

Monday Session Descriptions

Andrake. *Will an Ice Cube Melt Faster in Saltwater or Freshwater?*

Many years ago I gave my students four saltwater solutions of varying salinity and asked them to figure out a way to rank them in order from least salty to greatest with only one rule, they weren't allowed to taste the solutions. There were a number of ideas ranging from measuring the salt left after evaporation to various density and buoyancy tests.

One group of students came up with a unique way of solving this problem. They decided to float an ice cube in each solution with the hypothesis that the one in which the ice cube melted fastest would be the saltiest solution. From their trial we all learned something interesting and were met with an unexpected outcome. Ever since, I have used this experiment as a way to successfully engage students in the scientific process and a study of ocean circulation.

Participants in this session will conduct a simple experiment to answer the question "Will an ice cube melt faster in freshwater or saltwater? This experiment offers a way to bring ocean science into any classroom as it examines the physical properties of seawater vs. freshwater as they relate to ocean circulation, in particular thermohaline circulation and the Global Ocean Conveyor Belt (GOCB).

Since this circulation is driven by cold dense salty water sinking in polar seas and warmer less dense water rising to the surface in warmer regions "Will an ice cube melt faster in saltwater or freshwater?" provides a model and a basis for understanding this circulation as it incorporates such concepts as convection, buoyancy, and density.

In this session we will also discuss and model follow up lessons that explore the factors that drive and potentially disrupt thermohaline circulation to learn how climate change has impacted this circulation in the past and may lead to future changes to the "GOCB."

Ocean circulation is certainly a major influence on the Earth's climate as well as the transport of nutrients or even pollutants throughout the sea. Its study in the classroom is an opportunity to examine dynamics of climate change in our ocean and helps our students to realize that we all have an important connection to the ocean and see that: "The ocean and humans are inextricably connected."

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Ashley. *Activities for the Anthropocene*

Scientists are now referring to our current geological age as “The Anthropocene” to emphasize the impact that humans have had on the land, seas, climate and wildlife over the past 200 years. In fact, as our species’ population has grown from barely a billion to over 7 billion since the Industrial Revolution, human settlements and natural resource use have changed the planet’s physical geography and ecosystems. Teaching about the Anthropocene integrates life sciences with world history and geography, making for interdisciplinary lessons rich in content, real-world data and problem-solving challenges.

In this hands-on session, discover classroom activities and interactive online resources to help students explore different aspects of the Anthropocene including human population growth, climate change, and changes in biodiversity. The presenter will especially focus on changes to marine ecosystems as a result of human activities – ocean acidification, pollution, overfishing and alterations to coastal ecosystems including coral reefs and mangrove forests.

The presented activities build knowledge and skills in life and social sciences, while applying learning to authentic problems. Activity formats include data analysis and interpretation, modeling and group problem solving. The presenter will also engage the group with new online, interactive media that combines social science platforms (mapping and historical timelines) with environmental themes. Participants will receive lesson plans and background readings on CD-ROM and through online links. The presented materials relate to “Earth and Human Activity,” a Disciplinary Core Idea of the Next Generation Science Standards (NGSS). The presenter will provide guidance on using the resources with students of different learning styles in the classroom or environmental education center.

Michelle Ashley
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Bader, Rocha, Lunsford. *NMEA 101*

Are you new to NMEA? Wondering exactly what we are all about? Since the early 1970s, NMEA has been where people representing all aspects of marine education get together to discuss common ideas and concerns in the field, and share expertise, resources and experience. Come meet the current NMEA leadership, learn what is new with the organization and how you can become more involved!

Dave Bader
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Binz, Tipton. *Climate Change in the Classroom*

We believe that all teachers can incorporate climate science in the classroom to increase the climate literacy of their students. Join us as we demonstrate fun and interactive, standards based climate science lessons. We will use local data and NOAA visualization tools to gary_bremen@nps.gov analyze real world issues facing coastal communities, like sea level rise and extreme weather events. Lessons include an introduction to the greenhouse effect, as well as how to create maps and graphs to evaluate the impacts from climate change on wildlife, coastal habitats and water quality near you. NOAA Digital Coast and the National Estuarine Research Reserve System Wide Monitoring Program graphing tools will be used throughout the demo. Participants will also be provided with a suite of problem based learning STEM solution ideas and resources! Lessons are based on middle school standards but can be easily adapted for other grade levels. #ClimateAction #ClimateLiteracy

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Bishop, Ulderich. *Surviving in the Deep Blue Sea*

During this workshop session, teachers will learn multiple ways to teach elementary students about marine animal survival strategies, which enable them to survive in the ocean. This hands-on workshop will use the 5E model of engage, explore, explain, elaborate, and evaluate. We will look closely at the three dimensions of the Next Generation Science Standards, focusing on the science and engineering practices, and the cross cutting concepts. One example is allowing students to ask questions and design their own investigation. Teachers will leave with lessons that are easy to incorporate into their elementary classrooms. A few examples are color, size, shape, venom, and hanging out in groups. Multiple lesson ideas will be presented and handouts will consist of student pages to copy.

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Bremen. *Gifts from the Sea*

"Gifts from the Sea" was developed as the first "porch talk" at Biscayne National Park, designed to introduce the wonders of the ocean to folks who might not get the opportunity to explore the largest marine park in the National Park System for themselves. Ranger Gary Bremen starts with obvious "gifts" like seafood and seashells, and begins to weave an interactive and engaging story that introduces currents, the concept of one world ocean, and the problem of marine debris. As focus shifts from tangible objects to inventions and medical cures inspired by the sea,

he inspires listeners to think about the role that oceans play in their own lives, leaving them feeling uplifted with a new appreciation for the natural world.

Gary Bremen
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Brewer. *Extending Your Reach: Delivering Engaging Content on Apple iPads*

In 2014, the University of Alaska Southeast, Fisheries Technology (Fish Tech) program was funded by a grant from the Department of Labor TAACCCT project to offer 100 and 200 level college fisheries curriculum using innovative teaching technology to make classes available on Apple iPads. All the of lectures, reading materials, videos, frequently asked questions and even exams are loaded on iPads so that coursework can be taken virtually anywhere without an internet connection. Brig Malessa, a former Fish Tech student from Port Armstrong, AK that had to drop classes due to poor bandwidth said, "Wow! Thanks so much. This is an absolute game changer for those of us that live remote! I had pretty much given up on the idea of classes for the time being - not anymore!"

