# Connecting Tennessee to the World Ocean

## Formative Evaluation Report

Prepared for the Tennessee Aquarium
by Christopher S. Horne

February 24, 2011

## Table of Contents


Summary ..... 3
Overview of the formative evaluation ..... 5
Scope ..... 5
Guiding principles ..... 5
Structure of this report ..... 7
Findings: Classroom-based activities ..... 8
Proposed activities ..... 8
The evaluation questions ..... 8
How the evaluation was conducted ..... 8
What we learned ..... 9
Points for discussion ..... 14
Findings: Web-based activities ..... 15
Proposed activities ..... 15
The evaluation questions ..... 15
How the evaluation was conducted ..... 15
What we learned ..... 16
Points for discussion ..... 18
Findings: Civic engagement series ..... 20
Proposed activities ..... 20
The evaluation questions ..... 20
How the evaluation was conducted ..... 20
What we learned ..... 20
Points for discussion ..... 24
Findings: Professional development ..... 25
Proposed activities ..... 25
The evaluation question ..... 25
How the evaluation was conducted ..... 25
What we learned ..... 25
Points for discussion ..... 27
Appendix: Instrumentation ..... 28
Classroom observation tool ..... 30
Internet audience survey ..... 31
Community lecture follow-up survey ..... 42
Professional development follow-up survey ..... 57
References ..... 62
Contact ..... 63

## Summary

In October 2009, the Tennessee Aquarium began an ambitious program, *Connecting Tennessee to the World Ocean* (CTWO), funded by a grant from the National Oceanic and Atmospheric Administration. CTWO consists of several individual projects, all intended to increase the ocean literacy of Aquarium audiences and to promote their adoption of an ocean stewardship ethic. This formative evaluation report summarizes the extent to which the Aquarium has made progress toward these goals in the first year of the project and provides an information base for identifying opportunities to strengthen implementation of four CTWO components. The four project components and their key associated evaluation findings follow.

1. *Classroom-based activities.* The Aquarium renovated classroom spaces, updated educational technology and teaching materials, and introduced new ocean-related programming for visiting school groups. Aquarium educators have integrated recognized best practices of science education into their programming, particularly by adopting inquiry-based, hands-on, active learning approaches to helping students learn ocean literacy and stewardship messages. Of children who participate in Aquarium programs, 85% could write at least one statement about what they had learned about the ocean during the program, and 54% could write two statements. 75% of these children could also write a statement communicating an ocean-specific stewardship message, and about a third of these connoted an understanding of the importance of ocean stewardship specifically for inland persons. The Aquarium also expanded access to ocean-related programs to underrepresented student groups; in the first year of CTWO, 27,954 students from underrepresented groups were admitted free (a nearly 200% increase over the previous year), and 8,271 students participated in ocean-related programming in their own schools conducted by Aquarium outreach educators.

2. *Web-based activities.* The Tennessee Aquarium strengthened use of web-based media to communicate ocean literacy and stewardship messages by adding extensive ocean-related educational content to the main Aquarium website and by using social media outlets to pique web visitors' interest in the ocean and ocean life. In the first year of CTWO, the educational pages were viewed 236,398 times in 180,429 unique visits, and the Aquarium's 38 ocean-related YouTube videos were viewed 15,780 times. At the end of the first year, the Aquarium had over 3,500 Twitter followers and 31,000 Facebook fans, and these social media outlets generated many positive, enthusiastic responses. Many members of the Aquarium's internet audience had come to regard the Aquarium as a source of ocean-related educational content, with over two-thirds of survey respondents saying they would visit the Tennessee Aquarium website for ocean-related educational content.

3. *Civic engagement series.* During the first year of CTWO, the Aquarium hosted the first two of its series of lectures on ocean topics, with these first two lectures featuring Sylvia Earle and James McClintock and attended by a total of 240 people. 89% of respondents to a follow-up survey conducted 30 – 60 days after each lecture volunteered an ocean-related response when asked to summarize the main point of the lecture, 67% could describe at least one thing they learned about the ocean or life in the ocean, and 39% could describe a specific behavioral change indicative of an ocean stewardship ethic.

4. *Professional development.* By the end of 2010, 10 Aquarium staff members had participated in professional development opportunities to build their capacity for delivering ocean literacy and stewardship messages to Aquarium audiences. These Aquarium staff members were able to describe a number of ways that the training they received would help them achieve CTWO goals.

These findings, and the more detailed findings presented in the full report, are intended to provide a starting point for discussions at the Tennessee Aquarium about how to strengthen CTWO. Points recommended for discussion include how to engage students in more stages of the scientific method when exploring ocean topics, how to emphasize the connection of inland persons to the ocean when communicating stewardship messages, how the popularity of the Aquarium's social media might draw users into more in-depth ocean learning, how the Aquarium may capitalize on lecture attendees' enthusiasm for learning more and sharing what they learned, how to expand the lecture series to broader audiences, and how to institutionalize the benefits of Aquarium staff members' professional development.

## Overview of the formative evaluation

### Scope

This report presents the results of a formative evaluation conducted for the Tennessee Aquarium of their NOAA-funded Connecting Tennessee to the World Ocean (CTWO) project. This project is multi-faceted, including improvements to classroom-based ocean education programming, increased participation of underrepresented students, expansion of gallery-based hands-on programs, professional development for Aquarium educators, web-based ocean education, and a civic engagement series. All of the project's components are intended to promote the NOAA funding program's two targeted outcomes: increased ocean literacy and increased adoption of an ocean stewardship ethic. To focus their efforts toward achieving these outcomes, the Tennessee Aquarium has also adopted specific objectives for CTWO:

1. More students understand and appreciate their connection to the world ocean.

2. The Aquarium develops stronger long-term capacity to educate its target audiences about their connections with the ocean and to promote ocean conservation behaviors.

3. More members of the public hear, read, and discuss conservation messages focusing on their connection to the ocean and promoting conservation behaviors.

4. Education staff acquire new knowledge and skills to strengthen their ability to lead and manage the Aquarium's ocean science educational programming.

The relationships among these project activities, project-specific objectives, NOAA's funding program outcomes, and NOAA's education strategic plan outcomes are depicted in the CTWO project model (Figure 1).

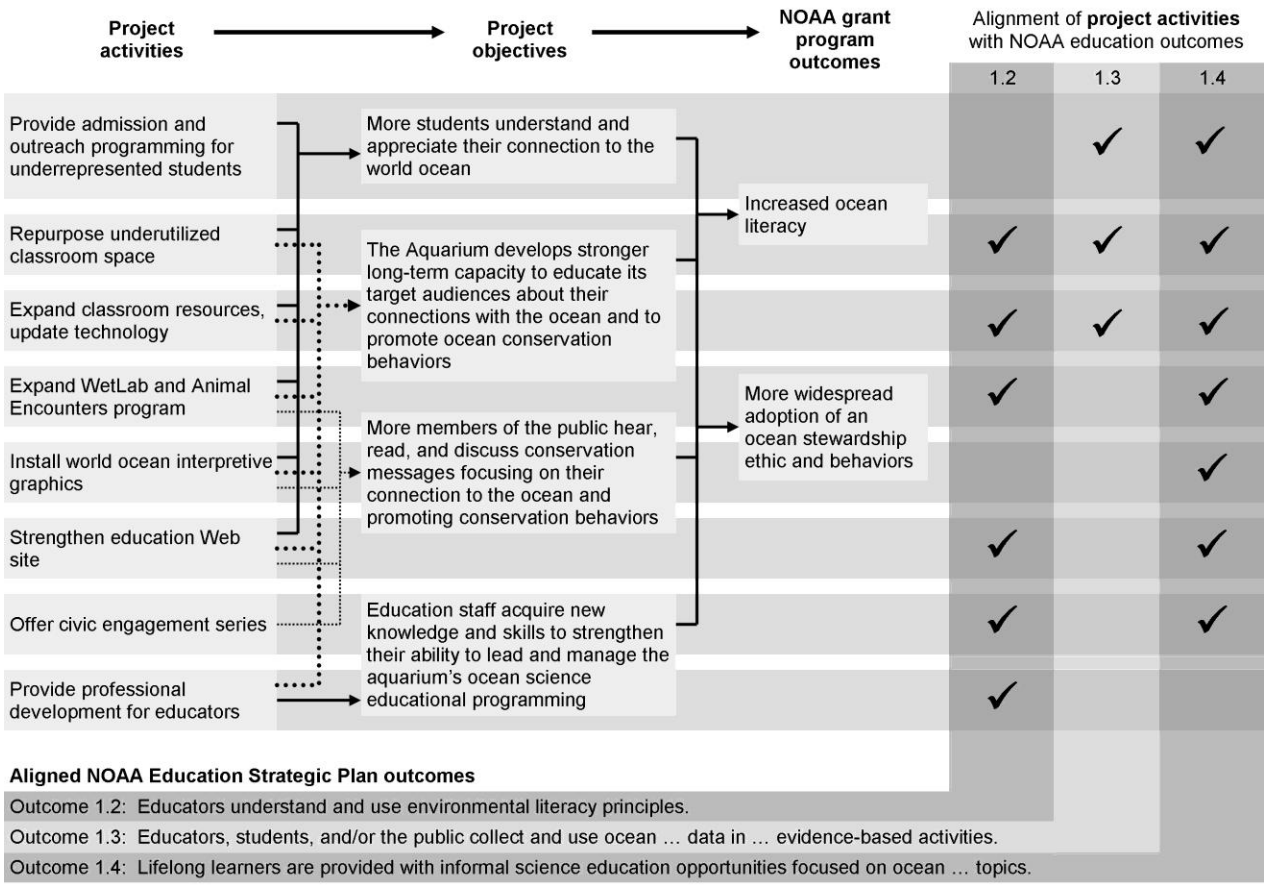
The formative evaluation has been conducted at approximately one year into the Aquarium's three-year project. The purpose of the formative evaluation is to document information about the project's implementation, outputs, and initial outcomes to inform the Aquarium's efforts at continual project improvement.

### Guiding principles

The overall evaluation design is guided by five principles:

1. Learning in informal science education programming is a highly individualized experience, and learning outcomes cannot be wholly anticipated. With this in mind, the evaluation relies heavily on the collection of qualitative data in the form of responses to open-ended questions, which allow respondents to describe learning in their own words, unconstrained by pre-established response sets. The evaluation demonstrates the feasibility and utility of collecting and analyzing qualitative data from larger samples than typically found in informal science education (ISE) evaluations.

