

Tuesday Session Descriptions

Allen, Allen, Chase, and Johnson. *Zooplankton in a Changing World*

Session participants will identify still and video images of zooplankton during an activity designed for classroom use and also gain experience with the resource, *Zooplankton of the Atlantic and Gulf Coasts - A Guide to Their Identification and Ecology*. Information about plankton ecology and the results of more than three decades of zooplankton research in North Inlet Estuary in South Carolina will also be shared, including evidence of climate impacts on plankton populations. A lesson plan with references for the activity will be provided.

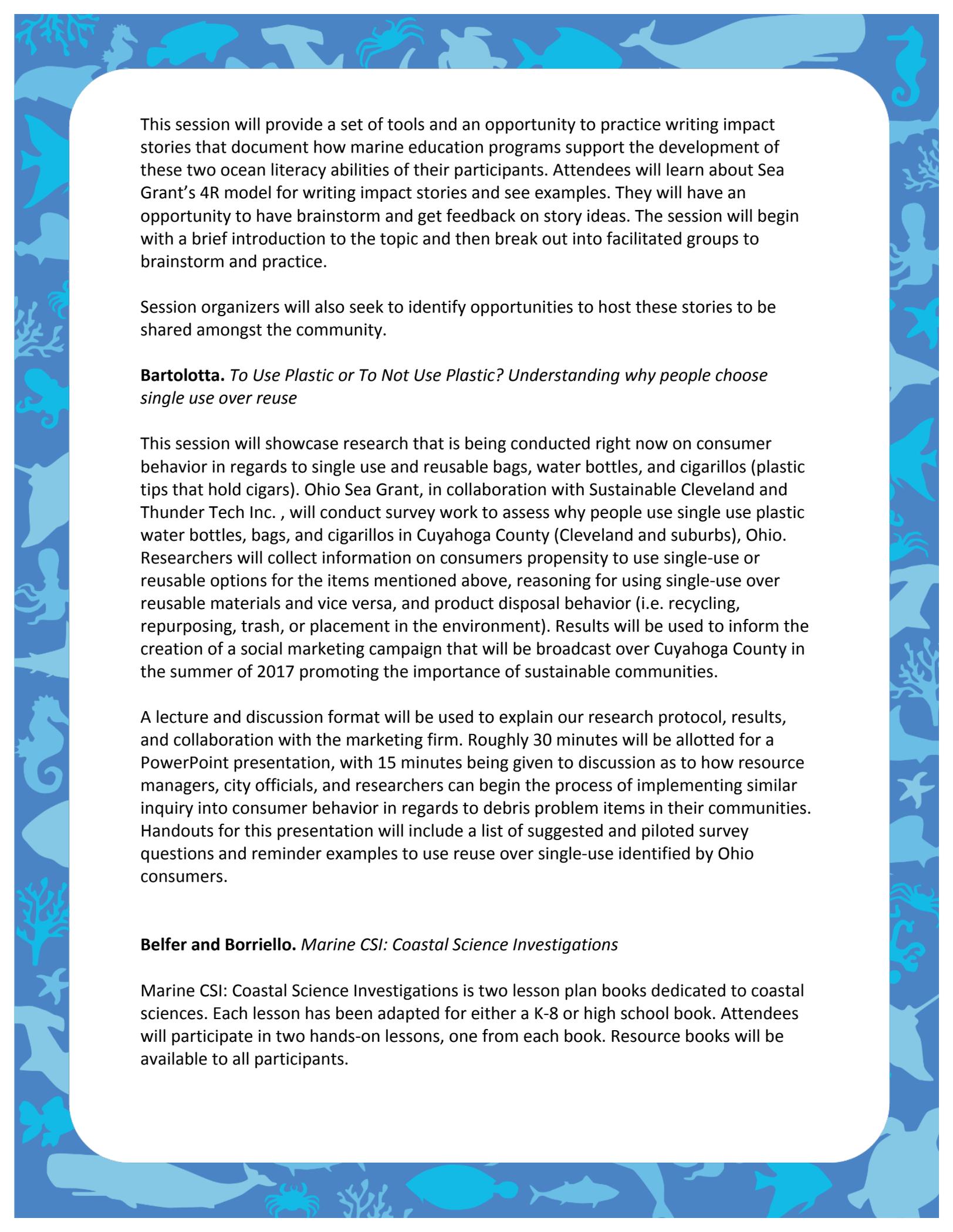
Marine Scientists and session co-presenters Dennis Allen and William Johnson collaborated to produce this identification guide for zooplankton – a first for the Atlantic and Gulf coast region. During the formative stages of this book, the authors solicited input from participants at NMEA conferences and enlisted NMEA members to review the manuscript. This guide, now in its second edition, serves as a unique resource to college and upper K-12 educators and their students interested in exploring the fascinating and important world of plankton.

Baek, Payne, East, and Marrero. *Writing Ocean Literacy Impact Stories: How Programs Can Do It?*

Ocean literacy is defined as an understanding of the ocean's influence on you and your influence on the ocean. An ocean-literate person understands: 1) the essential principles and fundamental concepts; 2) can communicate about the ocean in a meaningful way; and 3) is able to make informed and responsible decisions regarding the ocean and its resources.

Though this definition has three components, the second and third parts are woefully underdeveloped. The most attention and support for implementation has been given to the knowledge component. We see an opportunity to learn how our community of marine education providers support the communication and decision-making parts of the definition. By understanding the context of how programs have approached these skills, we can document the impact on those using these skills. Thus providing real evidence as to the value of ocean literacy education programs.

We seek to inspire marine educators to write their own impact stories. By telling their program's story, they can advocate for their own programs and also reflect on how their programs develop these important abilities in their participants. They need to be able to tell a story in a short amount of time, through bullet points and one-pagers. They need to be able to show how their program benefits their particular constituency, where they live and work.

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This session will provide a set of tools and an opportunity to practice writing impact stories that document how marine education programs support the development of these two ocean literacy abilities of their participants. Attendees will learn about Sea Grant's 4R model for writing impact stories and see examples. They will have an opportunity to have brainstorm and get feedback on story ideas. The session will begin with a brief introduction to the topic and then break out into facilitated groups to brainstorm and practice.

Session organizers will also seek to identify opportunities to host these stories to be shared amongst the community.

Bartolotta. *To Use Plastic or To Not Use Plastic? Understanding why people choose single use over reuse*

This session will showcase research that is being conducted right now on consumer behavior in regards to single use and reusable bags, water bottles, and cigarillos (plastic tips that hold cigars). Ohio Sea Grant, in collaboration with Sustainable Cleveland and Thunder Tech Inc. , will conduct survey work to assess why people use single use plastic water bottles, bags, and cigarillos in Cuyahoga County (Cleveland and suburbs), Ohio. Researchers will collect information on consumers propensity to use single-use or reusable options for the items mentioned above, reasoning for using single-use over reusable materials and vice versa, and product disposal behavior (i.e. recycling, repurposing, trash, or placement in the environment). Results will be used to inform the creation of a social marketing campaign that will be broadcast over Cuyahoga County in the summer of 2017 promoting the importance of sustainable communities.

A lecture and discussion format will be used to explain our research protocol, results, and collaboration with the marketing firm. Roughly 30 minutes will be allotted for a PowerPoint presentation, with 15 minutes being given to discussion as to how resource managers, city officials, and researchers can begin the process of implementing similar inquiry into consumer behavior in regards to debris problem items in their communities. Handouts for this presentation will include a list of suggested and piloted survey questions and reminder examples to use reuse over single-use identified by Ohio consumers.

Belfer and Borriello. *Marine CSI: Coastal Science Investigations*

Marine CSI: Coastal Science Investigations is two lesson plan books dedicated to coastal sciences. Each lesson has been adapted for either a K-8 or high school book. Attendees will participate in two hands-on lessons, one from each book. Resource books will be available to all participants.

Boyd. *Using GIS to Predict Cetacean Strandings Related to HABs*

Powerpoint presentation discussing the main points of topic (in detail below) -Exposure to harmful algal bloom (HAB) toxins, such as *Karenia brevis*, has been linked to cetacean strandings and mortalities. Biological and environmental data from a bottlenose dolphin (*Tursiops truncatus*) Unusual Mortality Event (UME) in 2004 are compared to those from pilot whale (*Globicephala macrorhynchus*) mass stranding events in 2013-2014 in western Florida. Geographical Information Systems (GIS) maps have been created by overlaying stranding locations and select *K. brevis* presence data in order to identify common spatial and temporal trends. Preliminary results indicate that elevated *K. brevis* levels (>10,000 cells/L) in Sarasota Bay during January-February and November may be predictive of stranding events in the following 2-9 weeks for bottlenose dolphins and pilot whales, respectively. Further development and refinement of this model to project the timing and location of potential stranding events may allow conservation managers and first responders to proactively stage equipment, accelerate response times, and increase live mammal rescues.

Browme and Burns. *Exploring the World of Marine Mammals Through Hands On Activities*

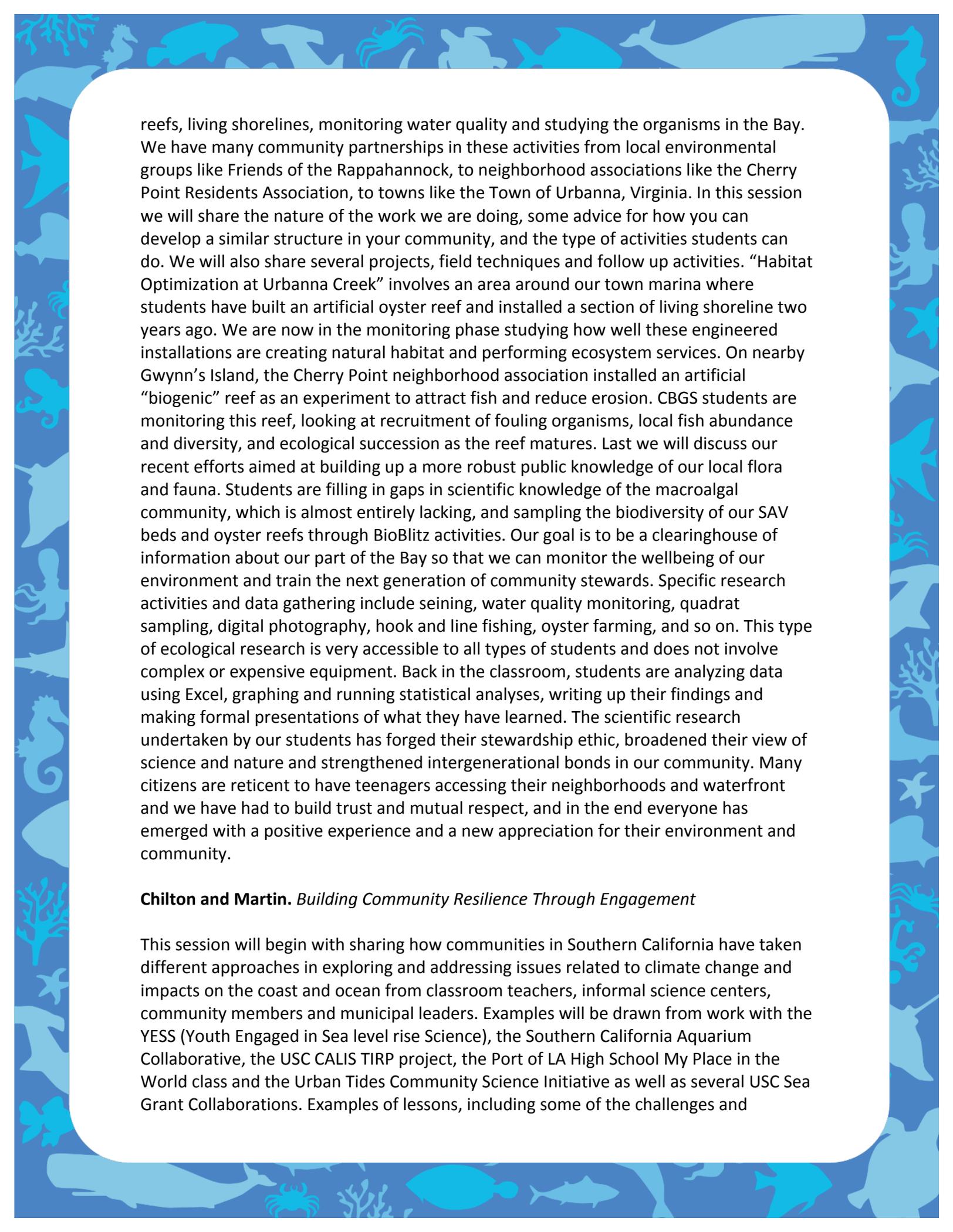
Participants will have the opportunity to learn about current research through two hands on stations. Virginia Aquarium will feature hands on activities utilizing data collected by their Stranding Team. Learn how scientists identify the individual marine mammals that they are studying by investigating fluke and fin matching. Dolphin Research Center will demonstrate how hands on activities can be used to teach principles of acoustics and share information from their team's current research on whistles. Additional resources will also be provided from other AMMPA facilities.