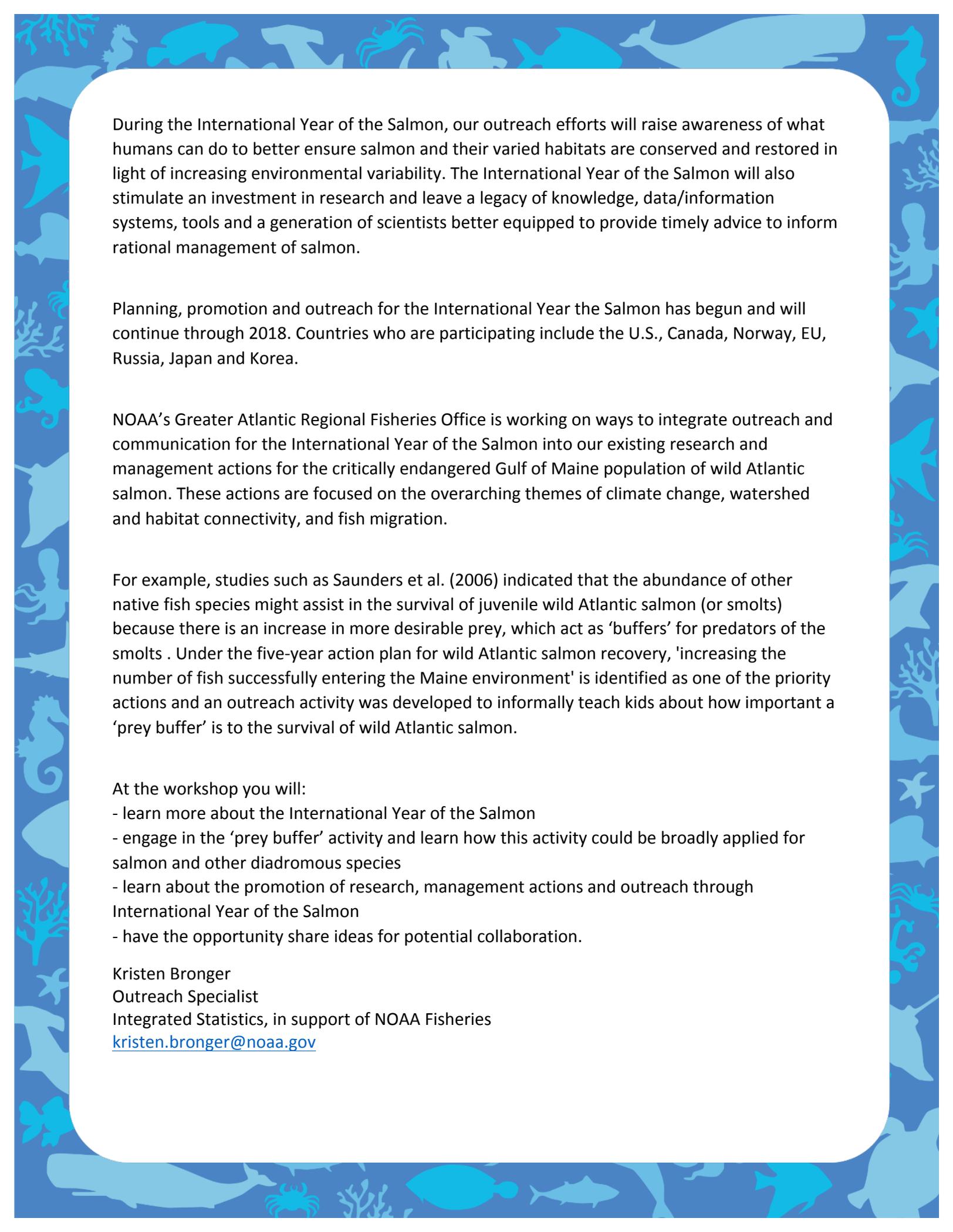
In the 2016-2017 academic year, over 100 students took six classes using the iPad format. Joel Markis, a Fish Tech faculty member said "The beauty of these classes is students of all types can take these classes from almost anywhere. Not only do we have students from all over Alaska taking our classes, but we also have many students in the contiguous United States taking our classes. And because our iPad classes are semi-asynchronous [students have to call-in to get exam passwords and discuss content three times a semester], they allow us to work with students that may not be able to meet during traditional semester or cannot meet at a fixed time each week, like seasonal employees, deployed servicemen, and fishermen."

Alex Lyons, a 2016 Fish Tech AAS graduate had this to say about the Fish Tech program, "I have been to big universities that offer only face to face classes and have dabbled on online courses, but the UAS Fish Tech program is different from all of the others. From the flexibility of online and iPad classes, to faculty engagement, to job placement assistance, the Fish Tech program is doing education the way it should be, with students needs first."

Reid Brewer
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Bronger. *International Year of the Salmon, 2019- Wild Atlantic Salmon and their Ecosystems*

The International Year of the Salmon in 2019 will be a celebration of salmon restoration and recovery. The overall theme is 'Salmon and people in a changing world'.



During the International Year of the Salmon, our outreach efforts will raise awareness of what humans can do to better ensure salmon and their varied habitats are conserved and restored in light of increasing environmental variability. The International Year of the Salmon will also stimulate an investment in research and leave a legacy of knowledge, data/information systems, tools and a generation of scientists better equipped to provide timely advice to inform rational management of salmon.

Planning, promotion and outreach for the International Year the Salmon has begun and will continue through 2018. Countries who are participating include the U.S., Canada, Norway, EU, Russia, Japan and Korea.

NOAA's Greater Atlantic Regional Fisheries Office is working on ways to integrate outreach and communication for the International Year of the Salmon into our existing research and management actions for the critically endangered Gulf of Maine population of wild Atlantic salmon. These actions are focused on the overarching themes of climate change, watershed and habitat connectivity, and fish migration.