Figure 1. Connecting Tennessee to the World Ocean project model




2. Quasi-experimental designs are preferable for attributing learning outcomes to ISE programming. Even if feasible, classic experimental designs are prone to pre-test artifact biases in ISE programming, and pre-tests that ask respondents to identify what they do not already know is of little use. Further, experimental designs are likely to detract from the ISE experience, threatening the internal and external validity of evaluation findings. Instead, the evaluation relies on quasi-experimental designs including retrospective post-tests and separate pre- and post-test samples.

3. The evaluation must not detract from Aquarium guests' ISE experience. Utmost attention has been paid to avoiding any evaluation approaches that may detract from the enjoyable, individualized experience that guests seek. With school children, the evaluation uses embedded assessments that are fun and incorporated seamlessly into the ISE programming.

4. The evaluation findings communicate to the larger ISE, technology-learning integration, and ocean education communities by grounding data analysis and reporting in the learning objectives summarized in NOAA's K-12 ocean literacy principles and fundamental concepts, NSF's informal STEM education impact categories, National Research Council's "strands of science learning" framework, and recognized technology-learning integration standards.

5. Most evaluation resources are being invested where the broadest and largest impacts are anticipated, with minor program components evaluated with more modest efforts.

## Structure of this report

The main body of this report is divided into four sections, one each for the CTWO components evaluated as part of the formative evaluation: (1) classroom-based activities, (2) web-based activities, (3) civic engagement series, and (4) professional development. Within each of these sections, the report summarizes the activities that were originally proposed for CTWO, the questions used to focus the formative evaluation of that component, how the evaluation was conducted, what was learned from the formative evaluation, and "points for discussion"—comments based on the evaluation findings that the Tennessee Aquarium may use as starting points for discussing how to further improve each component.

When the original CTWO proposal included performance goals, these goals are noted in blue callout boxes in the relevant tables and figures.

Copies of all data collection instruments are provided in an appendix.

## Findings: Classroom-based activities

### Proposed activities

The Tennessee Aquarium proposed to transform classrooms into Experiential Learning Centers to support programming characterized by active, hands-on learning, including direct experience with biofacts and educational materials; inquiry-based instruction; and use of technology to facilitate learning. As part of this effort, the Aquarium also proposed to repurpose classroom space to accommodate more students and to provide admission and outreach programming to underrepresented students.

### The evaluation questions

This formative evaluation explores the following questions about the classroom-based CTWO components:

1. To what extent and how is the Tennessee Aquarium using best practices in science education, including technology integration, to convey ocean literacy and stewardship messages?

2. What ocean literacy and stewardship messages do children learn from the Tennessee Aquarium's classroom programming?

3. To what extent has the Tennessee Aquarium used free admission and outreach programming to increase underrepresented students' participation in Aquarium ocean-related programming?

### How the evaluation was conducted

The evaluation questions were explored by analysis of data collected from direct observation, embedded assessment tools, and administrative records. Three classroom sessions were observed with data recorded using a standardized observation tool (available in the appendix) developed for this evaluation, drawing on the widely recognized Levels of Technology Integration (LoTi) framework (Moersch, 1995), the field-tested International Society for Technology in Education's Classroom Observation Tool, NOAA's Ocean Literacy Principles (National Geographic Society and National Oceanic and Atmospheric Administration, 2006), and the National Research Council's "strands of science learning" framework (Bell, Lewsenstein, Shouse, and Feder, 2009).

Students' comprehension and retention of ocean literacy and stewardship messages during onsite and in-school classroom-based sessions was measured with embedded assessments completed by 728 individual students. Aquarium educators were instructed to incorporate these embedded assessments as fun, nonthreatening learning activities in the sessions themselves (as suggested, for example, in Bell et al, 2009). The assessments take the form of two comic strips, one measuring the programs' contribution to ocean literacy and one measuring the contribution to students' ocean stewardship ethic (see appendix). The assessment instrument collected open-ended responses to fully capture the individualized and, often, unanticipated learning experiences that emerge during informal science education experiences. The assessments were conducted at the beginning of some programs (and used as a fun starting point for the sessions) and at the end of other programs (as a fun way to end the session) to construct experimental and comparison groups without the risk of introducing testing artifacts in post-tests.

To keep sample size requirements reasonable, 728 students in the 4th and 5th grades participating in Aquarium programming in October – December 2010 were sampled; 4th and 5th grade classes visit the Aquarium more often than other grades, and they are roughly the median grade range served by classroom Aquarium programming. The sample includes 4th graders from Title I schools (41%), 4th graders from non-Title I schools (23%), 5th graders from Title I schools (37%; no 5th graders from non-Title I schools participated in classroom programming during the data collection period).

Some of the school groups participated in classroom programming before their gallery tour and others participated afterwards as determined by the educational programming schedule. Within these two groups, some groups were assigned to complete their assessments before their classroom program, and others were assigned to complete their assessments at the end of the classroom program. This resulted in assessments being collected from four subsamples: (1) students who had not participated in any Aquarium programming (n = 168, including 19 students from in-school outreach programming), (2) students who had participated in classroom programming but not a gallery tour (n = 160, including 29 students from outreach programming), (3) students who had completed a gallery tour but not classroom programming (n = 273), and (4) students who had completed a gallery tour and participated in a classroom program (n = 127). Of these 728 assessments, 296 were selected for analysis by stratified random selection to maximize similarity of the comparison groups' grade levels, Title I status, and whether or not they had completed a gallery tour before the classroom programming while maintaining nearly the same proportions of these characteristics as in the entire sample.

Students' responses were coded into categories as reported below. After the first coding pass, a second researcher coded a random sample of 60 responses, and the coding scheme demonstrated a very high level of reliability, with 93% of the two sets of codes matching.

Administrative data provided by the Aquarium were analyzed to determine the level of participation in Aquarium programming by underrepresented students.

## What we learned

*To what extent and how is the Tennessee Aquarium using best practices in science education, including technology integration, to convey ocean literacy and stewardship messages?*

During the three classroom programs observed, Aquarium educators demonstrated a great deal of enthusiasm for ocean education in an out-of-school setting. The content of the programs largely aligned with CTWO goals. Two of the programs were squarely focused on building students' ocean literacy by focusing on ocean animals and ocean pollution. The third program focused on a freshwater ecosystem. All three programs integrated the theme of Tennessee's connection to the ocean most explicitly near the end of the session by showing an animated graphic tracing the flow of water from the Tennessee River to the Gulf of Mexico and by discussing how local behaviors can thus affect the ocean.

Pedagogically, all three of the observed programs included examples of good practices in informal and out-of-school science education (distilled from Bell et al., 2009; Cava, Schoedinger, Strang, and Tuddenham, 2005; Friedman, 2008; Moersch, 1995; and NOAA, n.d.; and italicized throughout this discussion). The programming successfully

*built on students' prior knowledge*, such as by relating the program to current news about the Gulf oil spill, to family trips to the ocean, to their familiarity with the Tennessee River, and to students' experiences with everyday materials like soapy water and plastic grocery bags. *Hands-on learning* was central to one of the observed programs, with children handling biofacts—in this case, bird feathers—and observing firsthand how they were affected by water, oil, and soap in a simulation of an oil spill and clean-up. In two of the programs, students were given the opportunity to *interact as science learners* with time for social interaction structured around conducting simulations together. During these times, students shared their observations, helped each other complete the simulations, learned by vicarious trial-and-error by watching each others' simulations, and described the outcomes of their simulations in question-and-answer periods.

The same two programs were largely *inquiry-based*, and to varying degrees, students *engaged in the scientific process* during the programs. The educators posed questions like "What would happen if a bird got too much oil on its feathers?", "Why do you think birds would want some oil on their feathers?", and "What do you think will happen if a pollutant enters our stream?" Students did not have an opportunity to articulate their own hypotheses or predictions, but they were guided through the process of manipulating independent variables, making observations of dependent variables, making comparisons, and drawing conclusions based on their observations. In one program, the students were directly engaged in *manipulating biofacts* and making their own observations; in another, the educator played the role of the scientist by making observations, recording data, and drawing conclusions, with the students helping to simulate the effects of pollution on a stream's aquatic life.

Some of the good practices observed were quantified based on their frequency of occurrence in 5-minute increments throughout the programs. The programs consistently engaged children in *active learning*; across all three programs, children had an opportunity to engage in active learning during almost every 5-minute segment. Examples of active learning include conducting simulations, handling and experimenting with biofacts, making and recording observations, looking for patterns in data, and answering the educators' questions. Of these active learning opportunities, just under half of the 5-minute segments observed included opportunities for *hands-on learning* (manipulating biofacts and participating in simulations). For most of the programs, at least 75% (and often nearly 100%) of the children were paying attention at the end of each 5-minute interval, though less than half of the students were paying attention to the educators in about 25% of the 5-minute marks, almost all during segments of the programs when children were invited to ask questions for sustained periods of time.

The CTWO educational technology upgrades were used heavily in each of the observed programs. The technology use was *fluid, nondistracting, learning-centered,* and *related to what became before and after*. The computers and projectors were used to show children detailed pictures of aquatic animals, depictions of the ecological impacts of pollution, microscopic images of microbes breaking down oil, and video news footage describing the effects of a local oil spill. In all these instances, the technology use was well integrated into the narrative of the programs. An animated graphic was projected near the end of all three programs to demonstrate the flow of water from the Tennessee River to the Ohio River, the Mississippi River, and finally the Gulf of Mexico to emphasize local children's connection to the ocean. In one program, this graphic reinforced a theme that had been introduced early in the program; in two programs, this

graphic seemed to represent a sudden shift in the emphasis of the program and came at a time when the children were having difficulty paying close attention. One program used a "smart board" extensively. As with the other programs, the smart board was used to show images of aquatic life, but it was also used interactively as a *tool for scientific inquiry* by recording observations and visualizing the data to facilitate the children's analysis.