Cackowski. *Bridge DATA Activity - Flotsam & Jetsam: A Little Litter Goes a Long Way*

Not only does marine debris spoil the scenery, it also has the potential to cause serious harm to organisms that reside in the ocean. Using data from the International Coastal Cleanup, we'll determine the most common kinds of marine debris collected and calculate the impact of specific types in relation to overall totals.

Chaves Beam. *Citizen Science and Building Stewardship at the Chesapeake Bay Governor's School*

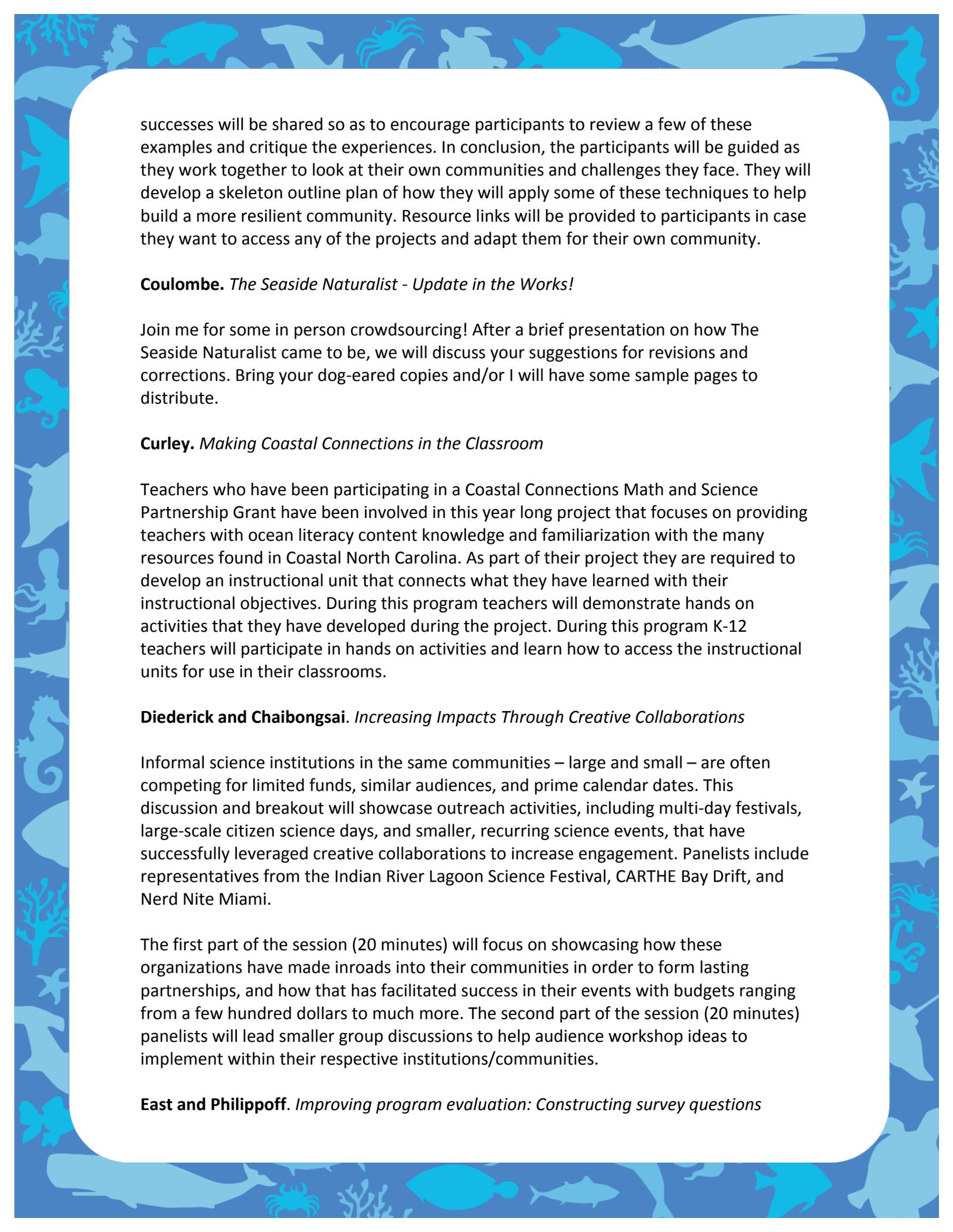
Students from the Chesapeake Bay Governor's School for Marine and Environmental Science have been conducting scientific research in our local community for many years. Our classroom laboratory is the middle Chesapeake Bay and its smaller tributaries where oyster reefs, submerged grass beds, and salt marshes offer us ample opportunity for field research. In recent years, habitat restoration efforts in the area have provided perfect classroom activities to get young scientists out in the field planting restoration

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reefs, living shorelines, monitoring water quality and studying the organisms in the Bay. We have many community partnerships in these activities from local environmental groups like Friends of the Rappahannock, to neighborhood associations like the Cherry Point Residents Association, to towns like the Town of Urbanna, Virginia. In this session we will share the nature of the work we are doing, some advice for how you can develop a similar structure in your community, and the type of activities students can do. We will also share several projects, field techniques and follow up activities. “Habitat Optimization at Urbanna Creek” involves an area around our town marina where students have built an artificial oyster reef and installed a section of living shoreline two years ago. We are now in the monitoring phase studying how well these engineered installations are creating natural habitat and performing ecosystem services. On nearby Gwynn’s Island, the Cherry Point neighborhood association installed an artificial “biogenic” reef as an experiment to attract fish and reduce erosion. CBGS students are monitoring this reef, looking at recruitment of fouling organisms, local fish abundance and diversity, and ecological succession as the reef matures. Last we will discuss our recent efforts aimed at building up a more robust public knowledge of our local flora and fauna. Students are filling in gaps in scientific knowledge of the macroalgal community, which is almost entirely lacking, and sampling the biodiversity of our SAV beds and oyster reefs through BioBlitz activities. Our goal is to be a clearinghouse of information about our part of the Bay so that we can monitor the wellbeing of our environment and train the next generation of community stewards. Specific research activities and data gathering include seining, water quality monitoring, quadrat sampling, digital photography, hook and line fishing, oyster farming, and so on. This type of ecological research is very accessible to all types of students and does not involve complex or expensive equipment. Back in the classroom, students are analyzing data using Excel, graphing and running statistical analyses, writing up their findings and making formal presentations of what they have learned. The scientific research undertaken by our students has forged their stewardship ethic, broadened their view of science and nature and strengthened intergenerational bonds in our community. Many citizens are reticent to have teenagers accessing their neighborhoods and waterfront and we have had to build trust and mutual respect, and in the end everyone has emerged with a positive experience and a new appreciation for their environment and community.

Chilton and Martin. *Building Community Resilience Through Engagement*

This session will begin with sharing how communities in Southern California have taken different approaches in exploring and addressing issues related to climate change and impacts on the coast and ocean from classroom teachers, informal science centers, community members and municipal leaders. Examples will be drawn from work with the YESS (Youth Engaged in Sea level rise Science), the Southern California Aquarium Collaborative, the USC CALIS TIRP project, the Port of LA High School My Place in the World class and the Urban Tides Community Science Initiative as well as several USC Sea Grant Collaborations. Examples of lessons, including some of the challenges and



successes will be shared so as to encourage participants to review a few of these examples and critique the experiences. In conclusion, the participants will be guided as they work together to look at their own communities and challenges they face. They will develop a skeleton outline plan of how they will apply some of these techniques to help build a more resilient community. Resource links will be provided to participants in case they want to access any of the projects and adapt them for their own community.

Coulombe. *The Seaside Naturalist - Update in the Works!*

Join me for some in person crowdsourcing! After a brief presentation on how The Seaside Naturalist came to be, we will discuss your suggestions for revisions and corrections. Bring your dog-eared copies and/or I will have some sample pages to distribute.

Curley. *Making Coastal Connections in the Classroom*

Teachers who have been participating in a Coastal Connections Math and Science Partnership Grant have been involved in this year long project that focuses on providing teachers with ocean literacy content knowledge and familiarization with the many resources found in Coastal North Carolina. As part of their project they are required to develop an instructional unit that connects what they have learned with their instructional objectives. During this program teachers will demonstrate hands on activities that they have developed during the project. During this program K-12 teachers will participate in hands on activities and learn how to access the instructional units for use in their classrooms.

Diederick and Chaibongsai. *Increasing Impacts Through Creative Collaborations*

Informal science institutions in the same communities – large and small – are often competing for limited funds, similar audiences, and prime calendar dates. This discussion and breakout will showcase outreach activities, including multi-day festivals, large-scale citizen science days, and smaller, recurring science events, that have successfully leveraged creative collaborations to increase engagement. Panelists include representatives from the Indian River Lagoon Science Festival, CARTHE Bay Drift, and Nerd Nite Miami.

The first part of the session (20 minutes) will focus on showcasing how these organizations have made inroads into their communities in order to form lasting partnerships, and how that has facilitated success in their events with budgets ranging from a few hundred dollars to much more. The second part of the session (20 minutes) panelists will lead smaller group discussions to help audience workshop ideas to implement within their respective institutions/communities.

East and Philippoff. *Improving program evaluation: Constructing survey questions*

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Demonstrating a program's effect on participants' knowledge, attitudes, and/or behaviors is an important part of program evaluation. Collecting this information is often done through questionnaires. While there are pros and cons of administering written or online questionnaires compared to other survey methods, they are widely used due to their lower administration requirements and cost. At NMEA 2016, feedback from those attending the pre-conference workshop "Intro to Evaluation" indicated that they wanted more experience developing questions to measure the effect of their program on their participants. This presentation helps to address that request. Survey projects should address the topics of sampling, questionnaire development, pre-testing, measurement, and statistical analyses when constructing a validity argument for a survey instrument. While these are all important components of survey development and analysis this session will focus on questionnaire development.

The session format will be a combination of a presentation and small-group work. We intend to discuss the planning and thoughtful considerations that go into effective questionnaires. For example, what are you trying to measure? Why are you trying to measure it? Why does it matter how questions are worded? Session participants will think critically about the audience, question format, and how quantitative or qualitative strategies may be implemented. We will share some strategies for developing questionnaire items intended for both formal and informal educational settings. Session participants will think about their own programs or curriculum and practice writing questions and discussing strategies with other attendees. We will provide some resources and best practices that can be accessed online.

Egner. *Adapting Informal Marine Science Education Programs to 21st Century students*

Marine Resources Development Foundation's MarineLab education program has been in existence for over 30 years. Our curriculum focuses on South Florida subtropical marine ecology, specifically on the interconnection of the seagrass, mangrove, and coral reef habitats and is available to students in grade five through college. While our curricular focus and hands on learning style has not changed, the teaching techniques and student learning opportunities have had to be adjusted with student learning style modifications, advanced technology and as new educational focuses have been created (STEM!).

We are an experiential education facility with most of the teaching done on and in the water but our program incorporates lab and classroom components as well. Just as schools and classrooms have changed to accommodate the modern student, we have adjusted our programs to ensure students continue to discover and understand subtropical marine ecology while being fully immersed in experiential learning. Adjustments include making changes in the classroom in terms of media use and increased student interaction; incorporating citizen science and service learning opportunities; focusing on STEM with all of our programs; and creating inquiry based learning labs.

We have also made adjustments meant to assist current teachers. We understand the often inevitable inability to cover all of the necessary material within a school year and give students a field trip opportunity. Our curriculum is correlated to state standards and we have developed curriculum that can be continued once back in the home classroom.

The tactics we have developed successfully for MarineLab will be discussed but time will also be designated for an open discussion regarding methods that have worked at similar facilities and/or suggestions from formal teachers.