For example, studies such as Saunders et al. (2006) indicated that the abundance of other native fish species might assist in the survival of juvenile wild Atlantic salmon (or smolts) because there is an increase in more desirable prey, which act as 'buffers' for predators of the smolts. Under the five-year action plan for wild Atlantic salmon recovery, 'increasing the number of fish successfully entering the Maine environment' is identified as one of the priority actions and an outreach activity was developed to informally teach kids about how important a 'prey buffer' is to the survival of wild Atlantic salmon.

At the workshop you will:

- learn more about the International Year of the Salmon
- engage in the 'prey buffer' activity and learn how this activity could be broadly applied for salmon and other diadromous species
- learn about the promotion of research, management actions and outreach through International Year of the Salmon
- have the opportunity share ideas for potential collaboration.

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Cackowski. *Bridge DATA Activity- Ghostbusting the Chesapeake*

Even when crab pots are lost at sea, they continue to catch animals. Who you gonna call? Watermen! Participants will learn about a unique partnership to remove “ghost” pots, estimate the reduction in bycatch, and go home with classroom activities.

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Chen. *Help Fish Back to Their Home*

Fishes with different color and body shape normally indicate they are living in different habitat. Corals require sunlight and grow in clear, shallow water. Most coral fishes have colorful body to display themselves. On the other hand, deep fishes show black or red body color. Those fishes living in sandy bottom tend to have flat body and yellow-brownish color. Pelagic fishes own streamline body shape and deep blue color on their upper body while silver or white color on their lower body.

Megan Chen
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Chierici. *The Art of Data*

The presentation will show ways in which teachers can make real data more accessible to students. It will look at using online research data sets to create graphs as well as using pre existing graphs and data tables as a source of data for the classroom. Students will then examine the data to look for trends and meaning, using the internet and prior knowledge as a source of explanation. A variety of art and design activities can be used to illustrate the trends and make the meaning more accessible to the average student, thus strengthening their understanding of the data. The presentation will walk through how to implement this and will have many examples of this activity in action from my own classroom. Links to resources will be made available online for participants

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Crolley. *Barrier Island on the Dynamic Edge*

The South Atlantic barrier islands are the sentinel of ocean meeting land. These fragile ribbons of sand are shaped by the winds, tides and currents to form relationships with the vast salt water beyond. This is demonstrated by the front beaches through a largely transgressive geological migration towards the mainland, often delivering shells, trees (bone yards) and other treasures to the shore. The dynamic edges between ecosystems are phenomenal in this arena. The hypersaline winds from the ocean influence a salt pruning of the beach front plant community, eventually transitioning into the maritime forest of the island's interior. Pelagic and near coastal plant and animal populations yield to diverse flora and fauna interactions that are characteristic of an inland forest community. The salt water continues to shape the margins of the islands creating inlets, bays and sounds that inevitably form the salt marsh estuary. Largely defined by the monoculture of *Spartina alterniflora* with just a few other halophytic plant species, the ecosystem experiences another dynamic change as the estuary (nursery to the sea) becomes the dominant landscape. This leads to a more stable edge of North America.

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Curran, Bower, Furey. *Detangling Spaghetti: Tracking Deep Ocean Currents in the Gulf of Mexico*

This presentation will highlight examples of Best Practices that have supported plastics research, education and outreach in coastal regions. Sea Grant educators from Pennsylvania and New York will discuss successful collaborative efforts that have benefited researchers, educators and stakeholders alike. The presentation will examine activities including a regional and national conference, Newspaper in Education (NIE) publications, school programs and public presentations. Learn how researchers, educators, managers and Sea Grant staff have partnered together to enhance their work and identify research gaps. Examples of classroom/outreach activities will be demonstrated, as time permits. Participants will receive a jump drive with PowerPoint slides, NIE pages, factsheets, classroom activities and other information related to plastics in the ocean and Great Lakes.

Mary Carla Curran
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This presentation will highlight examples of Best Practices that have supported plastics research, education and outreach in coastal regions. Sea Grant educators from Pennsylvania and New York will discuss successful collaborative efforts that have benefited researchers, educators and stakeholders alike. The presentation will examine activities including a regional and national conference, Newspaper in Education (NIE) publications, school programs and public presentations. Learn how researchers, educators, managers and Sea Grant staff have partnered together to enhance their work and identify research gaps. Examples of classroom/outreach activities will be demonstrated, as time permits. Participants will receive a jump drive with PowerPoint slides, NIE pages, factsheets, classroom activities and other information related to plastics in the ocean and Great Lakes.

Helen Domske
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Dorcik, Kastler. *Students Assessing Community Vulnerability and Resilience*

Every community everywhere faces some sort of natural threat, whether it is an earthquake, a tornado, a hurricane or some effect of global climate change. Communities on the Gulf Coast were devastated by Hurricane Katrina's wind and storm surge in 2005. In response, a Coastal Resilience Index was developed to allow city leaders to consider various aspects of the community health, environment and economy to determine which aspects are most vulnerable to the most likely threat. This facilitates prioritizing the first task to undertake. During this presentation we will describe and practice a problem-based learning lesson that caps a classroom and field curriculum on coastal resilience. Teams of students work to address specific scenarios identified in coastal communities to address in preparation for another storm. At the end of the term the students present their solutions to local city leaders. Work described here is sponsored by the Mississippi Alabama Sea Grant Consortium, the NOAA B-WET program of the Gulf of Mexico Region, and The University of Southern Mississippi's Marine Education Center.

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Duncan Seraphin, Philippoff. *Concentration and Measurement: Making Abstract Concepts Meaningful through Smell, Taste, and Sight*

The average salinity of seawater is 35 parts per thousand (ppt). Sharks can smell blood from hundreds of meters away—in concentrations as low as one part per million (ppm). These, and many other marine science facts, are rooted in difficult concepts of scale, proportion, and

quantity. In this demonstration, we make connections between concentration measurements and everyday experiences (drink mix, lemon juice, and tomato juice). These demonstrations highlight the special role that water plays in the process of dilution relevant to learners. The physical, chemical, and biological interactions of seawater are affected by the types of substances dissolved in it, as well as the properties, sources, and concentrations of these substances. Understanding how concentration is measured, and what those measurements mean, leads to a better understanding of the unique properties of seawater as well as how the land, the ocean, and humans interact. The content and activities in this demonstration will work towards building an understanding of the properties of seawater and the relationships of these properties to natural processes. Participants will experiment with a drink mix concentration and dilution activity from the freely available, Exploring Our Fluid Earth curriculum (exploringourfluidearth.org) and have the opportunity to compare their sensory perception to that of a shark. We will also discuss the pedagogical utility of using measurement to help students make mathematic concepts, like concentration, meaningful in their everyday lives.