### *What ocean literacy and stewardship messages do children learn from the Tennessee Aquarium's classroom programming?*

The good pedagogical practices and use of educational technology are not, of course, ends in themselves, but means for promoting children's learning of ocean literacy and stewardship messages. When children were asked to write "one thing" and "one MORE thing" they had learned about the ocean, 85% were able to provide at least one valid response, and over half of the children were able to write two valid responses (Table 1).

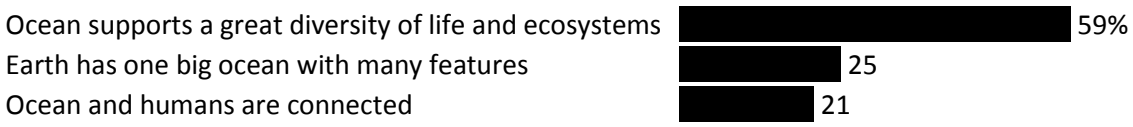
Table 1. Percentages of students giving no response, at least one valid response, and two valid responses when asked "What is ONE thing you learned about the ocean today?" and "What is one MORE thing you learned about the ocean today?" after classroom programming

N = 153. Note that about half of these children had also completed an Aquarium gallery tour before their classroom program. Of children who had completed the gallery tour and the classroom program, 90% provided at least one valid response, and 48% provided two valid responses.

Of all the children's valid responses, more than half reflected learning related to the fifth of the seven Ocean Literacy Essential Principles, "The ocean supports a great diversity of life and ecosystems." In most of these responses, children mentioned something they had learned about a specific ocean animal. Notably, in just over a fifth of the responses, children volunteered a message relating to the CTWO connectivity theme with responses classified under the sixth principle, "The ocean and humans are inextricably interconnected," even though they were not explicitly prompted to do so (Table 2).

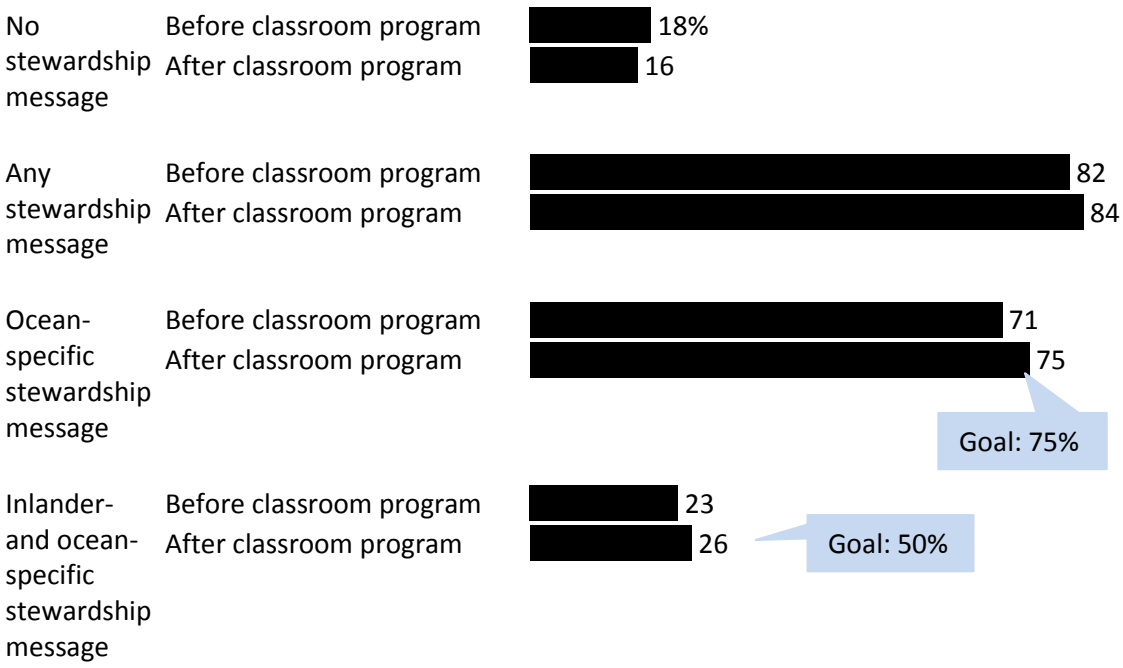
Children were also prompted to write a stewardship message explaining why someone should "care about protecting the ocean" even though "it's not even close to here." Three-fourths of the children who had just participated in a classroom program provided a response that connoted an ocean stewardship message (Table 3). While a slightly smaller proportion of children who had not yet participated in a classroom program wrote an ocean stewardship message, the difference does not achieve statistical significance.

Table 2. Percentages of students' valid responses to "What is ONE thing you learned about the ocean today?" and "What is one MORE thing you learned about the ocean today?" categorized within Ocean Literacy Principles, after classroom programming




N = 212 valid responses (from 132 students). Percentages exceed 100 because responses could be assigned to multiple categories. Less than 1% of responses were coded in the remaining four ocean literacy principles.

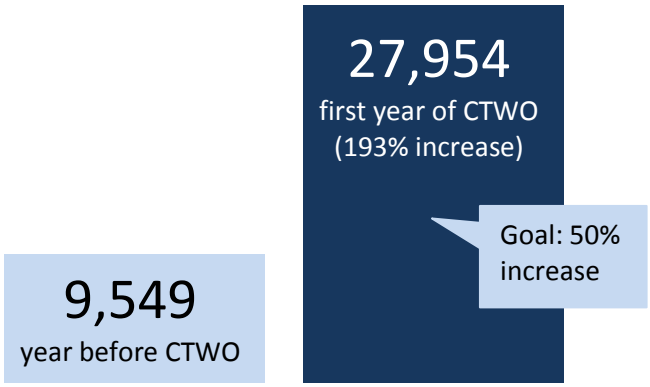
Table 3. Percentages of students communicating no stewardship message, a non-ocean-specific stewardship message, an ocean-specific stewardship message, and a stewardship message that is specific to the ocean and specifically relevant to inlander persons when asked to explain why someone should "care about protecting the ocean" even though "it's not even close to here," by participation in Aquarium programming




N = 296. Note that percentages for "Any stewardship message" and "Ocean-specific stewardship message" include the more specific responses as well. Differences do not achieve statistical significance.

*To what extent has the Tennessee Aquarium used free admission and outreach programming to increase underrepresented students' participation in Aquarium ocean-related programming?*

The Aquarium extends programming to underrepresented groups by providing free admission to students who qualify for federal free and reduced lunch programs and to groups of students from Title I schools. During the year prior to CTWO, October 2008 to September 2009, the Aquarium admitted 9,549 children from underrepresented groups. During the first year of the CTWO, October 2009 to September 2010, the Aquarium increased the number of children admitted under this program by nearly 200%, providing free admission to 27,954 children.




Number of children from underrepresented groups admitted free, year prior to CTWO and first year of CTWO

The Aquarium also extends CTWO programming to underrepresented student groups by conducting free ocean education programs for students in Title I schools—off-site, in the students' classrooms. During the first year of CTWO, outreach educators delivered 352 programs (300 funded under CTWO) in Title I schools for 8,271 students. (The goal for the 3-year project period is to deliver 850 outreach programs.)

Number of children who participated in in-school ocean education programming during the first year of CTWO

## Points for discussion

Aquarium classroom programming consistently engages children in active learning, a key "best practice" in science education. Children are frequently engaged in scientific behaviors, such as making observations and looking for patterns in data. Aquarium educators could identify more opportunities to engage children in scientific behaviors by integrating more stages of the scientific method (or "a" scientific method—there are, of course, varying models) into the programs. For example, children could be asked to develop hypotheses ("What do you think will happen when we add oil to the water?") and given a chance to articulate these hypotheses to their peers, to draw a picture of what they expect to happen, or to write their prediction in a journal. Children could then engage in experimentation, record and look for patterns in their data, evaluate their hypotheses, and draw conclusions. More thoroughly integrating steps of the scientific method could be accomplished with minor adjustments to current programming.

From Table 3, it is clear that many children come to the programming with existing knowledge about ocean stewardship in general, but far fewer are able to articulate stewardship messages that connote the importance of ocean stewardship even for inland persons. Children who have attended Aquarium programming do not fare much better. This validates the importance of the central CTWO connectivity theme and indicates the need to strengthen the integration of this theme, particularly in programs where the connectivity message is mostly limited to the animated graphic appearing at the end of the program. Building on the educators' strengths, they may consider how to have children engage with this theme more actively and socially, such as with hands-on group simulations. If educators require more time to introduce program improvements, unstructured question-and-answer time could be curtailed as they do not appear to successfully hold the attention of most of the young audiences.

As Aquarium educators discuss possible modification of ocean education programs, they may want to discuss the range of ocean literacy topics addressed in their programs. Children are getting consistent messages related to the fifth ocean literacy principle, and that is certainly an important contribution to their ocean literacy. As ocean education programming continues to evolve, educators may want to consider broadening the targeted learning outcomes to emphasize some of the other principles as well.

## Findings: Web-based activities

### Proposed activities

One set of strategies adopted by CTWO uses web-based content to deliver messages about and to generate interest in ocean literacy and stewardship. The proposed web-based activities included:

1. Developing and posting Animal ID pages that include basic facts, conservation information, pictures, and video for Aquarium animals;

2. Introducing a new webcam with views of the Aquarium's Secret Reef exhibit; and

3. Using social media to build an internet audience for conveying and stirring interest in ocean literacy and stewardship messages.

### The evaluation questions

This formative evaluation explores the following questions about the web-based CTWO components:

1. What web-based ocean-related educational content does the Tennessee Aquarium provide?

2. To what extent has the Tennessee Aquarium developed an internet audience?

3. Has the Tennessee Aquarium become regarded as a source of ocean-related content among its internet audience?

4. To what extent does the Tennessee Aquarium's internet audience attend to the Aquarium's ocean-related internet content?