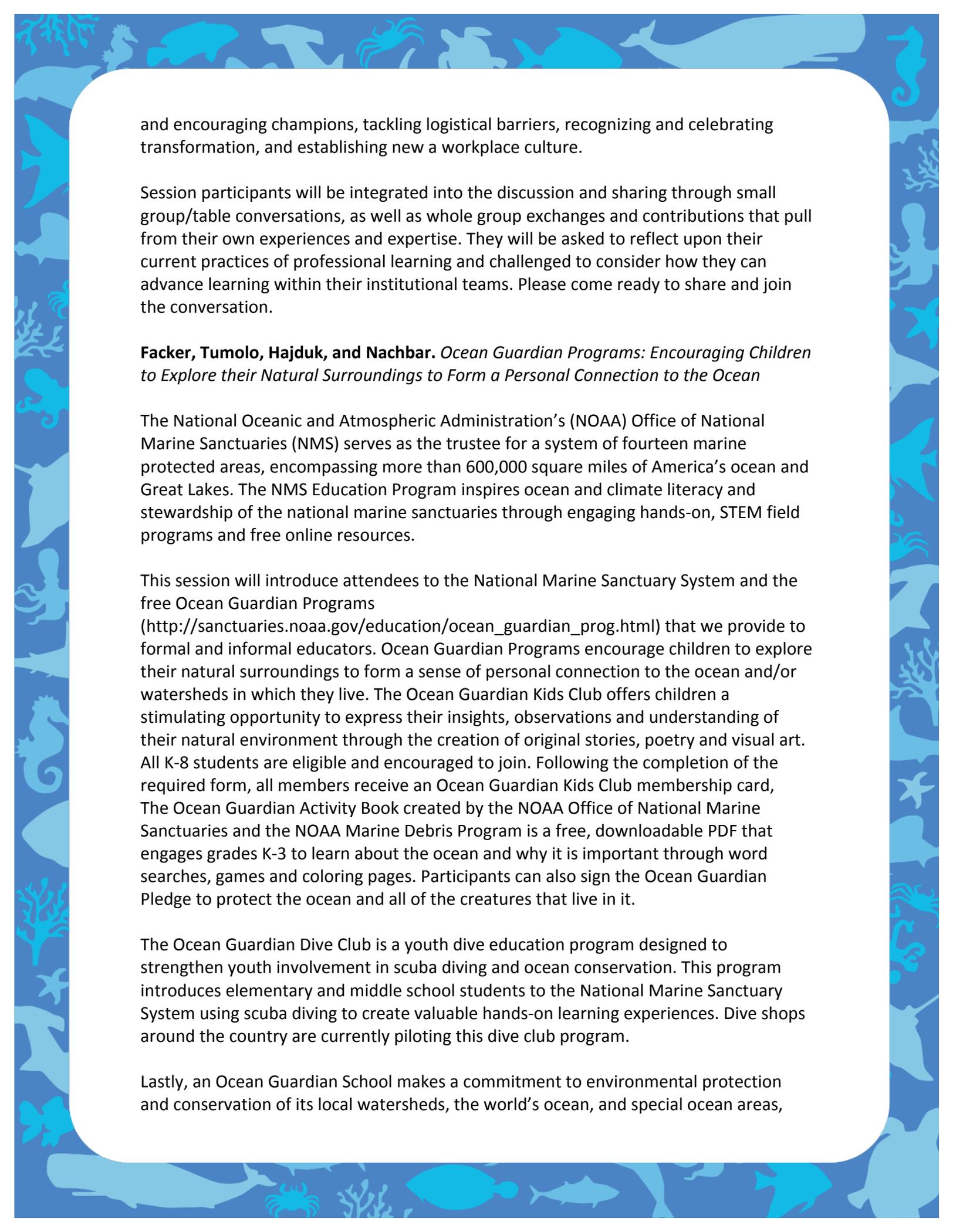
Evans, Bader, Burns, and LeBeau. *Reflecting on Practice- Making Professional Learning a Standard Operating Procedure*

Education departments at informal science institutions must continually adapt to meet the needs of visiting teachers and guests, as well as the changing needs of the educators working in these facilities. For more than a quarter century, formal and informal educators have understood the benefits of evolving professional practice, and the importance of ongoing and imbedded professional learning within a community of practice. Yet within the informal education field, many organizations are still challenged to support, and champion, a culture of professional development and reflective practice. Obstacles to implementation may vary, but the demonstrated need for the professionalization of our informal educators, staff and volunteers is clear.

Reflecting on Practice is a professional learning program that immerses novice and experienced science educators in informal environments in discussions about, reflections on, and applications of research and theory in learning and teaching science. The ideas and tasks in the program create and strengthen a shared knowledge base among educators within an institution. It makes public the practices of all educators through greater understanding of, and reflections on, their beliefs, goals, and actions. There are three primary goals for the program:

1. Build shared language and understanding through delving into the literature on learning and teaching;
2. Engage practitioners in habits of professional reflection, through observing their own teaching, as a means to develop their practice and make it public; and
3. Nurture a tradition of continued professional learning, and thereby build a professional learning community within an institution.

This session will share case studies from various institutions, big and small, that have adopted, championed, wrestled, and succeeded with institutionalizing staff professional learning and reflective practice programs for their educators. Presenters will share their experiences with the Reflecting on Practice program and highlight how the program has been implemented, how their educators evolved and advanced over time, and how they have adapted the program to best serve their team and organization. The discussions will touch upon key factors related to adopting and sustaining professional learning practices, such as establishing buy-in among stakeholders at various levels, identifying



and encouraging champions, tackling logistical barriers, recognizing and celebrating transformation, and establishing new a workplace culture.

Session participants will be integrated into the discussion and sharing through small group/table conversations, as well as whole group exchanges and contributions that pull from their own experiences and expertise. They will be asked to reflect upon their current practices of professional learning and challenged to consider how they can advance learning within their institutional teams. Please come ready to share and join the conversation.

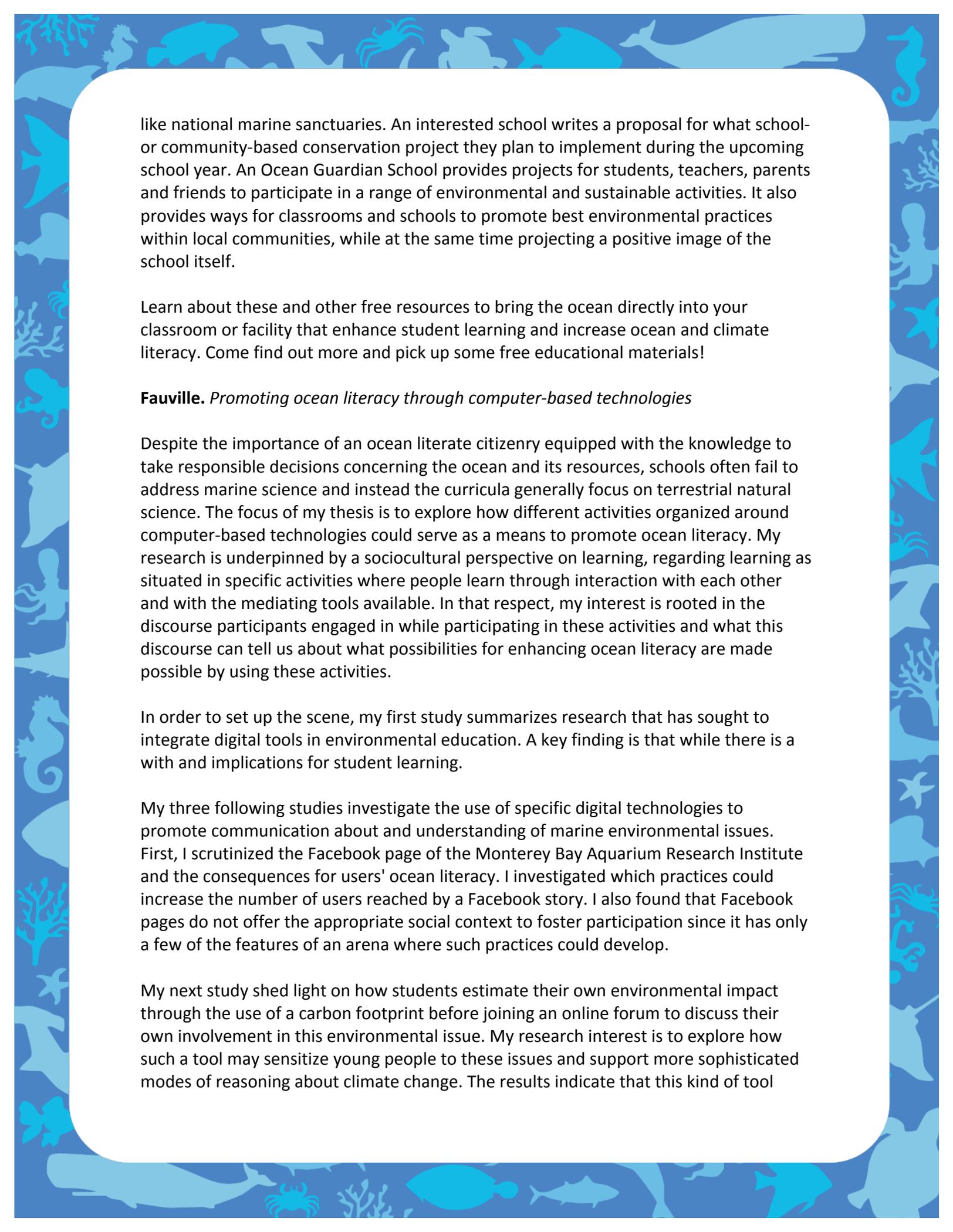
Facker, Tumolo, Hajduk, and Nachbar. *Ocean Guardian Programs: Encouraging Children to Explore their Natural Surroundings to Form a Personal Connection to the Ocean*

The National Oceanic and Atmospheric Administration's (NOAA) Office of National Marine Sanctuaries (NMS) serves as the trustee for a system of fourteen marine protected areas, encompassing more than 600,000 square miles of America's ocean and Great Lakes. The NMS Education Program inspires ocean and climate literacy and stewardship of the national marine sanctuaries through engaging hands-on, STEM field programs and free online resources.

This session will introduce attendees to the National Marine Sanctuary System and the free Ocean Guardian Programs (http://sanctuaries.noaa.gov/education/ocean_guardian_prog.html) that we provide to formal and informal educators. Ocean Guardian Programs encourage children to explore their natural surroundings to form a sense of personal connection to the ocean and/or watersheds in which they live. The Ocean Guardian Kids Club offers children a stimulating opportunity to express their insights, observations and understanding of their natural environment through the creation of original stories, poetry and visual art. All K-8 students are eligible and encouraged to join. Following the completion of the required form, all members receive an Ocean Guardian Kids Club membership card, The Ocean Guardian Activity Book created by the NOAA Office of National Marine Sanctuaries and the NOAA Marine Debris Program is a free, downloadable PDF that engages grades K-3 to learn about the ocean and why it is important through word searches, games and coloring pages. Participants can also sign the Ocean Guardian Pledge to protect the ocean and all of the creatures that live in it.

The Ocean Guardian Dive Club is a youth dive education program designed to strengthen youth involvement in scuba diving and ocean conservation. This program introduces elementary and middle school students to the National Marine Sanctuary System using scuba diving to create valuable hands-on learning experiences. Dive shops around the country are currently piloting this dive club program.

Lastly, an Ocean Guardian School makes a commitment to environmental protection and conservation of its local watersheds, the world's ocean, and special ocean areas,



like national marine sanctuaries. An interested school writes a proposal for what school- or community-based conservation project they plan to implement during the upcoming school year. An Ocean Guardian School provides projects for students, teachers, parents and friends to participate in a range of environmental and sustainable activities. It also provides ways for classrooms and schools to promote best environmental practices within local communities, while at the same time projecting a positive image of the school itself.

Learn about these and other free resources to bring the ocean directly into your classroom or facility that enhance student learning and increase ocean and climate literacy. Come find out more and pick up some free educational materials!

Fauville. *Promoting ocean literacy through computer-based technologies*

Despite the importance of an ocean literate citizenry equipped with the knowledge to take responsible decisions concerning the ocean and its resources, schools often fail to address marine science and instead the curricula generally focus on terrestrial natural science. The focus of my thesis is to explore how different activities organized around computer-based technologies could serve as a means to promote ocean literacy. My research is underpinned by a sociocultural perspective on learning, regarding learning as situated in specific activities where people learn through interaction with each other and with the mediating tools available. In that respect, my interest is rooted in the discourse participants engaged in while participating in these activities and what this discourse can tell us about what possibilities for enhancing ocean literacy are made possible by using these activities.

In order to set up the scene, my first study summarizes research that has sought to integrate digital tools in environmental education. A key finding is that while there is a with and implications for student learning.

My three following studies investigate the use of specific digital technologies to promote communication about and understanding of marine environmental issues. First, I scrutinized the Facebook page of the Monterey Bay Aquarium Research Institute and the consequences for users' ocean literacy. I investigated which practices could increase the number of users reached by a Facebook story. I also found that Facebook pages do not offer the appropriate social context to foster participation since it has only a few of the features of an arena where such practices could develop.

My next study shed light on how students estimate their own environmental impact through the use of a carbon footprint before joining an online forum to discuss their own involvement in this environmental issue. My research interest is to explore how such a tool may sensitize young people to these issues and support more sophisticated modes of reasoning about climate change. The results indicate that this kind of tool

provides insights into the invisible concept of CF and may serve as a catalyst triggering students' response toward mitigation.