Kanesa Duncan Seraphin

Professor

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Evans. *Data Literacy with HHMI Interactive*

Participants will be introduced the great variety of the coral bleaching resources available from HHMI including short films, animations, data points, images, and the "Scientist at Work" series. These resources all help strengthen student understanding of symbiotic relationships, coral bleaching, and the connection to global temperature.

There will be an opportunity for participants to work through a student activity. Suggestions for implementing data interpretation will be offered. An explanation tool will be shared so teachers can help guide students in making a coherent claims backed by evidence and reasoning.

All HHMI handouts will be provided and are also freely available for download at <http://www.hhmi.org/biointeractive>

Joe Evans

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Halverson, Tran. *Faculty Learning Program: Transferring STEM Learning*

Reforming undergraduate STEM education involves changing the instructional practices of STEM faculty who teach these courses. Research has shown that faculty can design their courses to be more effective by making their lectures active, such as having students think and



talk about their ideas with one another during class time. The opportunity to reflect on and express one's incomplete and disorganized ideas is an essential part of learning. The current challenge is helping STEM faculty integrate these active learning methods into their practice, and be able to use them consistently, confidently, and effectively. In this session, we will share representative activities, the design framework, and lessons learned from the development and implementation of the Faculty Learning Program, a professional learning program for STEM faculty that was designed specifically to address this challenge. The overarching goal is to support undergraduates learning, retain more of what they learn, and increase their motivation to engage in STEM lecture courses.

The Faculty Learning Program (FLP) is a ten-month commitment during the academic year so that faculty participate with cross-disciplinary peers to reflect on and discuss their teaching practice when they are immersed in teaching and focused on student learning. The FLP includes active learning experiences; tasks to apply, practice, and reflect on what participants learn; opportunities to share and receive feedback from peers; and activities that put faculty in the place of the learner to challenge them to think deeply about how learning happens. As they are thinking about their own experiences as a learner and assumptions about learning, we add in knowledge from the field for participants to consider. Participants in the program are provided with materials from the research literature on learning and teaching in higher education to read and discuss. Juxtaposing research and practice in this way encourages educators to consciously relate research into their practice.

In this session we will focus on peer observations of videos, used in FLP to develop faculty's skills in observing and providing feedback on teaching practice. The observation protocol we use is qualitative in nature, and structured in such a way to generate a safe space for giving and receiving feedback. We will also share how the FLP is designed, evaluation findings, and lessons learned. This last discussion serves two purposes. For those who are seeking a program to adopt, they will gain understanding of what the program is about and how it is impacting faculty's teaching practice. For those who design faculty development experiences, they will gain practical insights and a design framework to inform their own work.

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Harcourt. *Climate and the Ocean: Beyond the Sea Level Rise*

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.

Pat Harcourt

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Haynes, Blaney. *Exploring the Deep Ocean with NOAA: A Dive into our Most Amazing Recent Discoveries*

Over the past 15 years, Ocean Explorer expeditions have spanned the globe, discovering chemosynthetic habitats, hydrothermal vents, volcanoes, seamounts, canyons, cold seeps, shipwrecks, and a multitude of species new to science. Recent findings have supported the expansion of the Papahānaumokuākea Marine National Monument in the Pacific Ocean and the development of the new Northeast Canyons and Seamounts Marine National Monument in the Atlantic Ocean.

Educators have learned about why it is important to explore the ocean and how the National Oceanic and Atmospheric Administration’s (NOAA’s) Office of Ocean Exploration and Research (OER) and its partners explore the deep sea through professional development opportunities offered nationwide. Offerings have included Learning Ocean Science through Ocean Exploration and the Okeanos Explorer Education Materials Collection, V1 Why Do We Explore? and V2 How Do We Explore?



In 2017, OER will implement a new educator professional development workshop, titled Deep Ocean Discoveries, focused on key findings of the NOAA Ship Okeanos Explorer and other supported explorations. This new workshop will highlight important discoveries from our expeditions, including topics such as deep-sea corals, vents and volcanoes, seamounts, deep-sea canyons, marine archaeology and more. Content will focus on ocean related phenomena and classroom resources that support the Next Generation Science Standards and the Ocean Literacy Essential Principles and Fundamental Concepts.

This session will unveil portions of the new workshop, diving into intriguing discoveries made over the years and providing associated activities and resources to help participants integrate more ocean science into classroom instruction.

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Keener, Wawrzynski, Noronha, Thompson, Cline, Guimaraes, Sousa Pinto, O'Brien, Conesa Alcolea. *Educators Informing Public Perceptions of Aquaculture Across the Atlantic*

Seafood from well-managed wild-capture fisheries and environmentally responsible aquaculture has great potential to help meet the burgeoning need for healthy protein while minimally impacting the environment. Of the two sources, only aquaculture has the potential to expand. Aquaculture is a Priority Theme identified by the Galway Statement and the Atlantic Ocean Research Alliance (AORA), a tripartite international agreement for transatlantic research cooperation among the United States, the European Union (EU), and Canada. Recognizing the need to expand environmentally responsible marine aquaculture and the role that negative public perceptions play in the future of marine aquaculture development, AORA's Ocean Literacy and Aquaculture (OL) Working Groups are holding strategic Aquaculture Education Public Perception Workshops (Workshops) to encourage dialog and discussions on both sides of the Atlantic to define paths towards enhancing awareness of aquaculture's role as a healthy and environmentally responsible food supply and a means of ocean conservation.

The objective of the Workshops is to provide educators from the international community the opportunity to learn from and engage with aquaculture experts (science, education, extension, informal aquarium education) and to elicit input to address issues related to public perceptions among international stakeholders. These discussions are forming the basis of an AORA deliverable on best practices to introduce aquaculture to a wide range of stakeholders. The deliverable will help guide further discussions and inform the Working Groups as they identify collaborators/leveraging opportunities to address public perception issues.