5. Do preK-12 educators, specifically, regard the Tennessee Aquarium as a source of ocean-related educational content?

### How the evaluation was conducted

To explore the evaluation questions, two types of data were collected and analyzed. First, a broad range of webmetrics were collected from Aquarium staff to measure the breadth of the Aquarium's internet audience and how frequently they view ocean-related web content. Second, a web-based survey (see appendix) was conducted to gather feedback from the Aquarium's internet audience. Invitations were sent to the Aquarium's Facebook fans, Twitter followers, e-newsletter recipients, blog readers, and email lists of preK-12 educators and homeschool parents. Usually, such surveys are limited by the problem of self-selection bias—the bias that may be introduced into survey findings when those who choose to complete a survey are systematically different from those who do not. This survey, however, capitalizes on self-selection, allowing respondents to self-define as members of the Aquarium's active internet audience by choosing to complete the survey. This does not entirely preclude self-selection bias—survey respondents may still differ from active members of the Aquarium's internet audience—but we assume that survey results can safely be interpreted as representative of the most active members of the Aquarium's internet audience. Most items on the

survey were completed by about 252 respondents over 40 days in January and February 2011.

## What we learned

### *What web-based ocean-related educational content does the Tennessee Aquarium provide?*

The Tennessee Aquarium has used a broad range of web-based outlets to provide ocean-related educational content, including their own website and blog, Facebook, Twitter, and YouTube.

As of February 2011, the Aquarium website includes attractive, compact Animal ID pages for 22 fish, 13 amphibians, 32 reptiles, 4 mammals, 19 birds, and 14 butterflies. The Animal ID pages are featured prominently on the website, with the Animal ID page menu accessible by one click from the Aquarium's home page. Each Animal ID page features a professional photograph of the animal; the animal's common and scientific names; "fun facts," such as interesting anatomical features or unusual behaviors; basic information about the animal, including its size, range, habitat, and diet; conservation information, including any inclusion on lists of endangered species, causes of endangerment, and conservation efforts underway; displays of "fan photos" submitted by website visitors; video of the animal; links to games, pictures, and wallpaper featuring the animal; and a description of where the animal can be found in the Aquarium.

The Aquarium uses Facebook page updates to share pictures, videos, and news related to a broad range of topics, including updates related to ocean literacy and stewardship. For example, in September 2010 (the last month of the first year of CTWO), the Aquarium Facebook page included a video of feeding time for the Aquarium's seahorses, a link to the video recording of the Sylvia Earle lecture (itself a component of CTWO), a link to one of the "Love on the Rocks" penguin video series, a link to a blog entry about a guitarfish, and photos of an Aquarium-hatched penguin chick.

Similarly, in that same month, the Aquarium Twitter feed included links to a seahorse video, photos of sea turtles, two news items retweeted from the NOAA Ocean Today Twitter feed, photos of a spiny turtle hatchling, news about penguins added to the Aquarium's exhibit, three ocean conservation video news clips, ocean-themed online educational games, and the live penguin cam.

While the Facebook and Twitter posts are necessarily brief, Aquarium blog entries featured more in-depth ocean-related content. During the first year of CTWO, ocean-related entries included articles and photo essays about sea turtles, a giant guitarfish, penguins, the Wild Ocean IMAX movie, new cowfish in the Aquarium's Secret Reef exhibit, NOAA's resources for learning about the Gulf of Mexico oil spill, cuttlefish feeding behaviors, jellyfish, and a documentary about overfishing. In all, 18 of the year's blog posts emphasized ocean literacy and stewardship messages.

The Aquarium's YouTube channel featured 38 ocean-related videos in the first year of CTWO, including the "Meet Our Animals" videos also featured on the Animal ID pages, the "Love on the Rocks" penguin video series, videos about the importance of ocean education, and footage of interesting animal behaviors recorded in the Aquarium's Secret Reef exhibit.

The Secret Reef Cam went live in October 2010, the beginning of the second CTWO year and thus out of scope for this evaluation. It has quickly become a popular feature of the Aquarium's website, though, with over 13,000 views in its first four months.

*To what extent has the Tennessee Aquarium developed an internet audience?*

Through this broad range of web-based media, the Tennessee Aquarium has garnered a large internet audience. During the first year of CTWO, the Animal ID pages were viewed 236,398 times in 180,429 unique visits to the Aquarium website (source: Google Analytics). As of February 2011, the Aquarium has 3,773 Twitter followers; at the end of the first CTWO year, the Aquarium had 31,719 Facebook fans, and during the first CTWO year, the 38 ocean-related YouTube videos were viewed 15,780 times.

*Has the Tennessee Aquarium become regarded as a source of ocean-related content among its internet audience?*

Of respondents from the general internet audience (that is, excluding educators, whose responses are described in a later section) who have visited the Tennessee Aquarium website, a strong majority "mostly agree" or "completely agree" that the following terms describe the site: interesting (91%), educational (89%), fun (79%), inspiring (57%)—all terms evocative of factors conducive to informal science learning.

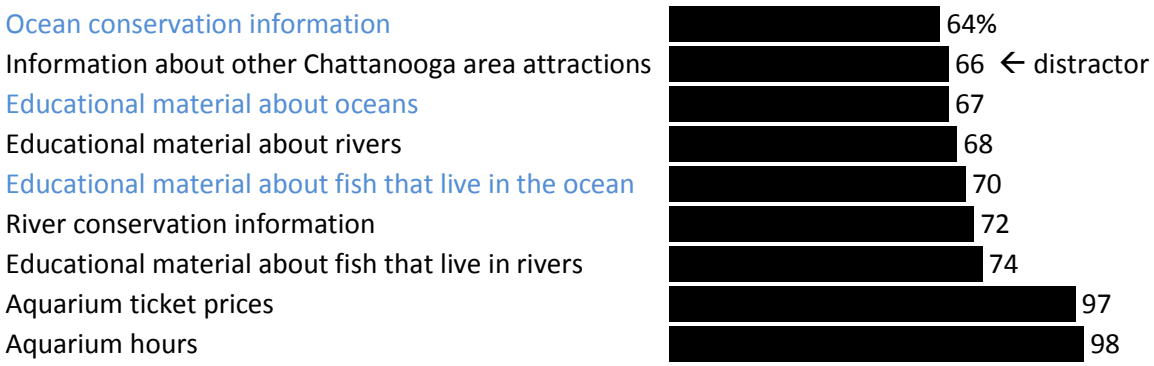
A majority of respondents indicate they would "probably" or "definitely" visit the Tennessee Aquarium website for ocean-related educational content (67%), information about ocean fish (70%), and information about ocean conservation (64%). These numbers likely overestimate the percentage of the internet audience who would actively seek out these types of ocean-related information on the Aquarium website, so their comparison to similar questions provides more insight. The Tennessee Aquarium was originally focused on river animals and ecosystems, but its website has become nearly equally regarded as a source of ocean-related content by its internet audience, who say they would visit the website for river-related educational content (68%), information about river fish (74%), and information about river conservation (72%) in nearly equal proportions. However, the percentages of respondents who indicate they would visit the Aquarium website for ocean-related information is about the same as the 66% who indicate they would look to the Aquarium website for information about other Chattanooga-area attractions—a "distractor" question (since providing this type of information is not a primary goal of the Aquarium website) included for the sake of comparison. Further, the percentages of respondents who would visit the Aquarium website for any kind of educational content is significantly lower than the nearly 100% who would visit the website for basic information like ticket prices (97%) and hours of operation (98%). (See Table 4.)

*To what extent does the Tennessee Aquarium's internet audience attend to the Aquarium's ocean-related internet content?*

Facebook fans and Twitter followers frequently "pay attention" to updates and tweets intended to convey ocean literacy and stewardship messages and to pique their interest in ocean-related topics. At least half of the Twitter-following survey respondents indicate that they pay attention to animal pictures, environmental news, and science news "such as by clicking on their links" either "more than half the time" or "almost always." Similarly, at least half of the Facebook-fan respondents indicate that they pay attention to animal FAQs, animal pictures, and videos either "more than half the time" or

"almost always." Just under half of the Facebook fans usually attend to updates about conservation news (48%) and links to blog entries (48%). The Aquarium's Facebook updates consistently receive a large number of "likes" and positive comments. In September 2010, the nine ocean-related updates received 917 "likes" and 168 comments, with the large majority of the comments conveying positive affective responses, such as "it's just great" and many variations on "so cute!" And, again, in the first CTWO year, the 38 ocean-related YouTube videos were viewed 15,780 times, and the Animal ID pages were viewed 236,398 times in 180,429 unique visits.

Table 4. Percentage of respondents who would "probably" or "definitely" visit the Tennessee Aquarium website for different types of information




N = 252

*Do preK-12 educators, specifically, regard the Tennessee Aquarium as a source of ocean-related educational content?*

Tennessee Aquarium educators have made a special effort to make ocean education materials available to homeschooling parents and preK-12 school teachers, and 58 homeschooling parents and 26 school teachers completed the survey. Of these educators, about 70% indicate they "probably would" or "definitely would" visit the Tennessee Aquarium website for educational materials related to the ocean, ocean fish, and ocean conservation (compared to 55% who responded in the same way to the distractor question about visiting the website for information about other Chattanooga attractions).

## Points for discussion

The Tennessee Aquarium's internet audience is vast and enthusiastic. Positive affect, enthusiasm, interest, and excitement are recognized as goals of informal science learning in themselves, but also as key precursors to more in-depth science learning. Aquarium staff members who generate web-based content and those who lead ocean education efforts may benefit from a discussion of how the social media content can be positioned as a "gateway" to more sustained, in-depth ocean-related learning.

A consistent pattern across the web-based outlets is the popularity of all-things-penguin. Penguin videos and pictures receive more "likes," comments, and views than other types

of content by far. Aquarium staff may be able to leverage penguin popularity to expand the breadth of ocean literacy messages they communicate. While penguin pictures and videos do a good job of inspiring curiosity and excitement about these ocean animals, they could also serve as a "hook" to get Aquarium audiences to attend to a broader range of ocean literacy and stewardship messages, such as by relating penguins to the effects of pollution or climate change or by highlighting animals that share penguin habitats.

From its beginnings as a freshwater aquarium, the Tennessee Aquarium has made tremendous progress toward becoming recognized as a source of ocean-related information as well. The Aquarium will surely continue to strengthen its identity as a source of ocean-related content over time, particularly as its various web-based outlets include ocean literacy messages like those observed in the first year of CTWO, and Aquarium staff may want to brainstorm for additional ways to market its ocean-related content.

## Findings: Civic engagement series

### Proposed activities

As part of the CTWO project, the Tennessee Aquarium proposed to host a series of community lectures by ocean conservation leaders intended to increase ocean literacy, promote attendees' adoption of an ocean stewardship ethic, and inspire ocean stewardship behavior.