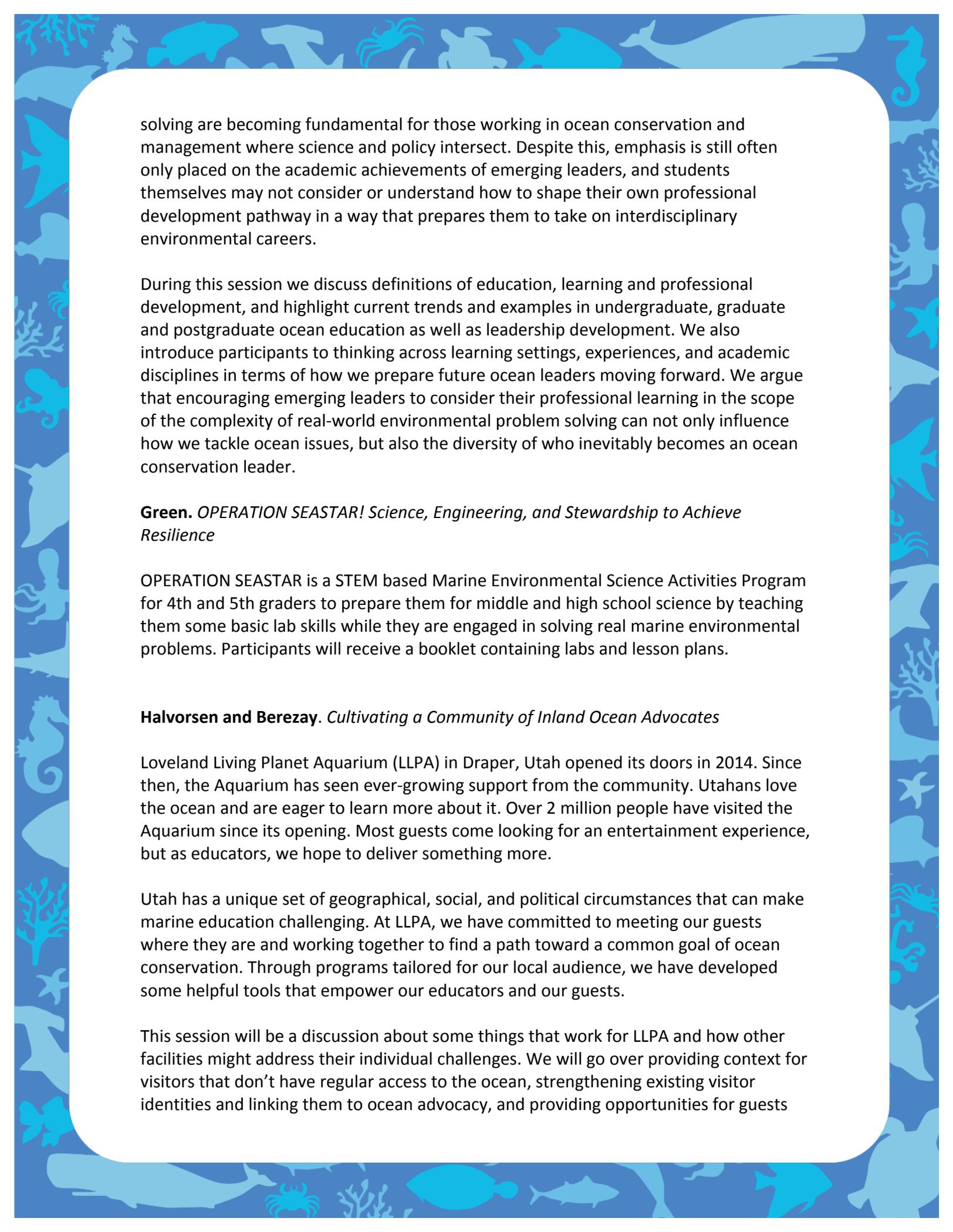
My last research focuses on the students prompted to ask questions to the marine scientist during an online asynchronous discussion hold on VoiceThread. The students' questions were thematically analysed to assess (1) the reasoning that can be discerned as premises in the students' questions, and (2) what possibilities for enhancing ocean literacy are made possible in this activity. The results show how interacting with a scientist gives the students an entry to the world of natural sciences with its complexity, uncertainty and choices that goes beyond the idealized form in which natural sciences often are presented in school. Finally I will discuss the implications of my research for the field of ocean literacy.

Frederick, Gotensparre, Bell, Scaroni, and Maier. *Biofilms and the Virtue Project, an international collaboration*

One way to measure biodiversity is to examine biofilm communities. Biofilms are bacterial colonies that form in layers. They can be found in many areas of the human body and in the environment. In this hands-on session you will evaluate biofilm communities grown on acrylic discs suspended vertically in the local aquatic ecosystems in Charleston at the Grice Marine Laboratory. The biofilm discs provide an opportunity to bring the field into the classroom in a unique, engaging and inexpensive way. In addition you will learn how to connect with a collaborative international project called the Virtue Project managed by partners from the University of Gothenburg in Sweden. In this session, you will evaluate some biofilm cultures grown on acrylic discs that were suspended vertically in the water. These discs were suspended so we could monitor water quality and biodiversity in three regions; shallow water (0-1m), middle level depth (2-3m) and deep water (3-4m). The project demonstrates how water quality, depth, and biodiversity are linked by finding answers to these questions: What organisms lurk in biofilm communities? What relationship do these organisms have with the water quality? How does depth of the water effect the species diversity? How can we design an experiment to answer these questions? How will data be collected? How can the data collected be analyzed? How can data be shared locally and internationally? As you progress through the session, you will learn how to make your own biofilm rack and conduct your own biofilm experiment.

Good. *Developing effective ocean leaders as a means for developing impactful ocean solutions*

Emerging ocean leaders in higher education require experiential professional learning opportunities that better prepare them for the demands of developing solutions to environmental problems. In essence, we need to develop effective leaders to develop effective solutions. Fewer ocean-interested students are moving into traditional academic jobs, and skills such as communication, collaboration, and innovative problem



solving are becoming fundamental for those working in ocean conservation and management where science and policy intersect. Despite this, emphasis is still often only placed on the academic achievements of emerging leaders, and students themselves may not consider or understand how to shape their own professional development pathway in a way that prepares them to take on interdisciplinary environmental careers.

During this session we discuss definitions of education, learning and professional development, and highlight current trends and examples in undergraduate, graduate and postgraduate ocean education as well as leadership development. We also introduce participants to thinking across learning settings, experiences, and academic disciplines in terms of how we prepare future ocean leaders moving forward. We argue that encouraging emerging leaders to consider their professional learning in the scope of the complexity of real-world environmental problem solving can not only influence how we tackle ocean issues, but also the diversity of who inevitably becomes an ocean conservation leader.

Green. *OPERATION SEASTAR! Science, Engineering, and Stewardship to Achieve Resilience*

OPERATION SEASTAR is a STEM based Marine Environmental Science Activities Program for 4th and 5th graders to prepare them for middle and high school science by teaching them some basic lab skills while they are engaged in solving real marine environmental problems. Participants will receive a booklet containing labs and lesson plans.

Halvorsen and Berezay. *Cultivating a Community of Inland Ocean Advocates*

Loveland Living Planet Aquarium (LLPA) in Draper, Utah opened its doors in 2014. Since then, the Aquarium has seen ever-growing support from the community. Utahans love the ocean and are eager to learn more about it. Over 2 million people have visited the Aquarium since its opening. Most guests come looking for an entertainment experience, but as educators, we hope to deliver something more.

Utah has a unique set of geographical, social, and political circumstances that can make marine education challenging. At LLPA, we have committed to meeting our guests where they are and working together to find a path toward a common goal of ocean conservation. Through programs tailored for our local audience, we have developed some helpful tools that empower our educators and our guests.

This session will be a discussion about some things that work for LLPA and how other facilities might address their individual challenges. We will go over providing context for visitors that don't have regular access to the ocean, strengthening existing visitor identities and linking them to ocean advocacy, and providing opportunities for guests

that want to take action. Come prepared to ask and answer questions about your own challenging audiences. This session will be useful to anyone who regularly interfaces with the general public in formal or informal settings.

Harcourt. *The C in the sea: carbon and the ocean*

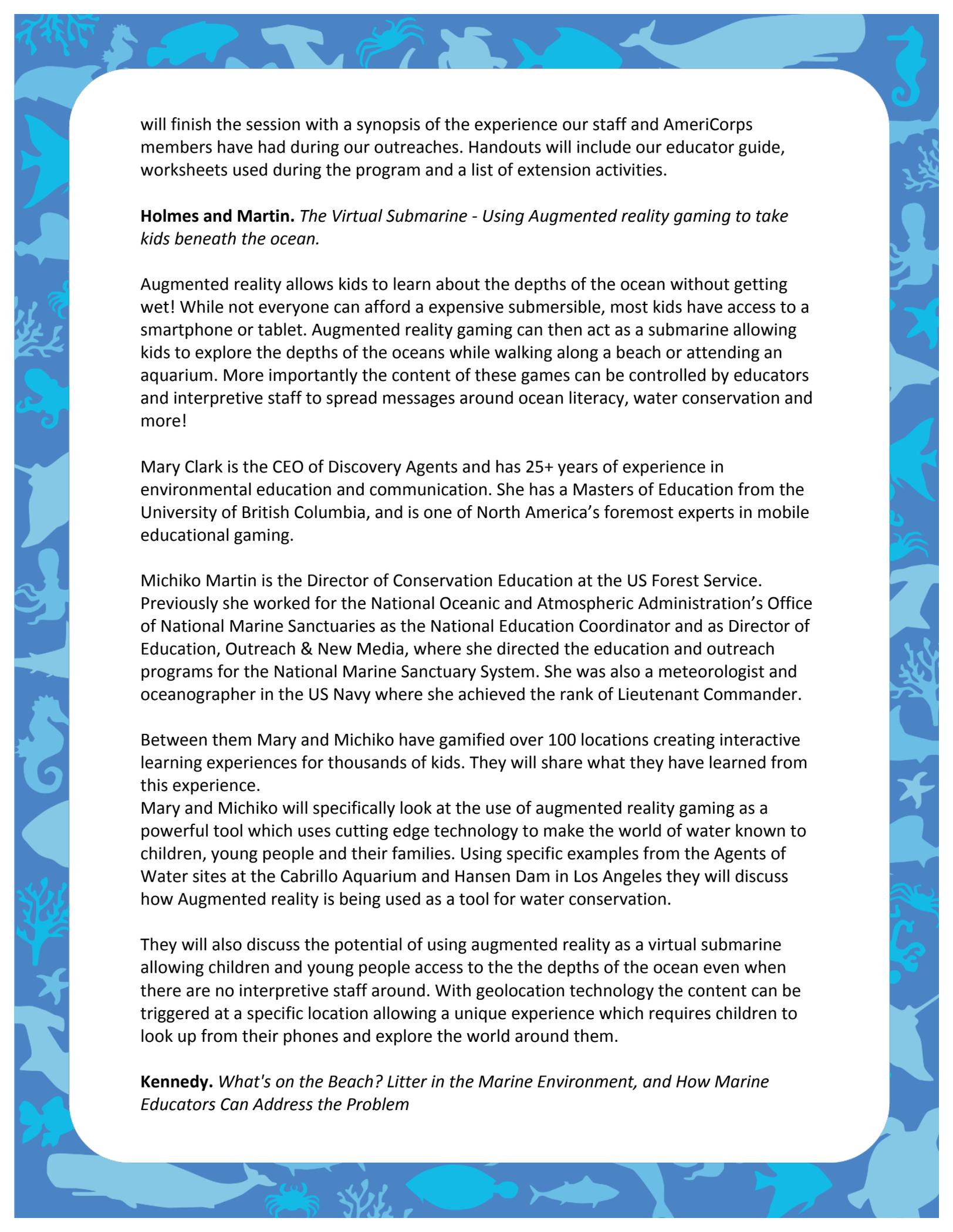
Climate change is the major environmental issue of our time, and levels of carbon dioxide in the atmosphere are steadily increasing. Recent research shows that the ocean *is a major carbon sink, and coastal wetlands take up and store carbon at much higher rates than other types of systems.* The role of aquatic systems in carbon uptake and sequestration has been termed “Blue Carbon.” However, research also shows that warming temperatures and other pressures from human activities, such as an oversupply of nutrients, habitat loss, or degradation, can reduce the ability of the ocean or wetland areas to serve as carbon sinks.

In this session we will introduce engaging activities on the important roles of the ocean and wetlands in the carbon cycle. We will model some observation and sampling activities for studying coastal wetlands, and show participants how to access maps and data visualizations about wetlands and coastal areas in their own locations. We will provide examples of student stewardship projects to restore, protect, and sustain coastal wetlands. Activities will include an overview of how students or a community group can adopt a local wetland, including guidance for simple and more in-depth field studies.

Activities will include “Carbon Walk,” “Where are My Wetlands?” “The Rising Tide” and “Adopting a Wetland.” The session will include time for participants to discuss how they might use activities in their own teaching situations.

Higgins and Wilson. *Merging Research, Management and STEM Objectives: Diamondback Defenders*

Since its establishment in June 2007, the Georgia Sea Turtle Center (GSTC) has substantially contributed to advancing conservation of Georgia’s fragile coastal environment, endangered species, and “species of concern”, particularly sea turtles and diamondback terrapins. The GSTC’s conservation strategy works through an integrated approach merging rehabilitation, research and education. As such the GSTC offers a wide variety of educational programs to our K-12 audience, including several career based options designed for an audience of 7th grade and up and correlated to state and national curriculum standards. Our newly developed Diamondback Defenders program has travelled to several schools, after school programs and other outreach venues in 2017, allowing young people first-hand experience with GPS technology and mapping strategies used for conservation management of the diamondback terrapin on Jekyll Island. Our 45 minute demonstration will allow include a brief introduction to the diamondback terrapin including its biology and conservation concerns, a simulated road survey including the use of hand-held GPS units, and a brief mapping component. We



will finish the session with a synopsis of the experience our staff and AmeriCorps members have had during our outreaches. Handouts will include our educator guide, worksheets used during the program and a list of extension activities.