The first Aquaculture Education Public Perception Workshop was held in October 2016 at the



European Marine Educators Association Annual Conference in Belfast, Northern Ireland. Workshop presenters included the NOAA Aquaculture Program Office, AORA OL and Aquaculture Working Groups, Ciencia Viva, Aquarium of the Pacific, International Council for the Exploration of the Sea, Interdisciplinary Centre of Marine and Environmental Research, and U.S. Aquaculture Society. Approximately 40 educators attended the two-hour long workshop. Presentations on aquaculture and ocean literacy, aquaculture educational programs for formal and informal audiences, the role of public aquaria in addressing public perceptions about marine aquaculture and research on integrated multitrophic aquaculture set the stage for large group discussions.

Preliminary workshop findings were used as a starting point for the discussion in the Workshop on aquatic food products and new marine value chains organized during the Conference FOOD2030 held on October 12-13, 2016 in Brussels, a high level event that provided a platform for dialogue that sought to build on the political momentum for a coherent research and innovation policy framework for Food and Nutrition Security in the European Union.

The NMEA 2017 Aquaculture Education Public Perception Workshop will bring a largely U.S. perspective to build upon the success of the EMSEA 2016 Workshop and to inform the transatlantic ocean literacy process on public perceptions of aquaculture, thus continuing to inform dialog and discussions on both sides of the Atlantic Ocean about aquaculture and defining paths towards enhancing awareness of aquaculture as not only environmentally and economically sustainable, but also as a means of ocean conservation.

Paula Keener
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Koester, Kurtz, Leverett. *Once Upon an Ocean: Entering As-if Worlds to Achieve Ocean Literacy*

It is true that the ocean and humans are inextricably linked. Participants at this conference know that. But did you know that 1 in 5 children in the U.S. struggle with issues related to reading, writing, math, focus, and organization? For these students, teaching through talking, telling, and required reading means they are inextricably marginalized. In this participatory experience, science education novelist, researcher and teacher educator, Dr. Merrie Koester, marine science author, Kevin Kurtz, and National Oceanic and Atmospheric Administration's (NOAA's) Office of Ocean Exploration and Research (OER) educator, Connie Leverett, team up to show how, when as-if worlds are created, deep learning of the principles of ocean literacy can be achieved for all learners. Join us to learn how, when mirror neurons in the brain are fired, the imagination creates channels for learning, made wide by the universal language of empathy. Learn how to use stories and the imagination to create powerfully contextual "ways

into” the worlds of water so that all learners can swim in the wonder that is marine science learning.

Modeling the principles of “embodied simulation” emerging from mirror neuron research, Dr. Koester will bring you through a creative drama experience into a world where the plight of the endangered North Atlantic Right Whale runs smack into issues of social justice. Science writer and teacher Kevin Kurtz will, through poetry and storytelling, invite you to uncover the Earth’s secrets through an adventure aboard the JOIDES RESOLUTION. Finally, with veteran marine educator and NOAA Office of Ocean Exploration educator Connie Leverett, you will board the ROV, Little Hercules, and enter into a spirit of exploration that will leave you shouting, “WE HAVE BUBBLES!”

Through embodied simulation, students can themselves enter as-if worlds where they, too, are sciencing in relationship with a focused visualization of themselves doing science. Now, this is DEEP learning!

Fantastic door prizes from the NOAA OER and two free ocean science books by Koester and Kurtz will be given away!

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Lee. *How a Knowledge Broker Impacts Marine Education*

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 of Ocean Science. The KMSEM project was initiated in 2015 and will be open in 2020 in Ulsan, 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.

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Moody. *Plankton in Their Hands*

Plankton is a word that describes both plants and animals that range in size from 150ft long to things that require a microscope to examine. The microscopic plants and animals can be especially challenging to share with students and teach about in a hands-on way. At the Dauphin Island Sea Lab, we teach about these microscopic organisms and have experimented with a number of different ways to put plankton into the hands of students. One method that we have utilized is 3-D printed plankton models. These large-scale replicas allow students to touch and examine an organism and then compare the model to the plankton that they later view under a microscope. We believe that these models are an excellent way to bring a tactile learning experience to a class that is primarily focused on visual learning. It also helps to bring



these plankton to life for visually impaired students. The Sea Lab educators modified a matching game where students are given a picture of larval plankton on a paddle. Other students in the class receive a similar paddle but on it is a picture of an adult organism. The objective of this activity is to have the student with the larval organism successfully locate their partner who has the corresponding adult organism. This enables students to see the drastic differences between planktonic larvae and their adult forms. It is also a refreshing way for students to leave their desks, interact with their peers, and use deductive reasoning to try to solve this puzzle. Finally, an activity that allows the students to get their creative juices flowing is a plankton building activity. This inexpensive craft uses pipe cleaners, along with a few other simple supplies, and enables students to create their own copepod to take home. This is an excellent activity to use when trying to teach a plankton class, explain biomass, and highlight the base of many ocean food webs since copepods are one of the most numerous animals on the planet, and this abundance helps support a huge diversity of life. Please join us as we learn, share, and create these plankton resources.

Joann Moody
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Mott, Santoro, Lindoso, Barbieri, Bailet, Vallette, Cira. *World Ocean Day as a Way to Advance Ocean Literacy*

Many countries have celebrated World Ocean/s Day on 8 June since 1992, when the concept was first proposed by the Government of Canada at the UN Conference on Environment and Development and especially since the involvement The Ocean Project and World Ocean Network to promote this opportunity worldwide, to celebrate and take action for our shared ocean. The UN General Assembly officially recognized 8 June as World Oceans Day in 2008, further catalyzing an increasing number of celebrations worldwide with events that range from community-organized beach clean-ups to awareness-raising seminars hosted by aquariums, to scientific roundtables organized by oceanography centers to events organized by the United Nations Secretariat and its Specialized Agencies. While events were held in over 100 countries in 2016, many more countries need to become engaged with their Governments as well as more participation from the Scientific Community. There is also a need to further expand the amount and types of communication materials and especially the amount of multilingual resources.