### The evaluation questions

This formative evaluation explores the following questions about the CTWO civic engagement series:

1. Who has attended the lectures?

2. To what extent have the lectures increased attendees' ocean literacy and adoption of an ocean stewardship ethic?

3. To what extent have the lectures promoted ocean stewardship behaviors?

### How the evaluation was conducted

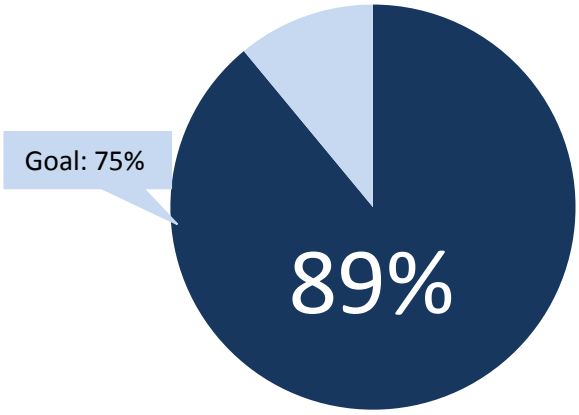
The civic engagement series was evaluated based on data collected through an online survey (see appendix) administered to attendees of the first two lectures. Email addresses were collected during registration and at the door. To maximize response rates, the emcee for each event emphasized the importance of completing the survey and incentives (chances to win restaurant gift certificates and tickets for the Aquarium's River Gorge Explorer) were offered to attendees who completed the survey. Survey invitations were emailed at 30 days after each event, a reminder was sent to nonresponders at 45 days after each event, and the surveys were closed at 60 days after each event. Email addresses were obtained from 156 (65%) of the 240 attendees, and the survey was completed by 92 attendees, for a response rate of 59%.

### What we learned

*Who has attended the lectures?*

The Aquarium hosted two lectures during the first year of CTWO, the first by Sylvia Earle and the second by James McClintock. The Sylvia Earle lecture was attended by 116 people, and the James McClintock lecture was attended by 124 people. (The proposed goal was 125 attendees per lecture.) Of the total number of attendees, 89% were white, 51% were male, and the average age was 53 (median age, 55). Over half of the attendees had a formal affiliation with the Aquarium; 14% were Aquarium employees, 42% were Aquarium volunteers, and 44% had neither formal affiliation with the Aquarium. A video of the Sylvia Earle lecture was made available on the internet at vimeo.com, which had been viewed 43 times as of February 9, 2011.

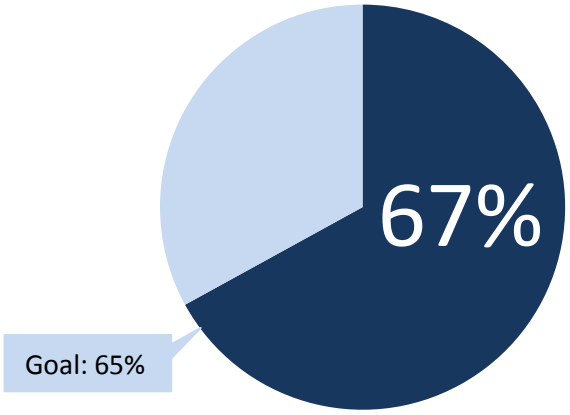
*To what extent have the lectures increased attendees' ocean literacy and adoption of an ocean stewardship ethic?*




Percentage of lecture attendees who wrote something related to ocean literacy or ocean stewardship when asked to summarize the speaker's main point (n = 92)

At the beginning of the survey, before ocean-related questions were asked, respondents were asked to summarize the speaker's main point. 89% of the responses were related to ocean literacy or ocean stewardship. In response to the closed-ended questions that followed, 98% agreed that they learned facts about the ocean that they didn't know before the event. Attendees reported similarly high levels of interest in learning more about the ocean, continuing to think about what they learned at the lectures, seeking out more information about the ocean, and talking to others about what they had learned—all indicators of successful learning in an informal science education setting (Table 5).

Respondents were also asked *What is one thing you learned about the ocean (or life in the ocean) that you didn't know before attending this event?* and then for *"one more thing"* they had learned. 67% provided at least one valid response, and 52% provided two valid responses.




Percentage of lecture attendees who could describe at least one thing they learned about the ocean or life in the ocean (n = 92)

Table 5. Percentages of lecture series attendees who completely or mostly agreed with statements about the events, by related strands of informal science learning

*Strand 1: Experience excitement, interest, and motivation to learn about phenomena in the natural and physical world.*

| | |
|---|---|
| I enjoyed attending this event. | 100% |
| I would enjoy attending another event to learn more about the ocean. | 100 |
| Since attending this event, I have continued to think about what I learned there. | 97 |
| This event made me want to learn more about the ocean. | 95 |
| This event made me want to take action to protect the ocean. | 91 |

*Strand 2: Come to generate, understand, remember, and use concepts, explanations, arguments, models, and facts related to science.*

| | |
|---|---|
| I learned facts about the ocean that I didn't know before attending this event. | 98 |
| This event helped me see how closely connected I am to the ocean. | 93 |
| This event helped me see how my behaviors can affect the ocean. | 92 |
| This event helped me see how much my own life is affected by the ocean. | 91 |

*Strand 4: Reflect on science as a way of knowing; on processes, concepts, and institutions of science; and on their own process of learning about phenomena.*

| | |
|---|---|
| This event helped me better understand how scientists learn about the ocean. | 95 |

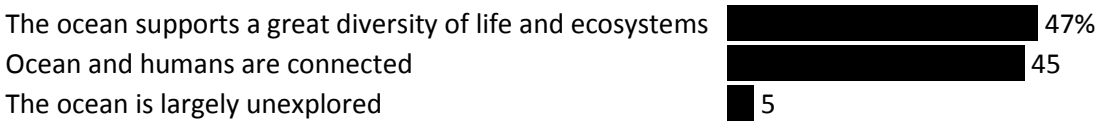
*Strand 6: Think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science.*

| | |
|---|---|
| Since attending this event, I have talked to others about what I learned there. | 93 |
| Since attending this event, I have looked for more information about the ocean on my own. | 70 |

N = 92. The "strands" refer to the National Research Council's "Strands of Science Learning" (Bell et al., 2009). The 3rd and 5th strands are specific to experiential learning and thus not relevant to the type of learning intended for lecture attendees.

Nearly all of the attendees' valid responses reflected learning related to two of the seven Ocean Literacy Essential Principles: "The ocean supports a great diversity of life and ecosystems" and "The ocean and humans are inextricably connected," aligning nicely with the goals of increasing attendees' ocean literacy and stewardship ethic (Table 6).

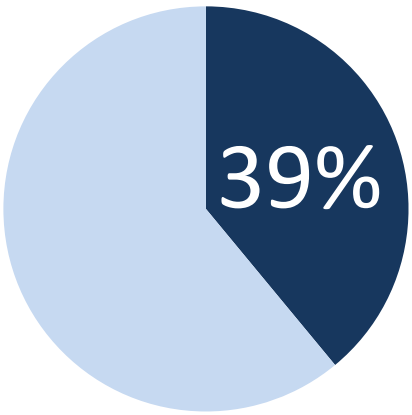
Table 6. Percentages of lecture attendees' valid responses to "What is one thing you learned about the ocean (or life in the ocean) that you didn't know before attending this event?" and "What is one *more* thing you learned about the ocean (or life in the ocean) that you didn't know before attending this event?" categorized within Ocean Literacy Principles




N = 108 valid responses (from 61 respondents). Less than 2% of responses were coded in the remaining four ocean literacy principles.

### *To what extent have the lectures promoted ocean stewardship behaviors?*

Measuring behavioral change is a difficult challenge, and even more so as a response to a single lecture. To gain some insight into this question, though, the survey presented the following question: *A few people who attended this event may have even changed their behaviors to help protect the ocean. After attending this event, did you start doing anything differently in your own life to help protect the ocean?* 41% responded "yes." These respondents were then asked how they had changed their behavior, and 94% were able to describe a specific behavioral change. The most common responses—44% of all valid responses—were related to conveying environmental stewardship messages to others. In response to related closed-ended questions, over 90% agreed that the event helped them see how closely connected they are to the ocean, how their behaviors can affect the ocean, and how their own lives are affected by the ocean (Table 5).




Percentage of lecture attendees who could describe a specific behavioral change they made following the event reflecting an ocean stewardship ethic (n = 92)

## Points for discussion

The lectures have successfully communicated ocean literacy and stewardship messages that relate to a broad range of ocean literacy principles, and many audience members recall these messages even one to two months later. A significant proportion of audience members even report behavioral impacts. Since many of these behavioral changes include talking to others about what they learned and seeking out additional information, the Aquarium may want to consider how to support these actions, perhaps by providing follow-up educational materials to lecture attendees.

A fairly large proportion of lecture attendees have been Tennessee Aquarium employees and volunteers. While these lectures are surely beneficial to these groups, the Aquarium may want to strengthen marketing to a broader audience in their effort to engage the community in dialog about ocean topics.

## Findings: Professional development

### Proposed activities

To build the Tennessee Aquarium's capacity to deliver ocean literacy and stewardship messages, the Aquarium proposed to have staff members participate in various professional development opportunities as part of CTWO. As of the end of 2010, 10 staff members had attended training conferences offered by professional associations, with one of these staff members attaining an education-related certification.

### The evaluation question

This formative evaluation explores the following question about the professional development CTWO component:

> To what extent has participating in professional development opportunities increased participating staff members' ability to communicate ocean literacy and stewardship messages to Aquarium audiences?