Holmes and Martin. *The Virtual Submarine - Using Augmented reality gaming to take kids beneath the ocean.*

Augmented reality allows kids to learn about the depths of the ocean without getting wet! While not everyone can afford a expensive submersible, most kids have access to a smartphone or tablet. Augmented reality gaming can then act as a submarine allowing kids to explore the depths of the oceans while walking along a beach or attending an aquarium. More importantly the content of these games can be controlled by educators and interpretive staff to spread messages around ocean literacy, water conservation and more!

Mary Clark is the CEO of Discovery Agents and has 25+ years of experience in environmental education and communication. She has a Masters of Education from the University of British Columbia, and is one of North America's foremost experts in mobile educational gaming.

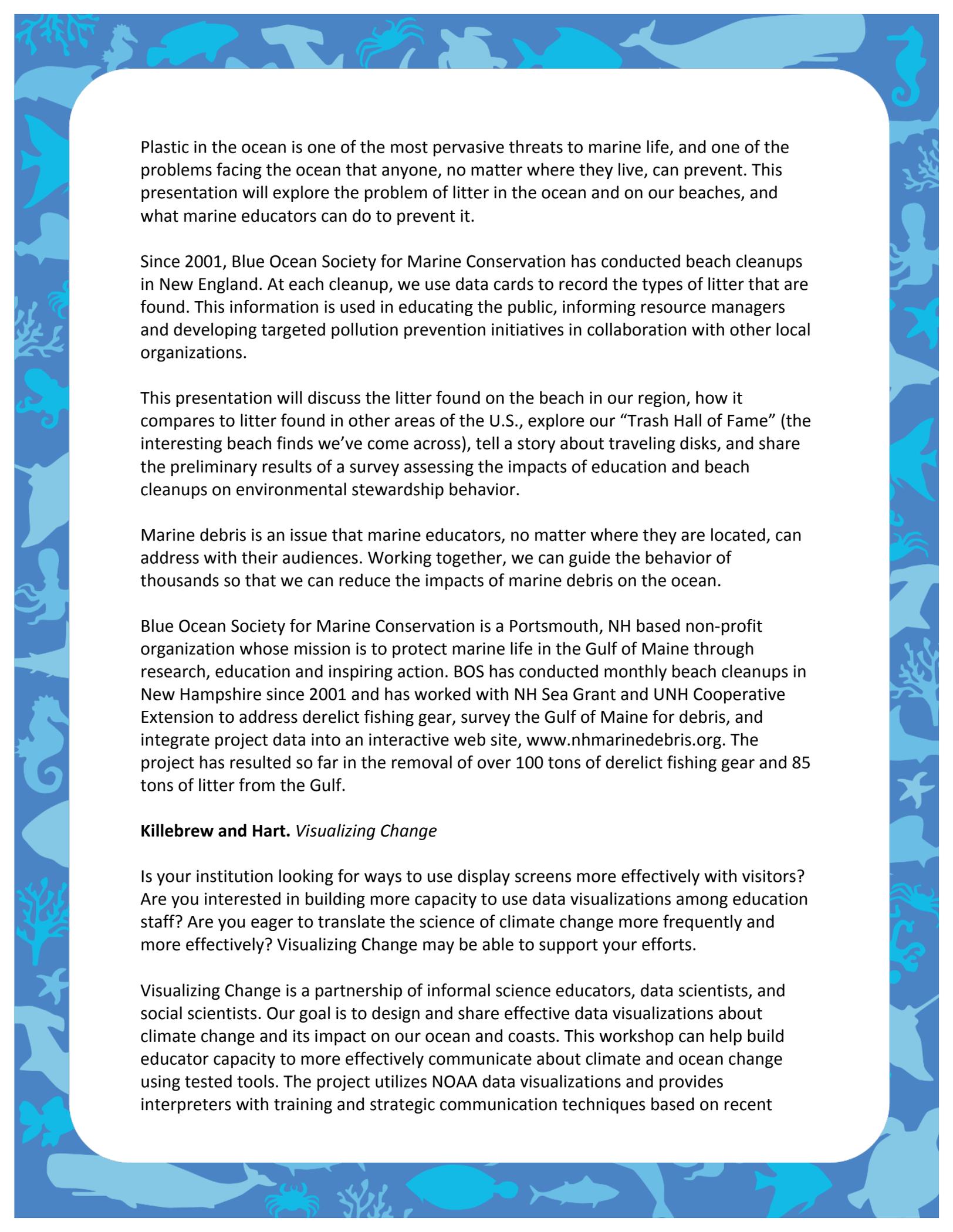
Michiko Martin is the Director of Conservation Education at the US Forest Service. Previously she worked for the National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries as the National Education Coordinator and as Director of Education, Outreach & New Media, where she directed the education and outreach programs for the National Marine Sanctuary System. She was also a meteorologist and oceanographer in the US Navy where she achieved the rank of Lieutenant Commander.

Between them Mary and Michiko have gamified over 100 locations creating interactive learning experiences for thousands of kids. They will share what they have learned from this experience.

Mary and Michiko will specifically look at the use of augmented reality gaming as a powerful tool which uses cutting edge technology to make the world of water known to children, young people and their families. Using specific examples from the Agents of Water sites at the Cabrillo Aquarium and Hansen Dam in Los Angeles they will discuss how Augmented reality is being used as a tool for water conservation.

They will also discuss the potential of using augmented reality as a virtual submarine allowing children and young people access to the the depths of the ocean even when there are no interpretive staff around. With geolocation technology the content can be triggered at a specific location allowing a unique experience which requires children to look up from their phones and explore the world around them.

Kennedy. *What's on the Beach? Litter in the Marine Environment, and How Marine Educators Can Address the Problem*

A decorative border surrounds the central text area, featuring various marine life silhouettes in shades of blue and white. The silhouettes include a whale, a shark, a crab, a turtle, a seahorse, a starfish, a squid, a jellyfish, and various fish species.

Plastic in the ocean is one of the most pervasive threats to marine life, and one of the problems facing the ocean that anyone, no matter where they live, can prevent. This presentation will explore the problem of litter in the ocean and on our beaches, and what marine educators can do to prevent it.

Since 2001, Blue Ocean Society for Marine Conservation has conducted beach cleanups in New England. At each cleanup, we use data cards to record the types of litter that are found. This information is used in educating the public, informing resource managers and developing targeted pollution prevention initiatives in collaboration with other local organizations.

This presentation will discuss the litter found on the beach in our region, how it compares to litter found in other areas of the U.S., explore our “Trash Hall of Fame” (the interesting beach finds we’ve come across), tell a story about traveling disks, and share the preliminary results of a survey assessing the impacts of education and beach cleanups on environmental stewardship behavior.

Marine debris is an issue that marine educators, no matter where they are located, can address with their audiences. Working together, we can guide the behavior of thousands so that we can reduce the impacts of marine debris on the ocean.

Blue Ocean Society for Marine Conservation is a Portsmouth, NH based non-profit organization whose mission is to protect marine life in the Gulf of Maine through research, education and inspiring action. BOS has conducted monthly beach cleanups in New Hampshire since 2001 and has worked with NH Sea Grant and UNH Cooperative Extension to address derelict fishing gear, survey the Gulf of Maine for debris, and integrate project data into an interactive web site, www.nhmarinedebris.org. The project has resulted so far in the removal of over 100 tons of derelict fishing gear and 85 tons of litter from the Gulf.

Killebrew and Hart. *Visualizing Change*

Is your institution looking for ways to use display screens more effectively with visitors? Are you interested in building more capacity to use data visualizations among education staff? Are you eager to translate the science of climate change more frequently and more effectively? Visualizing Change may be able to support your efforts.

Visualizing Change is a partnership of informal science educators, data scientists, and social scientists. Our goal is to design and share effective data visualizations about climate change and its impact on our ocean and coasts. This workshop can help build educator capacity to more effectively communicate about climate and ocean change using tested tools. The project utilizes NOAA data visualizations and provides interpreters with training and strategic communication techniques based on recent

climate communication research and climate interpretation initiatives in zoos and aquariums nationwide.

Understanding the science of climate and ocean change is important for educators to feel confident discussing these often complex topics with our audiences. Many compelling data visualizations exist to help present this science. Effective narrative structure can help bring data visualizations to life.

However, just presenting the scientific facts does not necessarily help our audiences engage with the issue and see themselves as part of both the story and the solution. By examining the evolution of one of these narratives, we can identify and discuss how storytelling and narrative structure can help our audiences understand the implications of visualization data, their connection to the story, and community level solutions that can have a positive impact on the issue.

The four tested Visual Narratives can be used on a flat screen, handheld tablet, or a spherical screen (such as Science on a Sphere®, Magic Planet®, or HyperGlobe®). These narratives have been field-tested with interpreters and visitors, and are highly effective in building public understanding of key climate topics: Extreme Weather, Ocean Acidification, Sea Level Rise and The Ocean-Climate Connection.

Lee and Kim. *Establishing Korean Marine Science Education Museum*

Ocean literacy is positioned as a new paradigm in marine education, and the Ocean Literacy Framework [OLF], developed in the USA in 2004, has gradually spread to many countries in Europe, Asia, and beyond.

In the USA, there have been ongoing efforts to reflect the OLF within the field of formal and informal marine educational contexts. The Ocean Literacy Scope and Sequence for Grades K-12 was produced to reflect the OLF in the formal education system. In informal marine education, museums and aquariums provide visitors with opportunities to connect with the ocean, and these institutions attempt to incorporate OLF into their exhibits and educational programs. For example, the Smithsonian's Sant Ocean Hall draws upon the seven Essential Principles [EPs] of Ocean Science as a guide for all educational programs, and the Aquarium of the Pacific strives to incorporate the seven EPs of Ocean Science into exhibits and programs.

However, it can be challenging for an individual museum and/or aquarium to reflect and cover all 45 concepts of Ocean Science because the institution did not originally plan to implement the OLF. In the case of the Vancouver Aquarium Marine Science Center, the exhibits and educational programs are more focused on the concepts related to marine organisms and subsequently greater emphasis is placed on the EPs #5 and #6 than EPs #1, 2, 3.

We proudly present a special project entitled “Establishing Korean Marine Education Museum [KMSEM]”. This is the first institution not only in Korea but worldwide, that from the beginning has planned on incorporating the OLF and will cover all 45 concepts. The KMSEM project was initiated in 2015 and will be open in 2020 in Uljin, a beautiful city located in the East coast of Gyeongbuk province, Korea. The space of the exhibition hall is approximately 12,000 square meters and as of Dec. 2016, the gallery planning is almost complete.

The main concept of KMSEM, “One Ocean, One Planet” is to help visitors understand that one ocean connects all waters and our planet. There are eight zones in KMSEM, and they are connected by a voyage story. Each of the eight zones (one ocean, diversity, deep sea, ocean in our life, observation, birth of life, ever changing ocean, and future ocean) consists of: one main exhibit related to one EP of Ocean Science; one related issue; and assisting exhibits such as an open laboratory. A total 25 exhibits of KMSEM fully reflect 45 concepts of Ocean Science. Another characteristic of the KMSEM is that learning components of exhibits and programs align with Korean National Science Education Standards, which will foster close collaborations with schools.

In the presentation, we will introduce the detailed designs and OL components of each zone in the KMSEM and seek your diverse comments to assist us in making a better institution as we follow a goal of building a more ocean-literate society.

Levin and Keener. *Involving the World in Marine Education*

This international hands-on learning program uses miniature GPS monitored sailboats on the ocean to bring incredible adventure and learning opportunities. It interests and engages people of all ages and now involves many ocean research centers and institutes around the world. The capability of these boats transiting the oceans amaze even experts. Think of the marine science lessons and inter-cultural opportunities as your boat lands on another continent. Could learning possibly be any more fun?

Levin, Stewart, McMahon, Barrera, Costa, Keener, Baldwin. *Project Trade Winds--a multiple continent program connecting classrooms using a small, unmanned sailboat.*

A Transoceanic Program Promoting International Ocean Literacy Educational Passages (EP) uses unmanned miniature sailboats to promote and advance global ocean literacy. Over 70 of these boats have been launched and are presently plying the world’s oceans. They are helping to educate students about our World’s oceans and its many and varied environs. EP has numerous partners worldwide. For this presentation, we have invited program participants from Lisbon, Portugal; PLOCAN a state of the art floating ocean research facility in the Canary Islands; and educators of the Charleston, South Carolina school system, to assist with this panel presentation. A NOAA educator will also discuss the educational partnership between EP and the Office of Ocean Exploration and Research.

Dick Baldwin, Creator and Chief Spokesperson for Educational Passages will introduce the panel and the amazing hands-on learning opportunities these little ocean sailboats provide students and the public.

Amy McMahon, South Carolina 2016 STEM educator of the year will discuss her school's miniboat "Carolina Dreamer". This boat followed the historic northern route, up the Gulf Current and then around to the east, landing "in the old world" where there was then taken to a local school in Wales. After lots of cultural exchanges between students and a trip to Ireland their boat was relaunched and is currently following the southern route back towards the new world and can be seen at <http://educationalpassages.com/boats/00-167470091/>.

Raquel Costa of Portugal to share her experiences on how she involved so many students and 7 organizations in Portugal came together to help miniboat "Charger" sail 80% of the way around the Atlantic making 4 or 5 stops along the way (see the map).

