%	33%	48%	54%	47%	44%
Washington DC	26%	25%	47%	26%	15%	29%	31%	35%	27%
Elsewhere in the US	18%	5%	3%	5%	23%	15%	10%	9%	13%
East Coast	13%	9%	1%	12%	19%	3%	6%	7%	11%
Outside the US	4%	2%	4%	6%	11%	5%		3%	5%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Responses sorted in descending order of Total.

How did you hear or learn about this lecture?

Email/ Listserv	26%	45%	38%	32%	16%	36%	50%	41%	32%
Word of mouth	33%	22%	27%	18%	20%	14%	23%	25%	24%
Poster/ Flyer	12%	6%	23%	12%	41%	27%	13%	13%	19%
Other	16%	12%	7%	20%	19%	14%	10%	13%	15%
NHHH Website/ Social Media	13%	14%	5%	18%	4%	9%	4%	9%	10%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

Responses sorted in descending order of Total.

**Characteristics of Lecture Series Attendees
(cont.)**

	8-Jun-10	7-Oct-10	24-Feb-11	19-Apr-11	3-Jun-12	19-Jul-12	17-Oct-12	8-Nov-12	Total
Are you of Hispanic descent?									
No	90%								90%
Yes	10%								10%
Total	100%								100%

What race/ethnicity do you consider yourself to be (Mark one or more)?									
African American/Black	13%								13%
American Indian/Native American +									
Asian (Chinese, Indian, Japanese, etc.) +									
Native Hawaiian/Pacific Islander	2%								2%
White	85%								85%
Total	100%								100%

With whom are you here?											
Other adult(s)	54%				55%		55%		39%		52%
Alone	19%				38%		43%		49%		32%
Other adult(s) and youth	20%				6%				7%		12%
With youth	7%						2%		4%		5%
Total	100%				100%		100%		100%		100%

Responses sorted in descending order of Total.

Common Questions Answered by All Lecture Series Attendees

8-Jun-10	7-Oct-10	24-Feb-11	19-Apr-11	3-Jun-12	19-Jul-12	17-Oct-12	8-Nov-12	Total
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PRE-Session

Which ONE of the following do you think most threatens the long-term health of the ocean?

Climate change and ocean acidification	39%	36%	43%	48%	44%	51%	58%	48%	44%
Habitat transformation	11%	8%	11%	8%	4%	8%	2%	3%	7%
Invasive species	1%	5%	1%	0%	0%	2%		4%	1%
Overfishing/destructive fishing techniques	21%	21%	13%	17%	13%	18%	15%	14%	17%
Pollution	29%	31%	32%	27%	40%	22%	25%	31%	31%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

POST-Session

Which ONE of the following do you think most threatens the long-term health of the ocean?

Climate change and ocean acidification	48%	59%	59%	46%	68%	52%	53%	32%	52%
Habitat transformation	7%	7%	14%	18%	10%	11%	13%	2%	10%
Invasive species			3%	1%	2%				1%
Overfishing/destructive fishing techniques	34%	14%	11%	11%	3%	11%	13%	8%	16%
Pollution	12%	21%	14%	23%	17%	25%	21%	58%	22%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

PRE-Session

Which ONE do you agree with most? My personal actions have [impact choice] on the health of the ocean.

... a great impact	26%	44%	31%	36%	34%	28%	23%	26%	31%
... some impact	52%	42%	45%	51%	37%	46%	47%	50%	46%
... little impact	20%	14%	16%	11%	20%	23%	26%	20%	19%
... no impact	2%		8%	2%	9%	3%	4%	4%	4%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

POST-Session

Which ONE do you agree with most? My personal actions have [impact choice] on the health of the ocean.

... a great impact	47%	36%	43%	33%	54%	31%	25%	36%	40%
... some impact	40%	54%	31%	51%	38%	44%	52%	47%	44%
... little impact	12%	8%	22%	14%	6%	20%	19%	16%	14%
... no impact	1%	1%	4%	1%	2%	4%	4%	2%	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%

8-Jun-10	7-Oct-10	24-Feb-11	19-Apr-11	3-Jun-12	19-Jul-12	17-Oct-12	8-Nov-12	Total
----------	----------	-----------	-----------	----------	-----------	-----------	----------	-------

Please rate your overall experience at this lecture.