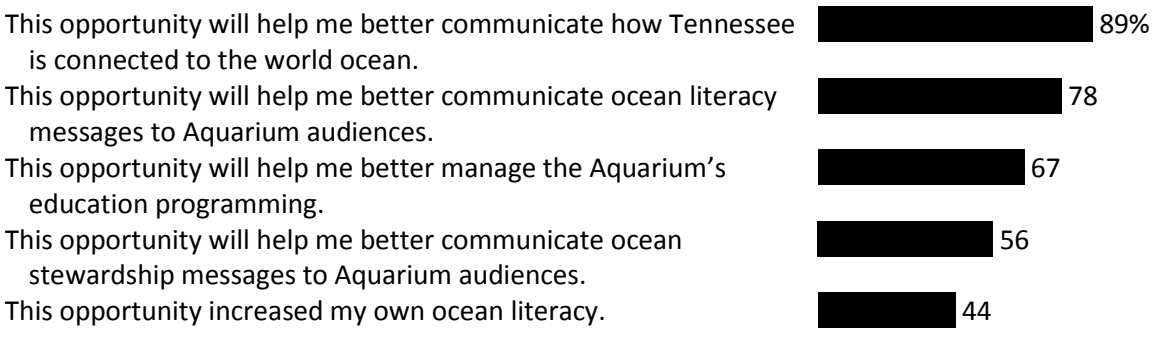
### How the evaluation was conducted

After staff members completed participation in professional development opportunities, they were asked to complete a brief online survey (see appendix). Nine of the 10 staff members who had participated in a professional development opportunity completed the survey.

### What we learned

The professional development opportunities were well aligned with CTWO goals (Table 7). Notably, 8 of the 9 Aquarium staff members reported that their professional development opportunity would help them achieve CTWO's primary goal of helping Aquarium audiences understand their connection to the world ocean.

Table 7. Percentage of professional development participants who report achieving different CTWO goals through their professional development opportunities




N = 9

Aquarium staff members commented on how the professional development opportunities helped them achieve these goals. These comments demonstrate a conscientious effort to use training opportunities to achieve CTWO goals during and beyond the grant period, excitement about ocean education, strengthened professional identification, and the professional development opportunities' contributions to the staff members' own ocean literacy:

Meeting educators who have developed curriculum and research which can be revamped into the Aquarium's education programs was the most interesting part of the conference.

Finding sources and organizations which provide up-to-date and cutting-edge science and information was also helpful.

There were several presentations of educational programs both about the ocean ecosystem and how to help connect our visitors with the world's oceans.

In my session, "Climate Change Interpretation-Learning from Reflective Practice in Aquariums," I learned how to bridge the guest's attention to climate change while discussing marine exhibits.

… being around educators from all over the world and hearing what they are doing in their own organizations was not only informative but inspiring.

This conference provided the opportunity to attend panels with topics directly related to our grant topic, "Connecting Tennessee to the World Ocean." I attended demonstrations of classroom activities regarding fluorescent proteins of ocean life, ocean acidification, sea level rise, dolphin and right whale conservation, oil spill outreach, and various methods of outreach efforts of aquariums.

National Association for Interpretation (NAI) … puts the entire process of program development and presentation together into such a thorough and logical framework, that it is sure to improve the quality of programming of the people and institutions implementing it. … I intend to work my way through each and every one of the seven books covered, honing and "perfecting" my interpretive skills as I go.

A number of the sessions I attended offered new tools for physically demonstrating the aquatic connection, and others led to brainstorming ideas to help young group audiences better utilize the aquarium for focused learning.

I have been able to bring home materials to adapt and include in my own outreach programs, including educational activities and short lab experiments.

Having the opportunity to talk with other employees of other facilities about how they conduct their education programs with their animals gave new ideas to try at our facility.

Attended seminars on climate change, which will be helpful in discussing how this may affect all aquatic life, both in freshwater and in the oceans. Also attended several sessions on the current extinction crisis with amphibians.

One of the benefits I had not considered was the networking of other informal educators and regional educators that are not found at state level meetings. I have already found these connections helpful when planning programming.

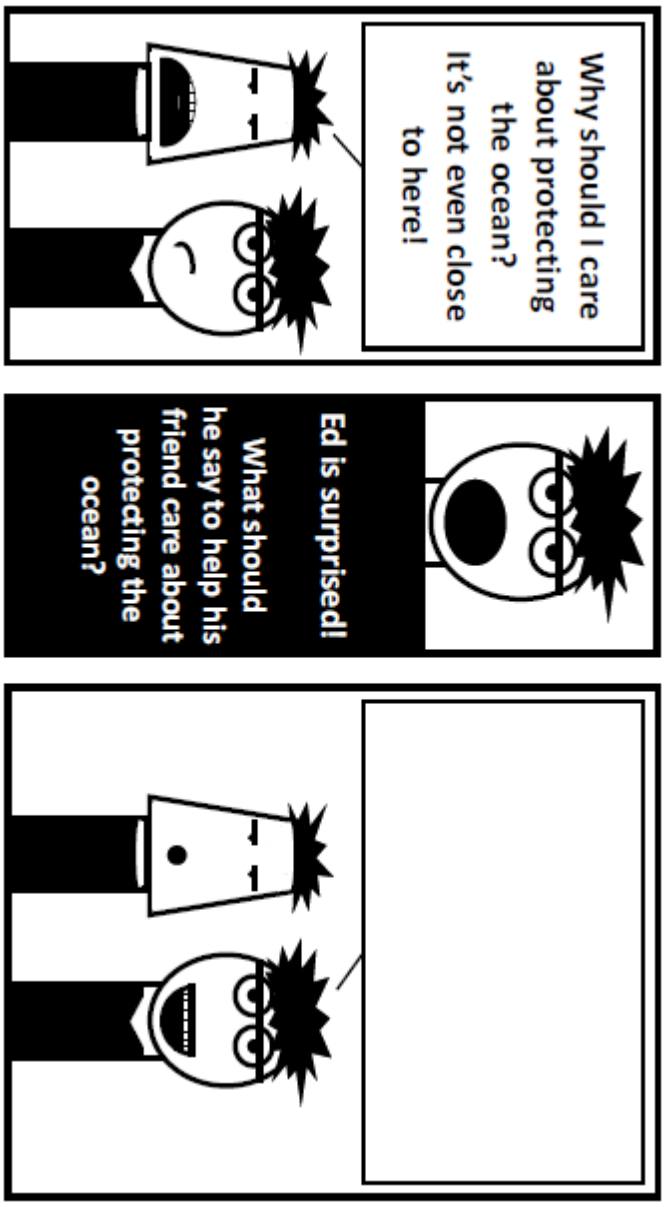
The opportunity to visit other areas of the country, meet strangers who become friends, and share goals, trade ideas, and work on each others' problems allows us to see that we are not alone in wanting to make this planet a safe and beautiful place for future humans to enjoy.

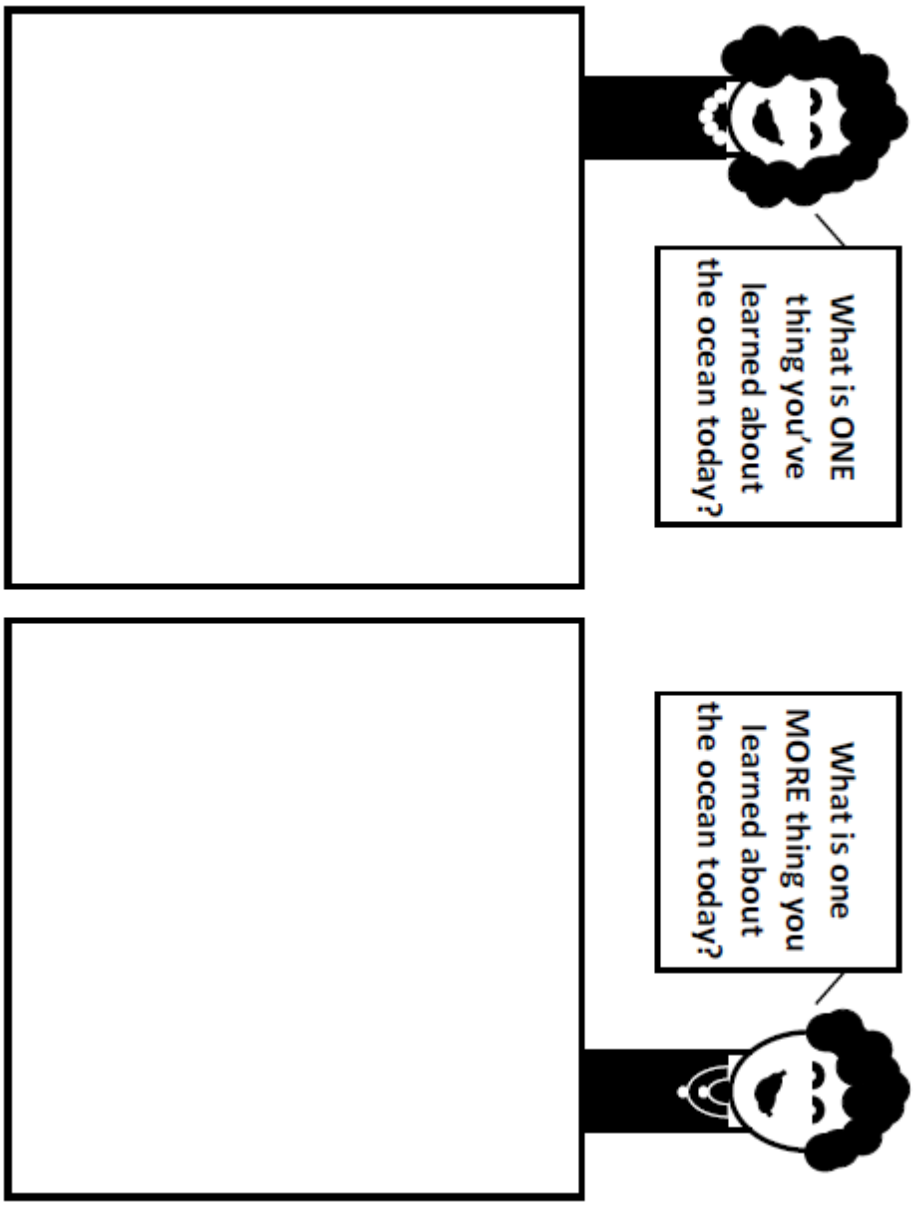
## Points for discussion

Tennessee Aquarium staff members who have participated in professional development opportunities had uniformly positive experiences that directly support their capacity to deliver ocean literacy and stewardship messages to Aquarium audiences. The Aquarium may want to consider how to promote implementation of what was learned in these professional development opportunities, such as by giving time to staff members to develop proposals for program improvement based on what they learned. These staff members' learning may also be extended by giving them time to share what they learned to appropriate staff units. By whatever means, the Aquarium should consider how the knowledge and skills acquired through staff members' professional development may be institutionalized in Aquarium programming.