Carlos Barrera, Chief of Instrumentation at PLOCAN will explain their experiences working with Canary Island students. They have made 5 of their own boats and have now launched a total of 8 boats. One is currently approaching Puerto Rico and hopefully will sail on to our east coast.

Paula Keener Chavis, National Education Coordinator for NOAA's Office of Exploration and Research is stationed at Hollings Marine Laboratory in Charleston, South Carolina. She will present a program where EP is partnering with the Atlantic Ocean Research Alliance through the 2016 Atlantic Miniboat Regatta which involves 30 or more boats from 7 countries and how these boats are enhancing global awareness of our oceans. Douglas R. Levin, PhD, NMEA life member and EP Education Director will present the future of EP's educational program. This will include the advent of two way communications with the miniboats for "on the water programming", wave, color, and temperature measurements, data frequency changes with specific conditions, and data products that may aid scientists with the calibration of satellite monitoring. All of these systems will promote NGSS classroom learning. Time will be reserved for attendee questions and answers.

For further information contact Dick Baldwin at; dick@educationalpassages.com or Doug Levin at; dlevin2@washcoll.edu. A packet of additional information has been mailed to the NMEA program committee.

Linsky. *"Sure, I can read an ocean book:" Teacher's Misconceptions About Ocean Literacy*

After a 14-day professional development program in Hawaii, teachers revealed three main misconceptions about the definition and purpose of ocean literacy, including



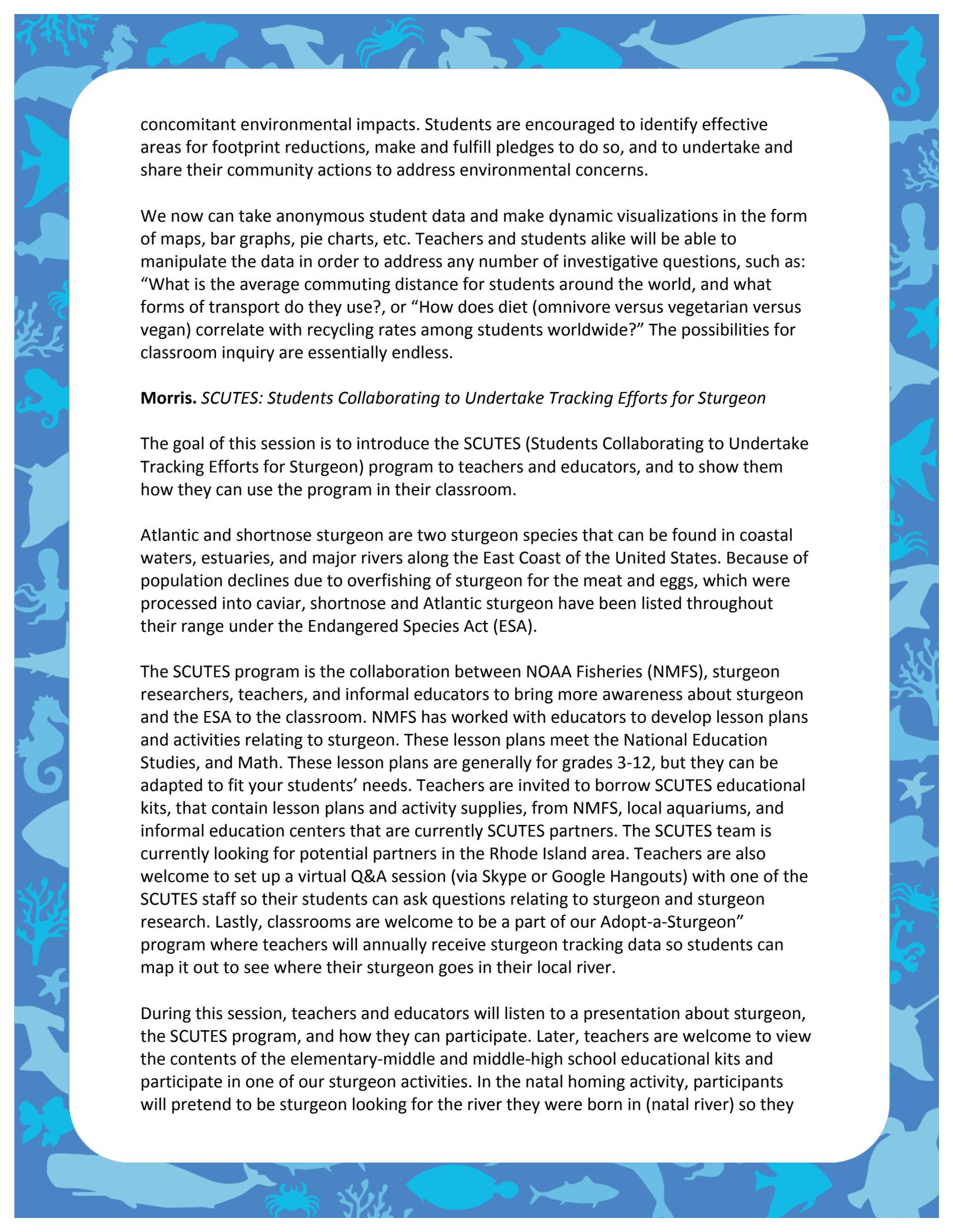
ocean literacy as synonymous with ocean reading, ocean literacy as synonymous with oceanography, and ocean literacy as unattainable. To counteract these misconceptions, I recommend that workshop developers and professional development instructors differentiate their programs based on an ocean literacy “Continuum of Development.”

Miller, Fauville, and Hodin. *“To do is to learn” and isn’t learning what each person can do about climate change essential to impart to our students?*

The Paris Climate agreement (UNFCCC 2015), signed by all 195 participating countries in late 2015, offers tremendous potential for addressing the dual threats of global warming and ocean acidification (OA). Still, in order for any of these countries to reach and exceed these laudable goals, the citizens of each nation are going to need to participate by reducing their carbon impacts in their daily lives. Acceptance of climate change as real and largely human-caused is nearly unanimous among climate scientists (Cook et al. 2013), yet a major impediment to meaningful individual climate actions, especially here in the United States, is that only about half of US citizens (48%) accept that climate change is real and largely human caused, and an even smaller proportion of those polled (41%) think that scientists largely agree (Howe et al. 2015). Shockingly, the percent of US high school teachers who recognize the scientific consensus is similarly low (45%; Plutzer et al. 2016). This disconnect between the scientific reality and the opinion of the populace is crucial: research indicates that acceptance of human responsibility for climate change is directly connected to willingness to take personal action to reduce emissions (Leiserowitz et al. 2006; Kellstedt et al. 2008; Ferguson & Branscombe 2010).

The overall goal of our project, a collaboration of colleagues at Stanford’ Hopkins Marine Station, Friday Harbor Labs, and the University of Gothenburg is to provide tools to assist teachers in formal high school and early college settings, to effectively communicate and heighten student understanding of climate change, and in turn to promote and evaluate the impact that these tools have on student understanding, concern, and communication about climate change as well as their inclination to take action.

Our carbon footprint calculator (<http://i2sea.stanford.edu/calculate>) is composed of 50 questions in four main areas: transport, home energy, food and personal purchases. Unlike most calculators available on the web, ours (which is consistently the top google hit for “student footprint”) is: truly inquiry-based, promoting investigation of alternative choices that could lower footprints; extensively documented on demand for each question; fully international, including location-specific calibrations for carbon sources, agricultural practices and climatic conditions across the globe; and student focused. We promote classroom use through our International Student Carbon Footprint Challenge (ISCFC) program (<http://i2sea.stanford.edu/iscfc>) in which classrooms worldwide calculate their footprints, get their school data mapped on our website, and then engage in online international discussions concerning their carbon production and



concomitant environmental impacts. Students are encouraged to identify effective areas for footprint reductions, make and fulfill pledges to do so, and to undertake and share their community actions to address environmental concerns.

We now can take anonymous student data and make dynamic visualizations in the form of maps, bar graphs, pie charts, etc. Teachers and students alike will be able to manipulate the data in order to address any number of investigative questions, such as: “What is the average commuting distance for students around the world, and what forms of transport do they use?”, or “How does diet (omnivore versus vegetarian versus vegan) correlate with recycling rates among students worldwide?” The possibilities for classroom inquiry are essentially endless.

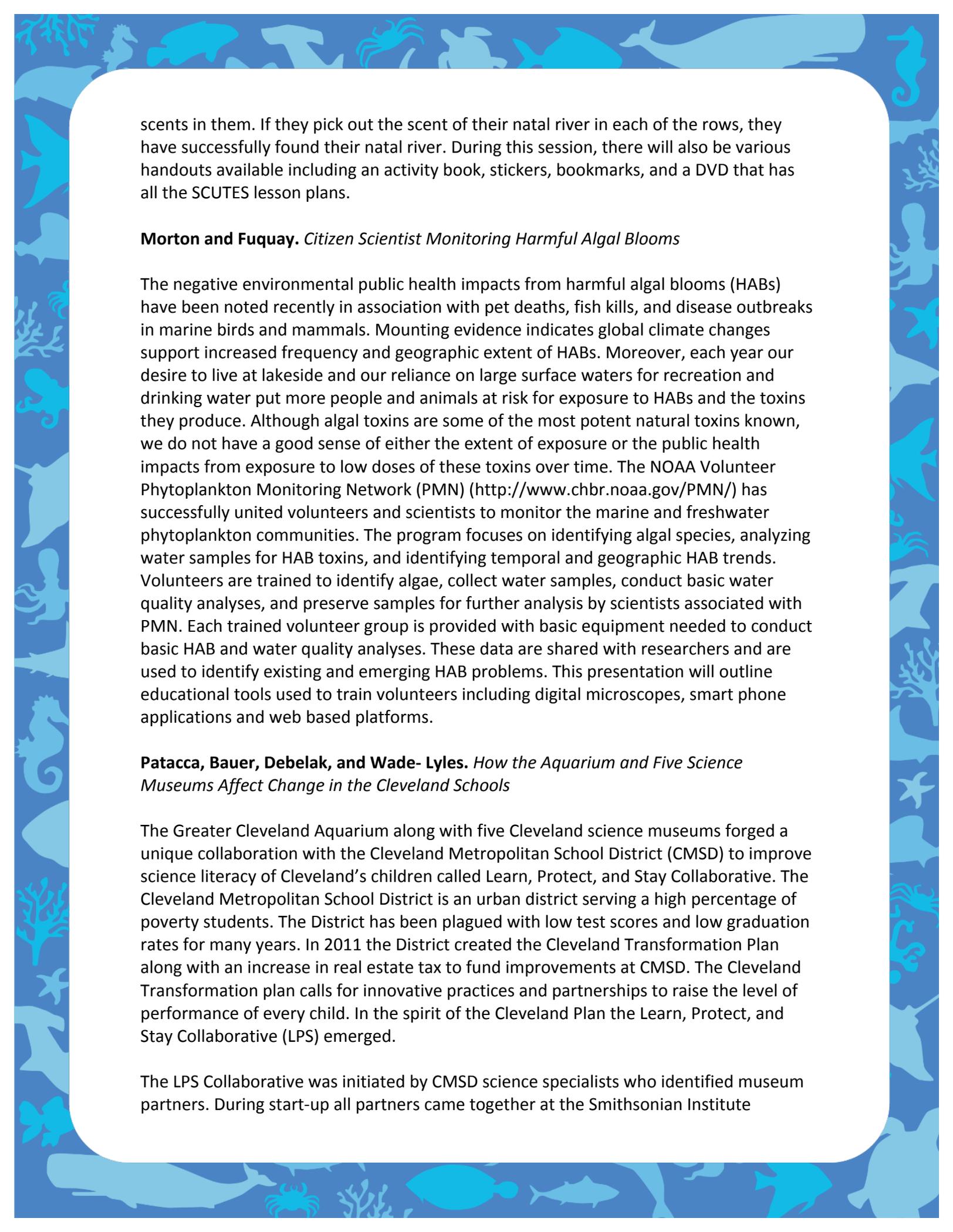
Morris. *SCUTES: Students Collaborating to Undertake Tracking Efforts for Sturgeon*

The goal of this session is to introduce the SCUTES (Students Collaborating to Undertake Tracking Efforts for Sturgeon) program to teachers and educators, and to show them how they can use the program in their classroom.

Atlantic and shortnose sturgeon are two sturgeon species that can be found in coastal waters, estuaries, and major rivers along the East Coast of the United States. Because of population declines due to overfishing of sturgeon for the meat and eggs, which were processed into caviar, shortnose and Atlantic sturgeon have been listed throughout their range under the Endangered Species Act (ESA).

The SCUTES program is the collaboration between NOAA Fisheries (NMFS), sturgeon researchers, teachers, and informal educators to bring more awareness about sturgeon and the ESA to the classroom. NMFS has worked with educators to develop lesson plans and activities relating to sturgeon. These lesson plans meet the National Education Studies, and Math. These lesson plans are generally for grades 3-12, but they can be adapted to fit your students’ needs. Teachers are invited to borrow SCUTES educational kits, that contain lesson plans and activity supplies, from NMFS, local aquariums, and informal education centers that are currently SCUTES partners. The SCUTES team is currently looking for potential partners in the Rhode Island area. Teachers are also welcome to set up a virtual Q&A session (via Skype or Google Hangouts) with one of the SCUTES staff so their students can ask questions relating to sturgeon and sturgeon research. Lastly, classrooms are welcome to be a part of our Adopt-a-Sturgeon” program where teachers will annually receive sturgeon tracking data so students can map it out to see where their sturgeon goes in their local river.