	8-Jun-10	7-Oct-10	24-Feb-11	19-Apr-11	3-Jun-12	19-Jul-12	17-Oct-12	8-Nov-12	Total
Poor	1%	3%	3%	4%			2%		2%
Fair	4%	9%	3%	17%					6%
Good	24%	28%	32%	40%			19%	10%	26%
Excellent	30%	37%	38%	31%			54%	42%	36%
Superior	41%	22%	25%	7%			25%	47%	30%
Total	100%	100%	100%	100%			100%	100%	100%

Questions Answered by Attendees at Specific Lecture Series Talks

LECTURE #1:	8-Jun-10	8-Jun-10
	PRE-	POST-
Of the following four statements about the health of the ocean, which ONE do you agree with most?		
The ocean is in great shape	0%	1%
The ocean is in good shape, but we need to protect it	18%	1%
The ocean is in bad shape and we need to take action now	80%	82%
It's too late for the ocean, the ocean is doomed!	2%	15%
Total	100%	100%

On a scale of 1-5, where 1 is 'dismal' and 5 is 'bright,' where would you place the Ocean's future?

	PRE-	POST-
1 –Dismal	11%	35%
2	36%	43%
3	45%	14%
4	7%	6%
5 - Bright	2%	1%
Total	100%	100%

**Correct response is in italics and dark green.*

Questions Answered by Attendees at Specific Lecture Series Talks
(cont.)*

LECTURE #2:

What effect do you think climate change will have on hurricanes?

	7-Oct-10	7-Oct-10
	PRE-	POST-
Increase the <u>number</u> of hurricanes and tropical cyclones	5%	4%
<i>Increase the <u>intensity</u> of hurricanes and tropical cyclones</i>	13%	68%
Increase the <u>number</u> AND <u>intensity</u> of hurricanes and tropical cyclones	72%	23%
It will have minimal or no effects	5%	1%
I don't know	5%	3%
Total	100%	100%

Which of the following statements best describes your opinion about the value of hurricane modeling?

	PRE-	POST-
It's just a research tool that's not very useful in practice	3%	3%
<i>Though not exact, it's one of the best tools we have to predict hurricane behavior</i>	82%	82%
It can be used to accurately predict a hurricane's exact path	8%	15%
I don't have an opinion about hurricane modeling	8%	
Total	100%	100%

**Correct response is in italics and dark green.*

LECTURE #3:

Which of the following statements best describes your opinion about the connection between the ocean and human health?

	24-Feb-11	24-Feb-11
	PRE-	POST-
<i>The ocean and human health are closely connected</i>	86%	90%
The ocean and human health are somewhat connected	10%	8%
The ocean and human health are minimally connected	3%	1%
The ocean and human health are not connected	1%	1%
Total	100%	101%

How much impact do you think climate change will have on human health?

	PRE-	POST-
<i>Climate change will have a dramatic impact on human health</i>	73%	81%
Climate change will have some impact on human health	17%	18%
Climate change will have minimal or no impact on human health	10%	1%
Total	100%	100%

**Correct response is in italics and dark green.*

LECTURE #4:

Of the oil that wasn't removed by burning, skimming, and direct recovery, where do you think the oil from the Deepwater Horizon spill went?

	19- Apr-11	19- Apr-11
	PRE-	POST-
It's all still in the environment: in the marsh, buried in sand and sediments, and in the water of the Gulf and beyond	32%	28%
It's all gone, evaporated, dissolved, or eaten by microbes	2%	1%
A combination of the above answers	24%	45%
<i>We still don't know exactly where it has all gone</i>	42%	26%
Total	100%	100%

Which of the following statements best describes your opinion about the use of oil dispersants during the Gulf Oil Spill?

	PRE-	POST-
Dispersants are okay for the environment and it was good to use them	2%	8%
Dispersants aren't the best for the environment, but it was necessary in the Gulf	27%	52%
Dispersants are bad for the environment and should not have been used	17%	7%
<i>More research needs to be done to determine the impact that dispersants combined with oil has on the environment</i>	54%	33%
Total	100%	100%

**Correct response is in italics and dark green.*

Would you eat seafood from the Gulf?

	PRE-	POST-
Yes	45%	67%
Not sure	20%	15%
No	21%	9%
I don't eat seafood	13%	9%
Total	100%	100%

LECTURE #5:

Which of these four statements best describes your understanding of ocean acidification?