## Appendix: Instrumentation

Embedded assessment for classroom programs




What is ONE thing you've learned about the ocean today?
What is one MORE thing you learned about the ocean today?

Classroom observation tool

***Connecting Tennessee to the World Ocean***
**Classroom program observation tool**

| Date | | Number of children | | Title of program | | IIV NIIV IV NIV |
|---|---|---|---|---|---|---|

*Learning goals, topics*

- What do students learn about the ocean? How does this align with the Essential Principles and Fundamental Concepts?
- What do students learn about their connection to the ocean?
- How are stewardship ethic and behaviors promoted?

*Activities, instructional methods*

- How is technology used to facilitate learning? By instructor? By students? As a tool for scientific inquiry?
- Was technology use fluid, adept, non-distracting, integrated into what came before and after?
- Is learning active? How do students participate in and/or observe scientific processes? Observation, manipulation, questioning, measurement, recording, hypothesizing/predicting, hypothesis testing, drawing conclusions from evidence? Do students use ocean science concepts, arguments, explanations, models?
- Do students interact as ocean science learners? Do they articulate ocean facts, scientific processes, stewardship messages, etc., in their own words to each other? Do they use scientific tools together?
- Is learning hands-on? Do students see/touch biofacts, living organisms, other educational materials?
- Is learning inquiry-based? Are students presented with questions and problems? Do students engage in gathering evidence, trial-and-error experimentation, problem solving, prediction and testing?
- Does the programming build on/connect to students' prior knowledge, interests, experiences?

*Students' affective responses*

- Do students demonstrate excitement, interest, motivation, boredom, curiosity?

| | :05 | :10 | :15 | :20 | :25 | :30 | :35 | :40 | :45 | :50 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Engaged % | | | | | | | | | | |
| 2. Tech now % | | | | | | | | | | |
| 3. Tech used | | | | | | | | | | |
| 4. Active op | | | | | | | | | | |
| 5. Hands on | | | | | | | | | | |
| Notes | | | | | | | | | | |

*At point in time*

1. Approximate % of students engaged (such as hands-on activities, answering questions, participating in discussion) vs. passive (such as listening to lecture, passively watching video, not participating in activities, "active" but off task)
2. Approximate % of students using technology as a tool for learning or inquiry

*In past five minutes*

3. Instructor used technology to facilitate learning (yes/no)
4. Students given opportunity for active learning (includes hands-on activity, answering questions, participating in discussion) (yes/no)
5. Students given opportunity for hands-on activity specifically (touching biofacts, using equipment, manipulating materials for scientific inquiry) (yes/no)

## Internet audience survey

**Thank you** for volunteering 5 minutes of your time to help the Tennessee Aquarium. By completing this quick survey, you are helping us learn how to better serve you. Please complete this survey only once.

**Please click the "Next" button to begin.**

**Anonymity**
Your participation in this survey is completely anonymous. A report based on this survey will be submitted to the Tennessee Aquarium, the National Atmospheric and Oceanic Agency, and a publicly accessible website, www.informalscience.org.

**Minors**
Please do not complete this survey if you are younger than 18 years old.

**Contact**
This survey is being conducted by Christopher Horne under contract with the Tennessee Aquarium. Please email any questions you may have about the survey to ChristopherHorneResearch@gmail.com.

**Please base your responses on whatever impressions of the Tennessee Aquarium website you have now. You don't need to visit the website. We're interested in whatever your opinion is right now.**

**First, have you ever visited the Tennessee Aquarium website?**

- ◯ Yes, recently enough that I can somewhat remember what the website looks like
- ◯ Yes, but I don't really remember what the website looks like
- ◯ No
- ◯ Not sure

**How much do you agree or disagree that the following words and phrases describe the Tennessee Aquarium website?**

| | Completely **disagree** that this describes the Aquarium website | Mostly disagree | Neither agree nor disagree | Mostly agree | Completely agree that this describes the Aquarium website |
|---|---|---|---|---|---|
| Easy to navigate | ◯ | ◯ | ◯ | ◯ | ◯ |
| Attractive | ◯ | ◯ | ◯ | ◯ | ◯ |
| Confusing | ◯ | ◯ | ◯ | ◯ | ◯ |
| Up-to-date | ◯ | ◯ | ◯ | ◯ | ◯ |
| Accurate | ◯ | ◯ | ◯ | ◯ | ◯ |
| Fun | ◯ | ◯ | ◯ | ◯ | ◯ |
| Boring | ◯ | ◯ | ◯ | ◯ | ◯ |
| Educational | ◯ | ◯ | ◯ | ◯ | ◯ |
| Interesting | ◯ | ◯ | ◯ | ◯ | ◯ |
| Inspiring | ◯ | ◯ | ◯ | ◯ | ◯ |

**How likely is it that you would visit the Tennessee Aquarium website for the following information?**

| | I definitely would visit the Aquarium website to find this | I probably would | I probably would not | I definitely would not visit the Aquarium website to find this |
|---|---|---|---|---|
| Ocean conservation information | ◯ | ◯ | ◯ | ◯ |
| River conservation information | ◯ | ◯ | ◯ | ◯ |
| Information about Aquarium exhibits | ◯ | ◯ | ◯ | ◯ |
| Aquarium ticket prices | ◯ | ◯ | ◯ | ◯ |
| Educational material about fish that live in the ocean | ◯ | ◯ | ◯ | ◯ |
| Aquarium IMAX showtimes | ◯ | ◯ | ◯ | ◯ |
| Aquarium hours | ◯ | ◯ | ◯ | ◯ |
| Educational material about oceans | ◯ | ◯ | ◯ | ◯ |
| Information about other Chattanooga area attractions | ◯ | ◯ | ◯ | ◯ |
| Educational material about rivers | ◯ | ◯ | ◯ | ◯ |
| Educational material about fish that live in rivers | ◯ | ◯ | ◯ | ◯ |

**Do you follow the Tennessee Aquarium on Twitter?**

- ◯ Yes
- ◯ No; I **am** on Twitter myself, but I don't receive the Aquarium's tweets
- ◯ No; I'm **not** on Twitter myself

**When you're looking at your Twitter feed, how often do you pay attention to these different kinds of tweets from the Tennessee Aquarium, such as by following their links?**

| | I almost never pay attention to these kinds of Aquarium tweets | Less than half the time | About half the time | More than half the time | I almost always pay attention to these kinds of Aquarium tweets |
|---|---|---|---|---|---|
| Aquarium contest announcements | ◯ | ◯ | ◯ | ◯ | ◯ |
| Environmental conservation news | ◯ | ◯ | ◯ | ◯ | ◯ |
| Special events at the Aquarium | ◯ | ◯ | ◯ | ◯ | ◯ |
| Science news | ◯ | ◯ | ◯ | ◯ | ◯ |
| Fun pictures and videos of fish and other animals at the Aquarium | ◯ | ◯ | ◯ | ◯ | ◯ |

**Do you "like" the Tennessee Aquarium Facebook page? If you like the Facebook page, Aquarium status updates appear on your Facebook wall. (This used to be called being a "fan.")**

- ◯ Yes
- ◯ No; I **am** on Facebook myself, but I haven't "liked" the Aquarium's page
- ◯ No; I'm **not** on Facebook myself

**When you're looking at your Facebook page, how often do you pay close attention to these update topics from the Tennessee Aquarium, such as by following their links?**

| | I almost never pay attention to these kinds of Aquarium Facebook updates | Less than half the time | About half the time | More than half the time | I almost always pay attention to these kinds of Aquarium Facebook updates |
|---|---|---|---|---|---|
| Contests | ◯ | ◯ | ◯ | ◯ | ◯ |
| Aquarium's Facebook Notes | ◯ | ◯ | ◯ | ◯ | ◯ |
| Videos by the Aquarium | ◯ | ◯ | ◯ | ◯ | ◯ |
| Animal FAQ | ◯ | ◯ | ◯ | ◯ | ◯ |
| Conservation information | ◯ | ◯ | ◯ | ◯ | ◯ |
| Animal photos | ◯ | ◯ | ◯ | ◯ | ◯ |
| Events at the Aquarium | ◯ | ◯ | ◯ | ◯ | ◯ |
| Blog posts | ◯ | ◯ | ◯ | ◯ | ◯ |
| Coupons and discounts | ◯ | ◯ | ◯ | ◯ | ◯ |
| Caption contests | ◯ | ◯ | ◯ | ◯ | ◯ |

**What would you like to see more of on the Tennessee Aquarium's Facebook page?**

Just a few questions about you . . .

### Are you an educator?

- ◯ No
- ◯ Yes, I'm a **homeschooling parent**
- ◯ Yes, I'm a **preschool teacher**
- ◯ Yes, I'm an **elementary school teacher**
- ◯ Yes, I'm a **middle school teacher**
- ◯ Yes, I'm a **high school teacher**
- ◯ Yes, I'm a **post-secondary instructor**
- ◯ Yes, other (please specify)

### What is your year of birth?

Please enter the full, 4-digit year

### Are you a Tennessee Aquarium employee or volunteer?

- ◯ No
- ◯ Yes, I'm an Aquarium **employee**
- ◯ Yes, I'm an Aquarium **volunteer**

Just three more questions . . .

**How much do you agree or disagree with the following statement?**

**In general, I enjoy completing online surveys.**

- ◯ Completely disagree
- ◯ Mostly disagree
- ◯ Neither agree nor disagree
- ◯ Mostly agree
- ◯ Completely agree

**When someone asks you to take an online survey, how often do you complete the survey?**

- ◯ Almost never
- ◯ Less than half the time
- ◯ About half the time
- ◯ More than half the time
- ◯ Almost always

**Not counting email, about how many hours per week do you use the Web? (Your best guess is fine.)**

**If there is anything else you would like to tell us, please do so here.**

You're finished! **Thank you** for completing this survey.

**Want to learn more?**

Visit the Tennessee Aquarium website and blog.

Learn about upcoming events at the Tennessee Aquarium.

Explore the Tennessee Aquarium's educational resources.

Learn about the Tennessee Aquarium's environmental conservation efforts.

Find the Tennessee Aquarium on Facebook, Twitter, YouTube, and Flickr.