During this session, teachers and educators will listen to a presentation about sturgeon, the SCUTES program, and how they can participate. Later, teachers are welcome to view the contents of the elementary-middle and middle-high school educational kits and participate in one of our sturgeon activities. In the natal homing activity, participants will pretend to be sturgeon looking for the river they were born in (natal river) so they



scents in them. If they pick out the scent of their natal river in each of the rows, they have successfully found their natal river. During this session, there will also be various handouts available including an activity book, stickers, bookmarks, and a DVD that has all the SCUTES lesson plans.

Morton and Fuquay. *Citizen Scientist Monitoring Harmful Algal Blooms*

The negative environmental public health impacts from harmful algal blooms (HABs) have been noted recently in association with pet deaths, fish kills, and disease outbreaks in marine birds and mammals. Mounting evidence indicates global climate changes support increased frequency and geographic extent of HABs. Moreover, each year our desire to live at lakeside and our reliance on large surface waters for recreation and drinking water put more people and animals at risk for exposure to HABs and the toxins they produce. Although algal toxins are some of the most potent natural toxins known, we do not have a good sense of either the extent of exposure or the public health impacts from exposure to low doses of these toxins over time. The NOAA Volunteer Phytoplankton Monitoring Network (PMN) (<http://www.chbr.noaa.gov/PMN/>) has successfully united volunteers and scientists to monitor the marine and freshwater phytoplankton communities. The program focuses on identifying algal species, analyzing water samples for HAB toxins, and identifying temporal and geographic HAB trends. Volunteers are trained to identify algae, collect water samples, conduct basic water quality analyses, and preserve samples for further analysis by scientists associated with PMN. Each trained volunteer group is provided with basic equipment needed to conduct basic HAB and water quality analyses. These data are shared with researchers and are used to identify existing and emerging HAB problems. This presentation will outline educational tools used to train volunteers including digital microscopes, smart phone applications and web based platforms.

Patacca, Bauer, Debelak, and Wade- Lyles. *How the Aquarium and Five Science Museums Affect Change in the Cleveland Schools*

The Greater Cleveland Aquarium along with five Cleveland science museums forged a unique collaboration with the Cleveland Metropolitan School District (CMSD) to improve science literacy of Cleveland's children called Learn, Protect, and Stay Collaborative. The Cleveland Metropolitan School District is an urban district serving a high percentage of poverty students. The District has been plagued with low test scores and low graduation rates for many years. In 2011 the District created the Cleveland Transformation Plan along with an increase in real estate tax to fund improvements at CMSD. The Cleveland Transformation plan calls for innovative practices and partnerships to raise the level of performance of every child. In the spirit of the Cleveland Plan the Learn, Protect, and Stay Collaborative (LPS) emerged.

The LPS Collaborative was initiated by CMSD science specialists who identified museum partners. During start-up all partners came together at the Smithsonian Institute

Strategic Planning Institute in 2013 to draft the district's science strategic plan. The collaborative programming became the centerpiece of this plan. Seven grade level programs were developed. These grade-level experiences have become embedded into the curriculum; and the concepts are reinforced by the newly adopted textbooks. Each institution raises funds for student transportation and its program. The LPS Collaborative's top priority is to create a fund raising plan to sustain these programs. Each program is professionally evaluated for its effectiveness.

The Greater Cleveland Aquarium presents the fourth grade program Nurturing the Environment by Maintaining Ohio. Its goal is to illustrate the concepts aquatic animal adaptations, habitat differences, and environmental change. The program studies four aquatic habitats – two freshwater and two saltwater habitats. Using project-based learning, students are charged with the problem of building a fish to live in one of four habitats. After habitat observations and identification of fish adaptations, they build a fish from craft items. Prior to their visit, each teacher must attend two training workshops to receive instruction for this program and a 10 gallon aquarium for their classroom.

Pekarcik. *PolarTREC in Antarctica: The Long-Term Benefits of Teacher/Researcher Collaboration*

Collaborative efforts between educators and research scientists are valuable opportunities to incorporate field research techniques and current data into STEM curriculum. This presentation focuses on oceanographic research involving biogeochemical cycles and diatom species in the Southern Ocean and waters near the Western Antarctic Peninsula. Field research conducted in the Southern Ocean in chemistry and microbiology. Field work introduces students to unique ecosystems that promotes interest and increases classroom engagement. The use of polar research data encourages students to make comparisons between polar and local ecosystems and creates opportunities for them to generate connections, analyze information and draw cross-curricular conclusions.

The opportunity for educators to participate in authentic learning encourages effective lesson plan development focused on Next Generation Science Standards (NGSS), especially cross-cutting concepts (CCC) and Science and Engineering Practices (SEP). Researchers also benefit from the experience as they learn more about current classroom practices and standards. In addition, researchers can enhance their broader impact by working alongside educators to make their science more accessible to the public. Examples of guided inquiry lesson plans, activities, assessments, use of current science data and classroom connections with researchers are presented.

Pike and Stoeckmann. *Plankton Sinking Rates - Bringing the SEPs and the Engineering Design Cycle into the Marine Biology Classroom*

It's important to think outside the box, collaborate and interact as a team member, and communicate ideas to others (the 21st century skillset). Engineering Design (STEM) challenges, rather than cookbook labs, teach our students that not every question or problem has one correct answer, and that there are many paths to the same endpoint. Opportunities to design, test, modify, and re-design are being included in many classes, not just science, to develop these skills that are critical for future employment opportunities. But it isn't enough to just add cool, fun, STEM challenges to your class – they need to connect with your subject, the standards, and content so that it is relevant and real. This can be easy in some disciplines (playground physics!) but it's harder to find STEM challenges for biology. With PowerPoint and video, we will present a STEM challenge lab on plankton sinking rates that is NGSS-aligned for 5th – 10th grade life sciences. This challenge connects content (structural adaptations that aid in survival) with the Engineering Design Cycle as student make a model out of clay, test it (many times), modify it, re-test and analyze results before arguing for a claim. It also exemplifies experimental design, giving the teacher ample opportunity to discuss methods, variables, and graphing data. We have done this lab with 5th grade students up through college freshmen, and students love it – there is a competitive aspect to it, as well as interdisciplinary connections with physics (surface area relates to sinking rate, buoyancy and density help to determine if something sinks) and chemistry (viscosity – we use corn syrup to mimic the viscosity of the ocean water to an organism as small as a plankton). What students do is this: taking a 250 ml graduated cylinder, filled with corn syrup, they drop (one at a time) replicates of a clay plankton and then record how long it takes to sink 100 ml. After observing, they redesign the plankton (making a different shape) and repeat. It is open-ended, and even the teachers get surprised with the "winning" answer. Handouts with data sheets and spots to write in hypotheses and identify variables are included.

Roberge. *Drive Through Florida: Aquaculture and Seafood*

The Florida Department of Agriculture and Consumer Services and Florida Agriculture in the Classroom have jointly developed the third in a series of non-fiction books entitled "Drive through Florida: Aquaculture and Seafood." The book was developed specifically for Florida Agriculture Literacy Day, an annual event that has been coordinated by Florida Agriculture in the Classroom since 2003. The book will be read by volunteers who reach thousands of elementary school students in Florida classrooms each spring. Florida Agriculture Literacy Day is May 2, 2017. But readers can visit classrooms before or after that date until the end of the school year.

The presentation will provide information on the predominant geographic counties for each species, common attributes, commercial uses and how species are raised, trapped,

or caught to maintain sustainable yields. Students will be able identify various species including shrimp, stone crabs, clams, oysters, snapper, grouper, spiny lobster, and others harvested through aquaculture or traditional fishing methods. The book is designed to promote knowledge of these industries in Florida schools.

Attendees will receive books for use in their educational settings as well as supplemental hands-on resources to reinforce the concepts taught. In addition, attendees will be provided with an overview of Florida's seafood and aquaculture industry through web-based resources available at the Florida Department of Agriculture and Consumer Services' website: FreshfromFlorida.com. These include educational videos on current and historical seafood and aquaculture production, aquatic invasive species seafood nutrition and availability information, seafood festival dates and more. Attendees will also be able to compare Florida aquaculture and wild-caught seafood harvesting to the production of other states. To view other books in the "Drive Through Florida" series, visit: <http://faitc.org/aglitday/>

Sasaki and Mizutani. *How to assess Forest-River-Ocean Relatedness*

To Develop resilience and sustainable community, we need to realize the importance of connectedness between watershed including ocean and human being. We conducted to instruct watershed activity for children at tsunami devastated area at northern Japan to foster intrinsic development for future, and we also conducted to establish an assessment measure to evaluate Forest-River-Ocean Relatedness.

Schwarzmann. *Value of Ocean Guardian- An Ocean Conservation Education Program*

The Ocean Guardian School Program (OGS) is a unique opportunity supported by NOAA's Office of National Marine Sanctuaries for students to gain stewardship practices while learning about the ocean. Public, private and charter schools may submit a grant proposal to NOAA's Office of National Marine Sanctuaries (ONMS) that outlines a plan of action for a school- or community-based project which contributes to the health and conservation of local watershed(s), the world's ocean and/or national marine sanctuaries. Schools are required to connect their proposed projects to one of the established five Ocean Guardian "project pathways": Refuse/Reduce/Reuse/Recycle/Rot, Marine Debris, Watershed Restoration, Schoolyard Habitat/Garden, and Energy & Ocean Health. Each project pathway provides a general focus and framework for a school's ocean stewardship project.

Although the costs (grant amounts) of OGS are known, little is known about the program's benefits to students and their communities. This presentation will discuss OGS and the results of a parent survey that estimated behavior change of participating students as well as the economic value that parents derived from their students' participation in the program. This study is the first of its kind to estimate the monetary value of hands-on ocean conservation education such as OGS. After providing a brief

overview of the OGS and its educational goals, the results of parents' attitudes towards the OGS will be presented. Attitudes include the perceived benefits their child receives, along with their attitudes towards education, nature and the five thematic OGS pathways.

One of the primary goals of OGS is to teach students how to be thoughtful and effective stewards of our watersheds and ocean. Several questions were asked to understand students' behavior before and after exposure to the program. In addition, parents' behavior before and after their child's exposure to the program was also measured to determine if there are any secondary impacts of the OGS.

Lastly, the final part of the presentation will briefly review the methods used to estimate the economic value (or monetary value) that parents place on the OGS. Through the use of surveys and accepted econometric modeling, a monetary value was estimated for the OGS. Further, a monetary value was estimated for each of the five thematic areas of OGS, indicating which types of ocean conservation and stewardship programs parents value most. Knowing this information can help the OGS or other ocean conservation and educational programs to increase their program benefits by incorporating the most valued themes into their curriculum.

Scott. *Beyond Your Aquarium Visit*

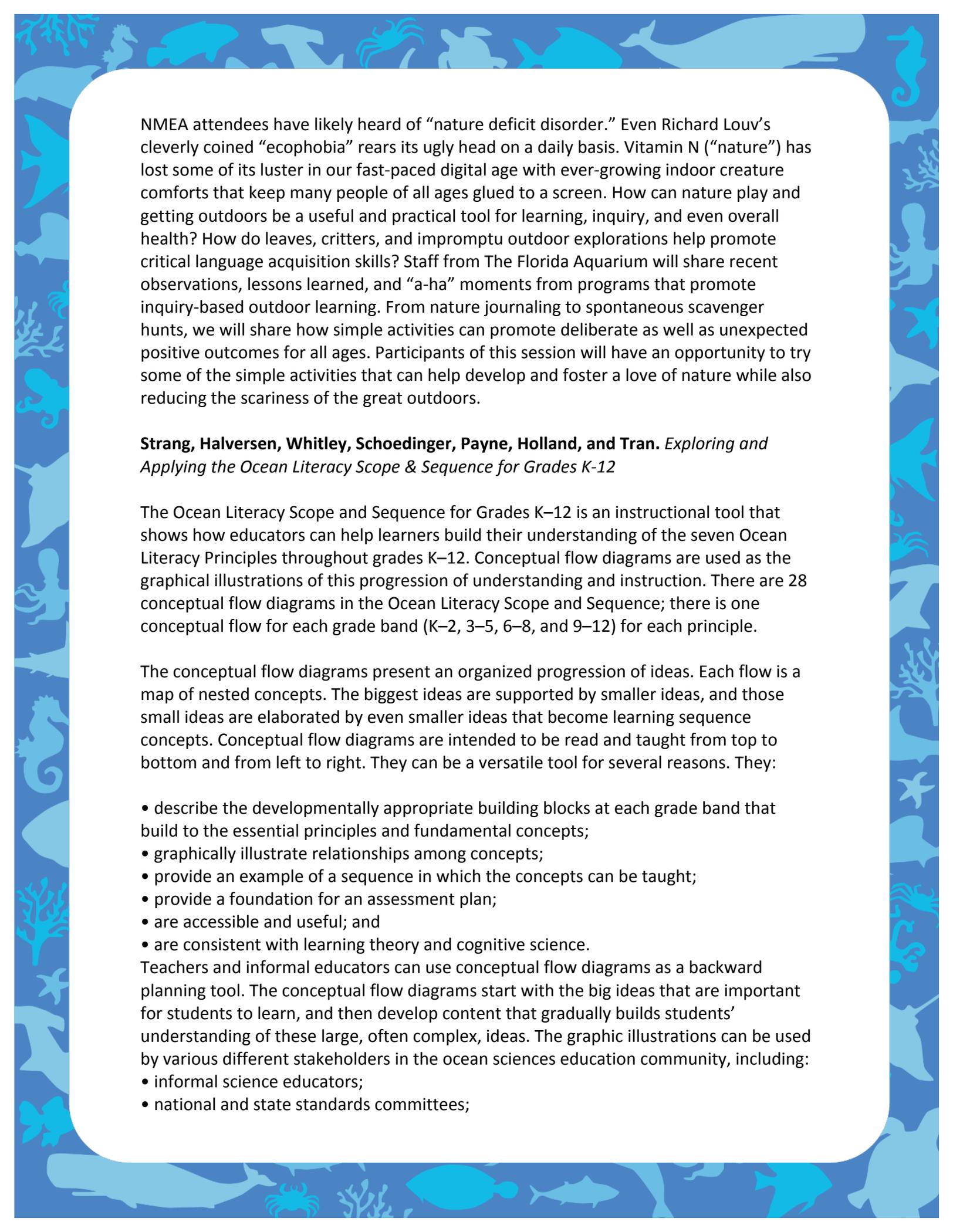
Using provided devices, participants will get a chance to be immersed in the Kelp Forest ecosystem, create their own virtual reality experience, look through the Kelp Forest eBook (available free online to all) and play an interactive game that teaches the components and interactions in the kelp forest ecosystem.