A UN-branded web portal for World Oceans Day, UNOceansDay.org will be launched in 2017 and strategically connected with WorldOceansDay.org, with each site helping amplify the other and thereby growing the overall reach and impact of World Oceans Day. The UNOceansDay.org platform will include the best scientific and educational resources, a shared database with

WorldOceansDay.org of events worldwide, and opportunities for involvement in English, French, and Spanish, to start. In particular, its objectives are:

- Create unified gateway for all World Oceans Day stakeholders
- Share a seamless back-end connection (i.e. share interactive database /map of World Oceans Day events) with WorldOceansDay.org and enhance existing World Oceans Day communities
- Engage new actors around World Oceans Day, especially governments and the scientific community
- Promote and coordinate the annual World Oceans Day Photo Contest, updating the web portal with the winning photos
- Enlarge the geographic scope of World Oceans Day

The UN Online Portal for World Oceans Day is a joint initiative of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the UN Division on Oceans and the Law of the Sea (DOALOS), The Ocean Project, and the World Ocean Network.

This presentation will describe the main characteristics of the portal, and will present ways for joining the initiative. We'll have lots of time for productive discussion to help grow the reach and impact of World Oceans Day!

Bill Mott
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Muhlstein, Goldman. *Traveling Through Trash with UNCW MarineQuest and Watson the Whale*

As part of the NOAA Marine Debris Prevention through Education program, UNCW MarineQuest created the Traveling Through Trash (3T) Project. The goal of this project was to capitalize on student empathy for marine species and engender a lasting change in the knowledge, attitudes, and actions of participating youth related to the behavior and choices that could contribute to the generation of marine debris and potentially impact migratory marine organisms. To meet this goal, MarineQuest created an inflatable life-size Right Whale classroom in which our 3T programs took place. Over the course of a year Watson the Whale and the 3T project facilitators traveled over 8,400 miles and served more than 10,200 students in rural communities of coastal North and South Carolina. Join MarineQuest for a presentation on 3T curriculum highlights, evaluation findings, and lessons learned. Tour the inside of the whale, try out our iRefuz app, and learn about Watson's new adventures in promoting climate literacy and engineering solutions to derelict ghost nets.

Harris Muhlstein
School Programs Coordinator

UNCW MarineQuest
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Muhlstein, Sirak- Schaeffer. *Ghost Busters with Watson the Whale*

Join UNCW MarineQuest to learn about the Ghost Busters project sponsored by National Fish and Wildlife Federation. Visitors to the whale will learn how and why we built the whale to conduct educational outreach on derelict fishing gear, specifically ghost nets, and their impact on marine mammals and other marine organisms.

Harris Muhlstein
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Pedemonte, Weiss. *Supporting Early Elementary Students to Think Like a Scientist*

A Framework for K-12 Science Education and the Next Generation Science Standards (NGSS) ask teachers and learners to use a three-dimensional approach to instruction and learning, bringing together content (disciplinary core ideas), what scientists/engineers do (science and engineering practices), and big ideas that cut across science disciplines (crosscutting concepts). This approach brings the focus back to a curiosity and wonderment of the natural world - a mindset innate to early elementary students. NGSS states that K-2nd grade students can and should engage in all of the science and engineering practices at some level, and yet these students are rarely given opportunities to engage in doing what scientists do. One of the common challenges faced by educators teaching science to early elementary students is a lack of familiarity and resources that support this type of teaching.

In this presentation we will share some NGSS-designed activities for K and 1st grade students, allowing participants to experience how students would build an understanding of the content. We will then debrief the experience, looking for the three dimensions and how they support students' understanding. And finally, we'll facilitate a discussion about designing curriculum materials to support three-dimensional instruction.

The activities explore science ideas about what plants and animals need to live and grow. To deepen students' understanding of these ideas, the students apply the crosscutting concepts of patterns, cause and effect, and structure and function as well as the science and engineering practices of planning and carrying out investigations and analyzing and interpreting data. In order to be explicit to both teachers and students about the three-dimensional nature, the instructor will create a Science Ideas wall. The wall has three categories—Key Concepts, What Scientists Do, and Making Connections. Key Concepts represent the content that students learn through the activities (similar to the ideas presented in the disciplinary core ideas within NGSS).

What Scientists Do represents the science and engineering practices of NGSS. And Making Connections represent the crosscutting concepts that cut across different disciplines of science and within a particular discipline. As participants apply each of these aspects of science, what they are learning or doing is explicitly called out and added to the Science Ideas wall so that it is easily accessible for students and the teacher to draw on repeatedly throughout the activity, a science unit, and even throughout the school year.

The activities used in the session are taken from the MARE Ponds Unit and the MARE Life at the Seashore Unit. The materials are explicit in their three-dimensionality to both the students and the teacher, as well as educative for the teacher. Both curriculum Units are freely downloadable, <http://mare.lawrencehallofscience.org/curriculum/teacher-guides/gr1-rocky-seashore>.

Sarah Pedemonte
Science Learning and Teaching Specialist
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Pedemonte, Weiss, Halversen. *Exploring Students' Thinking About Ocean-Atmosphere Connections Using Models*

Models are central to what scientists do, both in their research as well as when communicating their explanations. Models can be mental or conceptual representations of phenomena, and their purpose can be a tool to support thinking or visualizing, making sense of experiences, and making predictions or developing solutions. Using models is an iterative process of comparing predictions with observations, then evaluating and refining the model. In the Next Generation Science Standards (NGSS), the science and engineering practice of developing and using models is called for even in the earliest grades, having students develop a scientific habit of mind as they progress from more concrete models to the complex and abstract. Teachers are being asked to support their students to do what scientists do and help their students build an understanding of models and their role in science.

In this presentation we will consider the science and engineering practice of developing and using models at middle school level. At this grade band, modeling builds on K-5 experiences and progresses to developing, using and revising models to predict more abstract phenomena. There are a significant number of performance expectations at the Grades 6th-8th band that call out the application of this important science and engineering practice. We will focus on Performance Expectation MS-ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. Participants will engage in an activity that explores an introduced phenomenon and pushes them to construct an explanation. We will then debrief the activity to

think about how the instructor supported learner engagement with the science and engineering practice and reinforced learner perception of how science works. Finally, we will facilitate a discussion about supporting how students use and construct models to represent their ideas and explanations.