	3-Jun-12	3-Jun-12
	PRE-	POST-
Just as acid rain damages buildings and statues, ocean acidification will damage ships.	10%	2%
Ocean acidification is primarily a concern in shallow bays, where the impact is not as diluted as in the open ocean.	20%	3%
<i>Ocean acidification will make it hard for some ocean animals to make their skeletons/shells.</i>	64%	92%
The anticipated change in ocean pH is so slight, there will be minimal harm to ocean life.	6%	3%
Total	100%	100%

Of the following four statements about your role in ocean acidification, which ONE do you agree with most?

	PRE-	POST-
My personal actions have...		
...a great impact on ocean acidification	26%	52%
... some impact on ocean acidification	39%	37%
... a little impact on ocean acidification	22%	9%
... no impact on ocean acidification	13%	2%
Total	100%	100%

**Correct response is in italics and dark green.*

How useful did you find the combination of dance, film, and lecture in this presentation of ocean issues?

	POST-
Extremely useful to me	48%
Very useful to me	27%
Useful to me	15%
A little useful to me	8%
Not useful to me	2%
Total	100%

LECTURE #6:

Is the deep sea a challenging environment for life?

	19-Jul-12	19-Jul-12
	PRE-	POST-
Yes, because of the high pressure.	29%	18%
Yes, because there is no light.	35%	3%
Yes, because there is no food.	10%	1%
<i>No, because it is a constant and predictable environment.</i>	24%	76%
No, because there are no predators.	2%	1%
Total	100%	100%

When will mining minerals from the deep sea (at depths greater than 1000 meters) become a reality?

	PRE-	POST-
<i>Within a year, the technology and demand exist now.</i>	26%	83%
Within a decade, the technology is being developed now.	50%	13%
Between 20 and 30 years from now when land-based mines are likely to be largely depleted.	16%	3%
Probably never, as the cost to retrieve rocks and minerals from the deep sea floor is prohibitive.	8%	1%
Total	100%	100%

**Correct response is in italics and dark green.*

LECTURE #7:

Discovery and development of drugs from the deep are challenging because...

	17- Oct-12	17- Oct-12
	PRE-	POST-
It's expensive to conduct expeditions to collect deep-sea organisms	6%	4%
It takes a long time for a drug to be approved for human use		4%
Harvesting enough of the organism is often not environmentally sustainable	4%	
<i>All the above</i>	90%	92%
Total	100%	100%

The most common and preferred CURRENT method for producing marine-derived chemicals for clinical trials is by...

	PRE-	POST-
Aquaculture	13%	2%
<i>Chemical synthesis</i>	48%	96%
Cell culture	29%	0%
Genetic modification	10%	2%
Total	100%	100%

LECTURE #8:

Bioluminescence is most common in ... 8-Nov-12

	PRE-	POST-
Jungles	1%	0%
Open fields	0%	0%
Coral Reefs	17%	5%
<i>Open Ocean</i>	82%	95%
Total	100%	100%

Another way to describe bioluminescence is as ...

	PRE-	POST-
Phosphorescence	38%	10%
<i>Chemiluminescence</i>	46%	89%
Fluorescence	15%	2%
Total	100%	100%

**Correct response is in italics and dark green.*

APPENDIX C

Lecture Series Fliers

Lecture #1:



Each of these fliers were sent to email lists of museum staff, volunteers, area educators and NMNH-affiliated teachers, science writers, listservs for NOAA, NIH, and local colleges/universities, and shared via the Ocean Portal's social media prior to the event. These posters were also displayed throughout the museum the week before the lecture. If a certain audience might have found the presentation of particular interest they were also targeted, like dance groups and patrons for the June 2012 performance.

Lecture #2:



Changing Tides: A Series of Ocean Discussions 
"Eye on the Storm: Predicting a Hurricane's Path of Destruction"
Dr. Isaac Ginis

Date: Thursday, October 7

Time: 6:00 pm

Location: Baird Auditorium (Ground Floor)
Smithsonian's National Museum of Natural History
(Please use the entrance at 10th St. and Constitution Ave., NW.)

Cost: Free and open to the public

With hurricane season upon us, join us for an evening discussion with **Dr. Isaac Ginis** from The University of Rhode Island's Graduate School of Oceanography. His talk, **"Eye on the Storm: Predicting a Hurricane's Path of Destruction,"** will consider how we observe, model, and forecast hurricanes around the world.