This survey was prepared under award NA09SEC4690041 from the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. The statements are those of the author and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration (NOAA) or the U.S. Department of Commerce.

## Community lecture follow-up survey

**Thank you** for visiting this site to complete a follow-up survey about your attendance at the Tennessee Aquarium's Sylvia Earle lecture on June 25, 2010. This survey is being conducted to help *us* learn what *you* learned at the event, what you thought about the event, and how we might continue to improve Aquarium programming. **Completing the survey takes less than 10 minutes.**

At the end of the survey, you will be asked if you would like to be entered into a prize drawing as a token of our gratitude for your participation. One randomly selected person who completes this survey will win a gift certificate to a popular downtown restaurant.

**If you would like to participate in the survey, please click the "Next" button to begin.**

**Confidentiality**
Your participation in this survey will be kept confidential, your responses will not remain linked to your identifying information in any way, and your identifying information will be deleted at the conclusion of the study. A report based on this survey will be submitted to the Tennessee Aquarium, the National Atmospheric and Oceanic Agency, and a publicly accessible website, www.informalscience.org.

**Minors**
Please do not complete this survey if you are younger than 18 years old. If you are younger than 18 and attended the lecture with an adult, please ask that adult to complete the survey.

**Contact**
This survey is being conducted by Christopher Horne under contract with the Tennessee Aquarium. Please email any questions you may have about the survey to Christopher-Horne@utc.edu.

**Just to be sure . . . Did you attend the Sylvia Earle lecture at the Aquarium on June 25, 2010?**

◯ Yes

◯ No

**Please write a statement that you think best summarizes the speaker's main point.**

**Please rate your agreement or disagreement with the following statements. Note that when you're asked about "the ocean," that includes living things in the ocean as well as the ocean itself.**

| | Completely disagree | Mostly disagree | Neither agree nor disagree | Mostly agree | Completely agree |
|---|---|---|---|---|---|
| Since attending this event, I have talked to others about what I learned there. | ◯ | ◯ | ◯ | ◯ | ◯ |
| I enjoyed attending this event. | ◯ | ◯ | ◯ | ◯ | ◯ |
| This event helped me see how my behaviors can affect the ocean. | ◯ | ◯ | ◯ | ◯ | ◯ |
| Since attending this event, I have looked for more information about the ocean on my own. | ◯ | ◯ | ◯ | ◯ | ◯ |
| This event was well organized. | ◯ | ◯ | ◯ | ◯ | ◯ |
| This event helped me better understand how scientists learn about the ocean. | ◯ | ◯ | ◯ | ◯ | ◯ |
| This event helped me see how closely connected I am to the ocean. | ◯ | ◯ | ◯ | ◯ | ◯ |
| I learned facts about the ocean that I didn't know before attending this event. | ◯ | ◯ | ◯ | ◯ | ◯ |
| This event helped me see how much my own life is affected by the ocean. | ◯ | ◯ | ◯ | ◯ | ◯ |
| Since attending this event, I have continued to think about what I learned there. | ◯ | ◯ | ◯ | ◯ | ◯ |
| I would enjoy attending another event to learn more about the ocean. | ◯ | ◯ | ◯ | ◯ | ◯ |
| This event made me want to learn more about the ocean. | ◯ | ◯ | ◯ | ◯ | ◯ |
| This event made me want to take action to protect the ocean. | ◯ | ◯ | ◯ | ◯ | ◯ |

**What is *one thing* you learned about the ocean (or life in the ocean) that you didn't know before attending this event? (If you can't think of something, that's OK; just leave this box blank and click "next" to continue.)**

**What is one *more* thing you learned about the ocean (or life in the ocean) that you didn't know before attending this event? (If you can't think of something, that's OK; just leave this box blank and click "next" to continue.)**

**A few people who attended this event may have even changed their behaviors to help protect the ocean. After attending this event, did you start doing anything differently in your own life to help protect the ocean?**

- ◯ Yes
- ◯ No

**Please describe what you're doing differently to help protect the ocean.**

**Please write any suggestions you may have for improving future Aquarium events like this one.**

Just a few questions about you . . .

### What is your year of birth?

Please enter the full, 4-digit year

### What is your sex?

- ◯ Male
- ◯ Female

### What is your race/ethnicity? (You may select one or more than one category.)

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Hispanic or Latino
- ☐ Native Hawaiian or other Pacific Islander
- ☐ White
- ☐ Other (please specify)

### Are you a Tennessee Aquarium employee or volunteer?

- ◯ No
- ◯ Yes; I am an Aquarium **employee**
- ◯ Yes; I am an Aquarium **volunteer**

Just three more questions . . .

**How much do you agree or disagree with the following statement?**

**In general, I enjoy completing online surveys.**

- ◯ Completely disagree
- ◯ Mostly disagree
- ◯ Neither agree nor disagree
- ◯ Mostly agree
- ◯ Completely agree

**When someone asks you to take an online survey, how often do you complete the survey?**

- ◯ Almost never
- ◯ Less than half the time
- ◯ About half the time
- ◯ More than half the time
- ◯ Almost always

**Not counting email, about how many hours per week do you use the Web? (Your best guess is fine.)**

**If there is anything else you would like to tell us, please do so here.**

**Would you like to be included in the drawing for the prize offered to people who complete this survey? Your contact information will not be associated with your survey responses.**

- ◯ Yes
- ◯ No

**To enter the prize drawing, provide your contact information below. A prize winner will be randomly selected and notified within the next month or so.**

First and last name

Preferred phone number

Email address

You're finished! **Thank you** for completing this survey.

**Want to learn more?**

To learn about upcoming events at the Tennessee Aquarium, visit www.tnaqua.org. To learn more about the National Oceanic and Atmospheric Agency, visit www.noaa.gov.

This survey was prepared under award NA09SEC4690041 from the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. The statements are those of the author and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration (NOAA) or the U.S. Department of Commerce.

## Professional development follow-up survey

Thank you for visiting this site to provide follow-up information about your NOAA-funded professional development. This survey is being conducted as part of the external evaluation required under the terms of the NOAA "Connecting Tennessee to the World Ocean" grant. Your participation will help document the Aquarium's accomplishments in support of the NOAA grant program's goals. Completing the survey takes less than 5 minutes.

You will be asked to complete this survey once for each NOAA-funded professional development opportunity. The email you received asking you to complete this survey indicated the professional development opportunity that you're being asked about now.

Please be aware that your responses are not anonymous or confidential; your identifying information will remain associated with the responses you provide here. A report based on this survey will be submitted to the Tennessee Aquarium, the National Atmospheric and Oceanic Agency, and a publicly accessible website, www.informalscience.org. While there is no plan to include names of individual Aquarium staff members in these reports, anonymity should not be assumed.

This survey is being conducted by Christopher Horne under contract with the Tennessee Aquarium. Please email any questions you may have about the survey to Christopher-Horne@utc.edu.

Please click "Next" below to begin.

**Please write the name of the professional development opportunity you participated in here. For example, this could be the name of a conference you attended or the name of the certification program you completed. This should correspond with the professional development opportunity indicated on the email you received with the link to this survey.**

**What date did this professional development opportunity conclude?**

| | Month | Year |
|---|---|---|
| Please select the month and year. | | |

**Which of the following best describes the professional development opportunity?**

- ◯ Completing a professional association's certification program or formal training course
- ◯ Attending a conference or training program offered by a professional association or government agency (without completing a certification program or formal training course)
- ◯ Participating in a training program at the Aquarium
- ◯ Other (please specify)

**The professional development opportunities funded under the NOAA grant may be aligned with one or more of the following goals. Which of the following goals did you achieve by participating in this particular opportunity? (Check all that apply.)**

- [ ] This opportunity increased **my own** ocean literacy*.
- [ ] This opportunity will help me better **communicate ocean literacy messages** to Aquarium audiences.
- [ ] This opportunity will help me better **communicate ocean stewardship**** **messages** to Aquarium audiences.
- [ ] This opportunity will help me better communicate how **Tennessee is connected to the world ocean** to Aquarium audiences.
- [ ] This opportunity will help me better **manage** the Aquarium's education programming.
- [ ] None of these.

* "Ocean literacy" is understanding fundamental facts about the ocean, ocean life, how the ocean affects us, and how we affect the ocean.

** "Ocean stewardship" is our shared responsibility to protect the ocean.

**Please write a brief statement describing how this opportunity helped you achieve the goal(s) you indicated above. (If you selected "None of these," skip this and click the "Next" button below.)**

**Please provide any additional comments you may have here or click "Next" to complete this survey.**

You're done! Thank you very much for completing this survey.

This survey was prepared under award NA09SEC4690041 from the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. The statements are those of the author and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration (NOAA) or the U.S. Department of Commerce.

## References


Bell, P., Lewsenstein, B., Shouse, A. W., and Feder, M. A. (Eds.). (2009). *Learning Science in Informal Environments: People, Places, and Pursuits*. Washington, D.C.: National Academies Press.

Cava, N., Schoedinger, S., Strang, C., and Tuddenham, P. (2005). *Science Content and Standards for Ocean Literacy: A Report on Ocean Literacy*.

Friedman, A. J. (Ed.). (2008). *Framework for Evaluating Impacts of Informal Science Education Projects*. Retrieved from http://insci.org/resources/Eval_Framework.pdf.

Moersch, C. (1995). Levels of technology implementation (LoTi): A framework for measuring classroom technology use. *Learning and Leading With Technology* (November), 40-42.

National Geographic Society and National Oceanic and Atmospheric Administration. (2006). *Ocean Literacy: The Essential Principles of Ocean Sciences* [Brochure]. Retrieved from http://oceanservice.noaa.gov/education/literacy/ocean_literacy.pdf.

National Oceanic and Atmospheric Administration. (n.d.). *Education Strategic Plan 2009-2029*. Retrieved from http://www.education.noaa.gov/plan/index.html.

## Contact

Christopher S. Horne, Ph.D.

Independent Evaluation Consultant
and Associate Professor of Public Administration,
University of Tennessee at Chattanooga

615 McCallie Avenue, #6356
Chattanooga, TN 37403-2598

ChristopherHorneResearch@gmail.com

423-883-2433

This report was prepared under subcontract of award NA09SEC4690041 from the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce. The statements are those of the author and do not necessarily reflect the views of NOAA or the U.S. Department of Commerce.