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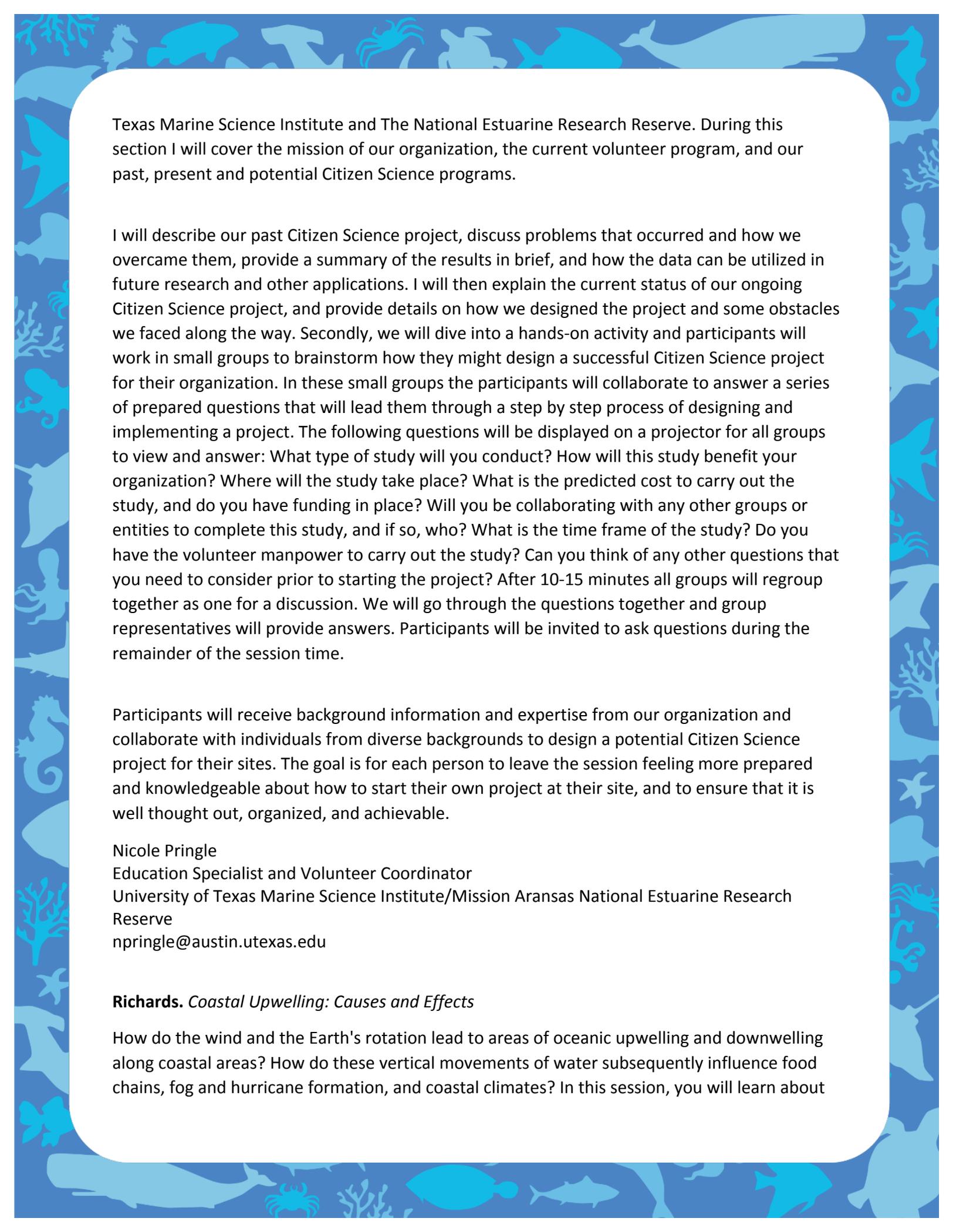
Petrone. *Under the Scope: Making Zooplankton Research Accessible to K-12 Classrooms and Beyond*

Zooplankton are dynamic and engaging animals when viewed by anyone who peers into a microscope. Recognizing this, UD researchers and educators are working with K-12 teachers to develop web-based resources for using zooplankton in the classroom. This outreach effort is part of an ongoing Delaware Sea Grant-funded research project studying seasonal dynamics of zooplankton in Delaware Bay. We have created a website (www.underthescope.udel.edu) which contains zooplankton and project information appropriate for all levels of students and the public. Included in the project's robust outreach plan are one-day teacher professional development workshops designed to engage educators in boat-based sampling, new and traditional methods of zooplankton identification, and discussions on ways to use zooplankton into their existing curricula, K-12. Teachers also explored the Under the Scope website, evaluating its design, content, and usability for their particular grade level. Specific suggestions from the evaluation were incorporated into the website, with additional implementation planned over the life of the project. This researcher-teacher partnership was successful in developing the digital resource itself, in building excitement and capacity among cohorts of teachers, and in establishing relationships among teachers and researchers for further partnership. During this and subsequent school years, teachers will be collecting local zooplankton samples with their students, which will then be co-analyzed by the students and UD researchers using the ZooScan imaging system. The students will then compare data sets and learn to communicate the results.

Christopher Petrone
Marine Education Specialist
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Pringle. *Connecting Volunteers Through Citizen Science*

The goal of this session is to help participants gain confidence in implementing Citizen Science projects at diverse organizations and facilities. This goal will be fulfilled in two parts during the 45-minute allowance. Part one will open with a presentation that introduces The University of

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

Texas Marine Science Institute and The National Estuarine Research Reserve. During this section I will cover the mission of our organization, the current volunteer program, and our past, present and potential Citizen Science programs.