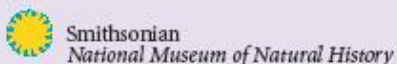
Dr. Ginis's lecture is the second installment of *Changing Tides: A Series of Ocean Discussions* in which top marine scientists discuss current research and how it is helping change the tide in ocean science and conservation.



ASL Interpretation will be provided.

For more information and a live Webcast of "Eye on the Storm," visit the Ocean Portal:
<http://ocean.si.edu/ocean-news/changing-tides/>

This series is brought to you by Smithsonian's National Museum of Natural History and the Centers for Ocean Sciences Education Excellence and made possible by a grant from the National Science Foundation.



ocean future

Lecture #3:



Photo by Mr. William Folsom, NOAA, NMFS

Changing Tides: A Series of Ocean Discussions

Dr. Rita Colwell

"Climate, Oceans, and Human Health: The Cholera Paradigm"

Date: Thursday, February 24, 2011
Time: 6:30 pm
Location: Baird Auditorium (Ground Floor)
Smithsonian's National Museum of Natural History
(Please use the entrance at 10th St. and Constitution Ave., NW.)
Cost: Free and open to the public



With the recent cholera outbreaks in Haiti, the impact of climate change on communicable diseases is becoming a major public health issue. Join us for an evening discussion with **Dr. Rita Colwell**, a former director of the National Science Foundation and Distinguished University Professor at both the University of Maryland and Johns Hopkins University's Bloomberg School of Public Health. Her talk, "**Climate, Oceans, and Human Health: The Cholera Paradigm**" will look at the connection between the ocean and human health and how climate change impacts cholera epidemics.

Dr. Colwell's lecture is the third installment of **Changing Tides: A Series of Ocean Discussions** in which top marine scientists discuss current research and how it is helping change the tide in ocean science and conservation.

ASL interpretation will be provided.

For more information and a live Webcast of "Eye on the Storm," visit the Ocean Portal: <http://ocean.si.edu/changing-tides/>

This series is brought to you by Smithsonian's National Museum of Natural History and the Centers for Ocean Sciences Education Excellence and made possible by a grant from the National Science Foundation.



Smithsonian
National Museum of Natural History



COSEE
CENTERS FOR OCEAN SCIENCES EDUCATION EXCELLENCE



NSF
NATIONAL SCIENCE FOUNDATION

Vertical text on the right side of the poster: **SCIENCE**

Lecture #4:



FREE
&
open to public

Photo by U.S. Coast Guard, "Deepwater Horizon Fire"

One Year After the Gulf Oil Spill

Where do things stand with wildlife, seafood, and the clean-up?
Hear from our panel of experts:

- **Dr. David Hollander**, University of South Florida: Fate of the oil and its impact
- **Dr. Judilee Marrow**, National Zoo: Rescuing Gulf Coast wildlife
- **Dr. John Stein**, NOAA: Gulf seafood and fisheries
- **Dr. James Bonner**, Clarkson University: Oil spill clean-up

Date: Tuesday, April 19, 2011

Time: 6:30 pm

Location: Baird Auditorium (Ground Floor)
Smithsonian's National Museum of Natural History
(Please use the entrance at 10th St. and Constitution Ave., NW.)

ASL Interpretation will be provided.

Watch the **Live Webcast** on the **Ocean Portal**
<http://ocean.si.edu/changing-tides>



This panel is a part of the Changing Tides Lecture Series, brought to you by Smithsonian's National Museum of Natural History and the Centers for Ocean Sciences Education Excellence and made possible by a grant from the National Science Foundation.



Smithsonian
National Museum of Natural History



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Lecture #5:



FREE
&
open to public

Photo: Scott Belding

OCEAN

A Multimedia Event Blending Art and Science

Dance Company: SpectorDance
(Monterey, CA, Artistic Director Fran Spector Atkins)






Presenter: Dr. George Matsumoto
(Monterey Bay Aquarium Research Institute)

Date: Sunday, June 3
Time: 3:00 to 4:00 pm

Location: Baird Auditorium (Ground Floor)
National Museum of Natural History
10th St. & Constitution Ave., NW, Washington, DC


The *OCEAN* presentation blends original music and dance, high definition underwater film, and interviews with leading ocean scientists to examine the state of the ocean. This performance expands perspectives by bringing together fact and feeling to inform and inspire. Remarks by Dr. George Matsumoto of the Monterey Bay Aquarium Research Institute.