The game allows students to build their own kelp forest exhibit as they learn about the needs of kelp, how to keep kelp alive, and the animals that survive in this amazing ecosystem. The curriculum flow supports the 3rd- through 5th-grade Systems and System Models NGSS Crosscutting Concept. The app is our first effort to gamify such a concept and includes consistent feedback mechanisms, such as rewards, goal progress, and animal reactions.

Stegemann. *Inspiring Marine Debris Prevention Through Education and Outreach*

The game allows students to build their own kelp forest exhibit as they learn about the needs of kelp, how to keep kelp alive, and the animals that survive in this amazing ecosystem. The curriculum flow supports the 3rd- through 5th-grade Systems and System Models NGSS Crosscutting Concept. The app is our first effort to gamify such a concept and includes consistent feedback mechanisms, such as rewards, goal progress, and animal reactions.

Stone and Segura. *GET OUT! The Power of Vitamin N...*



NMEA attendees have likely heard of “nature deficit disorder.” Even Richard Louv’s cleverly coined “ecophobia” rears its ugly head on a daily basis. Vitamin N (“nature”) has lost some of its luster in our fast-paced digital age with ever-growing indoor creature comforts that keep many people of all ages glued to a screen. How can nature play and getting outdoors be a useful and practical tool for learning, inquiry, and even overall health? How do leaves, critters, and impromptu outdoor explorations help promote critical language acquisition skills? Staff from The Florida Aquarium will share recent observations, lessons learned, and “a-ha” moments from programs that promote inquiry-based outdoor learning. From nature journaling to spontaneous scavenger hunts, we will share how simple activities can promote deliberate as well as unexpected positive outcomes for all ages. Participants of this session will have an opportunity to try some of the simple activities that can help develop and foster a love of nature while also reducing the scariness of the great outdoors.

Strang, Halversen, Whitley, Schoedinger, Payne, Holland, and Tran. *Exploring and Applying the Ocean Literacy Scope & Sequence for Grades K-12*

The Ocean Literacy Scope and Sequence for Grades K–12 is an instructional tool that shows how educators can help learners build their understanding of the seven Ocean Literacy Principles throughout grades K–12. Conceptual flow diagrams are used as the graphical illustrations of this progression of understanding and instruction. There are 28 conceptual flow diagrams in the Ocean Literacy Scope and Sequence; there is one conceptual flow for each grade band (K–2, 3–5, 6–8, and 9–12) for each principle.

The conceptual flow diagrams present an organized progression of ideas. Each flow is a map of nested concepts. The biggest ideas are supported by smaller ideas, and those small ideas are elaborated by even smaller ideas that become learning sequence concepts. Conceptual flow diagrams are intended to be read and taught from top to bottom and from left to right. They can be a versatile tool for several reasons. They:

- describe the developmentally appropriate building blocks at each grade band that build to the essential principles and fundamental concepts;
- graphically illustrate relationships among concepts;
- provide an example of a sequence in which the concepts can be taught;
- provide a foundation for an assessment plan;
- are accessible and useful; and
- are consistent with learning theory and cognitive science.

Teachers and informal educators can use conceptual flow diagrams as a backward planning tool. The conceptual flow diagrams start with the big ideas that are important for students to learn, and then develop content that gradually builds students’ understanding of these large, often complex, ideas. The graphic illustrations can be used by various different stakeholders in the ocean sciences education community, including:

- informal science educators;
- national and state standards committees;

- curriculum specialists;
- professional development specialists;
- curriculum developers and textbook writers; and
- assessment specialists.

In this session, participants will explore the Ocean Literacy Scope and Sequence for Grades K-12. Participants will learn to use this tool for a variety of purposes, including curriculum development and the design of professional learning opportunities.

Wehunt. *Managing a Global Fishery*

Students learn what it will take to maintain a fishery in the open ocean outside control of any nation. Besides 6 nations actively fishing the fishery, natural events and personal decisions will influence the outcome.

Weiss, Halversen, and Pedemonte. *Teaching Climate Science and Data Literacy: Workshops and Courses for Pre-service and In-service Teachers*

During this session, we will present an overview of the Teaching Climate Science and Data Literacy pre-service and in-service teacher course, as well as derivative workshops. The original university course was developed by the Lawrence Hall of Science at University of California, Berkeley, Rutgers University, and Padilla Bay NERR with funding from NOAA's Environmental Literacy Grants. The course and derivative workshops use climate science (particular focus on greenhouse effect, carbon cycle, ocean acidification, and sea level rise) as the context for teaching about and applying current teaching and learning research, as well as how to use real and near-real time data in the classroom in authentic and locally relevant ways, and building students' data skills. Additionally, the course supports understanding of three-dimensional instruction as called for in A Framework for K-12 Science Education and the Next Generation Science Standards. The course is currently being taught at four universities—UC Berkeley, California State University, East Bay, Florida State University, and Rutgers University.

We will share the course scope & sequence, some relevant background information, and the course rationale. Additionally, participants will experience an exemplar activity from the course that highlights development of data skills—orientation, interpretation, and synthesis. We will also share how the course is being used and adapted at different sites. For example, one site uses the course primarily with upper division science students interested in improving their science communication and data skills and in working with young people. Another offers it as part of the university's UTeach program to a combination of upper division science students and pre-service science teachers. And another offers an adapted version of the course as an introductory pre-service teacher course for lower division STEM undergraduates as part of the CalTeach program. The course has also been adapted for in-service teacher workshops and these settings.

Whaley. *Ocean Plastic Pollution Issue and Solutions*

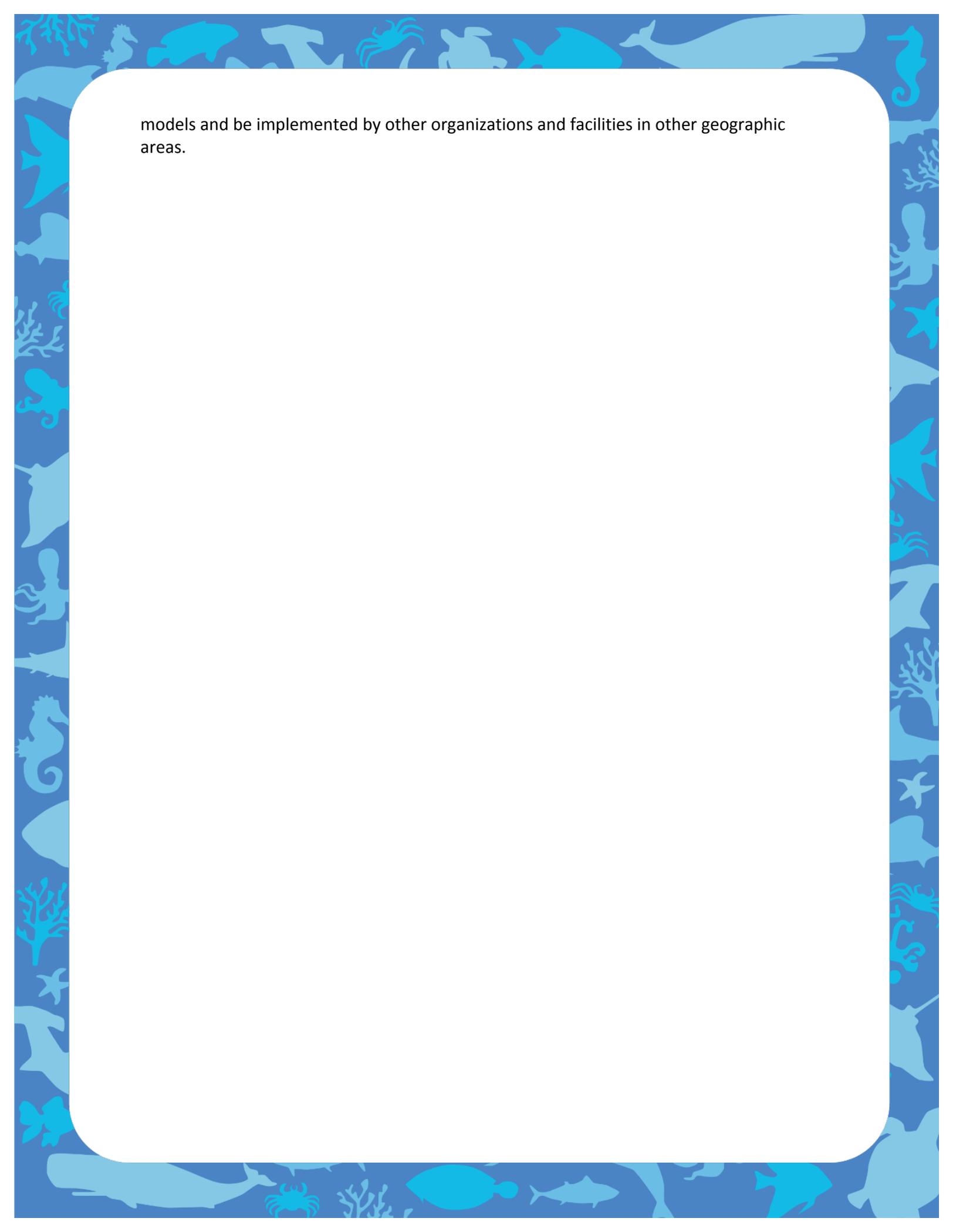
Monterey Bay Aquarium educators will share NGSS aligned curriculum that explores issues and solutions surrounding plastic pollution. We will highlight our suite of classroom activities focused on increasing understanding and awareness of this massive global problem. From conducting a waste audit to decoding recycling, these activities are perfect for getting started in teaching about this complex issue. Many of the activity materials are commonly accessible and often recycled/reused or very inexpensive. All of these activities are available free to all educators.

Learn about our Ocean Plastic Pollution Summit for teachers and how they engage students in single-use plastic reduction projects in their schools and communities. This three-part event prepares teachers with content and skills to engage students in a single-use plastic reduction project. We will share details about the Summit's structure in hopes that other organizations will replicate our efforts in their own communities. We will also share stories of hope and change from our participants that will keep everyone inspired to take action!

Whether you are an informal educator, classroom teacher or professional development provider, you will find this session informative!

Whitely and Chilton. *Citizen Science: Next Steps*

Citizen Science enables special connections between scientific research and the participating public. Many organizations are embracing this opportunity to more fully engage their participants in meaningful science. Citizen Science programs provide increased engagement and increase the role of the visitors to our marine science center. Together we will discuss how a facility or an organization does that? How do they decide on the type of program, create and implement programs that work best with their site? What is most relevant? What do you need? What are the challenges? How do you ensure quality data and feedback from and for participants? At our previous presentation we addressed some of these questions and we will provide a brief review of that information. Then we will share and explore outcomes and lessons learned from the citizen science programs we have initiated since that time and new ones we have created or revised. Many of our programs are based at an island marine science research station exploring everything from intertidal invertebrates, marine mammal sightings, plankton blooms, elasmobranch observations, and more. Hear how we involve members of the public, students, and teachers in collecting and then using the important data for our own and other programs. However, a marine field station is not the only place to implement citizen science programs. There are successful programs on our mainland and at places without actual facilities. Learn how non-facility based programs are also actively engaging participants. These kinds of programs can serve as

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models and be implemented by other organizations and facilities in other geographic areas.