This presentation is part of the Changing Tides series, presented by the National Museum of Natural History, in partnership with the Centers for Ocean Sciences Education Excellence (COSEE). Funding for Changing Tides is provided in part by NSF Award OCE-0943671.



performance

Lecture #6:



FREE
&
open to public

public event

Bottom left photo: Courtesy of C. Fisher and the NSF Ridge 2000 program (RIMCOL). Other photos: Courtesy of the EOUWNOAA OER Lophelia II project.

Changing Tides: A Series of Ocean Discussions

**The Deep Sea: Life in Extreme Environments
and Exploitation of Natural Resources**


Dr. Charles Fisher
Professor of Biology, Pennsylvania State University

Interviewed by Dr. Dave Pawson
Senior Research Scientist, National Museum of Natural History


Date: Thursday, July 19, 2012

Time: 3:00 – 4:00 pm

Location: Baird Auditorium (Ground Floor)






Dr. Charles Fisher




Dr. Dave Pawson

Join us for an informative and engaging afternoon interview with underwater visuals of extreme deep sea environments. NMNH's **Dr. Dave Pawson** will interview **Dr. Charles Fisher** of Penn State University about his exploration of deep sea hydrothermal vents and hydrocarbon seeps. Dr. Fisher will describe amazing adaptations of some of the unique animals that live in these environments around the world, while Dr. Pawson gets to the stories behind these explorations. Dr. Fisher will also address the impending mining of mineral deposits from vent communities, and some of the latest findings on the impact of the Deepwater Horizon oil spill on deep sea corals in the Gulf of Mexico.

This presentation is part of the Changing Tides series, presented by the National Museum of Natural History, in partnership with the Centers for Ocean Sciences Education Excellence (COSEE). Funding for Changing Tides is provided by NSF Award OCE-0943671.



Lecture #7:



FREE
&
open to public


Photo: Harbor Branch Oceanographic Institute-Florida Atlantic University

Changing Tides: A Series of Ocean Discussions

Drugs from the Deep

Dr. Shirley Pomponi




Date: Wednesday, October 17, 2012
Time: 5:30 – 6:30 pm
Location: Baird Auditorium (Ground Floor)



Dr. Shirley Pomponi



Join the search for medicines from deep-sea organisms. Dr. Shirley Pomponi will talk about manned undersea exploration of the U.S. outer continental shelf and deep coral reefs, and the quest to discover chemicals from marine sponges for drug development. Dr. Pomponi is a Research Professor and Executive Director of the NOAA Cooperative Institute for Ocean Exploration, Research and Technology (CIOERT) at Harbor Branch Oceanographic Institute, Florida Atlantic University, in Fort Pierce, Florida. She received her Ph.D. in Biological Oceanography from the University of Miami. Her research focuses on marine biotechnology, in general, and on sponges that produce chemicals with pharmaceutical properties, in particular. She has authored or co-authored more than 100 scientific publications and is co-inventor on several patents. She has led numerous research expeditions worldwide and has made more than 300 dives in Harbor Branch's *Johnson-Sea-Link* submersibles.

This presentation is part of the Changing Tides series, presented by the National Museum of Natural History, in partnership with the Centers for Ocean Sciences Education Excellence (COSEE). Funding for Changing Tides is provided by NSF Award OCE-0943671.



public event

Lecture #8:



Bernadette Widder 2012

public event

Changing Tides: A Series of Ocean Discussions

Bioluminescence in Art and Science


Dr. Edith A. Widder

Deep-Sea Explorer and MacArthur Fellow
CEO, President and Co-Founder, Ocean Research & Conservation Association

Date: Thursday, November 8, 2012

Time: 4:00 – 5:00 pm

Location: Baird Auditorium (Ground Floor)
National Museum of Natural History
10th St. & Constitution Ave. NW, Washington, DC



Dr. Edith A. Widder

Join us for an engaging afternoon discussion and inspiring images. Light made by living organisms is both scientifically illuminating and artistically inspiring. Dr. Widder, an internationally recognized expert in bioluminescence, will examine the intersection of science and art in bioluminescence, describing how science inspires art and art illuminates science. The presentation will be followed by an opportunity to ask Dr. Widder questions about bioluminescence and the intersection of science and art.

American Sign Language (ASL) Interpreter provided

This presentation is part of the Changing Tides series, presented by the National Museum of Natural History, in partnership with the Centers for Ocean Sciences Education Excellence (COSEE). Funding for Changing Tides is provided by NSF Award OCE-0943671.