I will describe our past Citizen Science project, discuss problems that occurred and how we overcame them, provide a summary of the results in brief, and how the data can be utilized in future research and other applications. I will then explain the current status of our ongoing Citizen Science project, and provide details on how we designed the project and some obstacles we faced along the way. Secondly, we will dive into a hands-on activity and participants will work in small groups to brainstorm how they might design a successful Citizen Science project for their organization. In these small groups the participants will collaborate to answer a series of prepared questions that will lead them through a step by step process of designing and implementing a project. The following questions will be displayed on a projector for all groups to view and answer: What type of study will you conduct? How will this study benefit your organization? Where will the study take place? What is the predicted cost to carry out the study, and do you have funding in place? Will you be collaborating with any other groups or entities to complete this study, and if so, who? What is the time frame of the study? Do you have the volunteer manpower to carry out the study? Can you think of any other questions that you need to consider prior to starting the project? After 10-15 minutes all groups will regroup together as one for a discussion. We will go through the questions together and group representatives will provide answers. Participants will be invited to ask questions during the remainder of the session time.

Participants will receive background information and expertise from our organization and collaborate with individuals from diverse backgrounds to design a potential Citizen Science project for their sites. The goal is for each person to leave the session feeling more prepared and knowledgeable about how to start their own project at their site, and to ensure that it is well thought out, organized, and achievable.

Nicole Pringle
Education Specialist and Volunteer Coordinator
University of Texas Marine Science Institute/Mission Aransas National Estuarine Research Reserve
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Richards. *Coastal Upwelling: Causes and Effects*

How do the wind and the Earth's rotation lead to areas of oceanic upwelling and downwelling along coastal areas? How do these vertical movements of water subsequently influence food chains, fog and hurricane formation, and coastal climates? In this session, you will learn about

the Coriolis effect through two demonstrations, and then you'll make your own (cut-out) model of an ocean basin. Each participant will receive a "Coastal Upwelling" teacher's guide from the American Meteorological Society's "The Maury Project," complete with instructions for your students to make their own models, as well as a set of questions to evaluate their mastery of the concepts.

Sarah Richards
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Riesbeck. *Suitcase Science: Hands-on Lessons Shipped to Your School*

The Aquarium offers five Suitcase Science Kits for grades K – 12 that can be shipped to your school. Each kit includes lesson plans and activity materials to highlight the topic plus games, posters, DVDs, biofacts, and books. Participants will take a closer look at two of our kits – Sea Turtle Science and Climate Science by trying out activities and resources. Our Sea Turtle Science Kit offers teachers a chance to use real biofacts in their classroom, help students learn about conservation issues facing sea turtles, and develop action projects. Our Climate Science Kit helps students to understand how our climate works, impacts due to a changing climate, and how they can become better stewards. Participants will receive a copy of all the lessons from the kits plus enter for a chance to win a free suitcase rental.

Rachel Riesbeck
School and Youth Program
Virginia Aquarium & Marine Science Center
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Scott. *Elementary Coding for the Ocean*

In this session, participants will discuss how to prepare their students for coding using no-tech games. Then, we'll play with some kid-tested, free coding apps (Kodable, Lightbot, HOC Minecraft, etc.) and code actual robots (BeeBot, Dot and Dash, etc.). We'll discuss how experiences like this allow for students to be creators of technology, not just consumers and how our students and partners have used their knowledge of coding to help combat local environmental issues. We'll also share our experience with the Hour of Code events we've done in-house and in outreach efforts.

Joe Scott
Senior Education Specialist
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Sharpe, Nuss. *Engaging Public Audiences with Open House- Style Marine Science Labs*

Sea turtle stomach contents, American eel parasites, marine debris, microplastics! Each year, CBNERR hosts a series of monthly family-friendly events called “Discovery Labs,” which aim to engage and educate public audiences on a variety of marine science topics through the use of exhibits, demonstrations, and hands-on activities. Examples of activities showcasing a variety of different teaching styles and topics will be presented, and attendees will have the opportunity to engage one-on-one with these activities.

Kristen Sharpe

Marine Education Specialist

Chesapeake Bay National Estuarine Research Reserve in Virginia, Virginia Institute of Marine Science

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Sullivan. *Polling for Improvement*

The Gulf of Maine Research Institute (GMRI) will describe our combination of the iClicker polling system and experience sampling research methodology to evaluate 10,000 students’ experience in our LabVenture! interactive learning program. The presentation will take participants through the steps taken and lessons learned while implementing clickers into the program. GMRI will share the current logistics and resulting polling data. Details about how the data resulted in improvements to the programing will be included. The session will wrap up with a discussion about how clickers may be used in participants programs/classrooms as learning tools for the program facilitators/educators.

Meredyth Sullivan

LabVenture! Program Manager

Gulf of Maine Research Institutue

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Sutton. *Penguin Dynamics Along the Antarctic Peninsula*

1. Participants will be provided an overview of the Palmer Station Long Term Ecological Research website and database.
2. Guided instruction will assist participants in accessing Palmer Station's LTER database to locate the data used in this activity.
3. Participants will manipulate "clean" data (created by the presenter) to generate 3 graphs illustrating changes in penguin populations along the Antarctic Peninsula since 1975.
4. Participants will explore variables relevant to penguin population dynamics along the Antarctic Peninsula including: thermodynamic, hydrologic, and food web.
5. Participants will observe and explore the complexity of the variables that affect reproduction rates in Adelie, Chinstrap, and Gentoo penguins living along the Antarctic Peninsula.

All participants will gain access to this activity including: Student data sets, Teachers data sets (including answers), and Tutorials for accessing and utilizing the LTER database.

Miriam Sutton
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Tossey, Petrone. *Diving Deep Into Digital Storytelling and Virtual Reality to Create Immersive Science Education Experiences*

Emerging digital tools allow you to literally immerse your audience into your projects and make the experience fun – you just need to embrace the innovative approaches that these new technologies allow!

At Delaware Sea Grant, we've been using Google Cardboard viewers to provide virtual "field trips" that give participants the opportunity to experience unusual places, like a scientific ocean drilling vessel and state-of-the art microbial laboratory. Learn how we're combining these virtual experiences with a variety of video offerings and insights from experts to help users understand the complexity, challenges, and importance of the deep biosphere.

Lisa Tossey
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Walters. *Pirate Science Camp*

Campers were introduced to ocean topics with some pirate flare. For Marine Biology, we studied dolphins, sharks, jellies, fish and plankton. We discussed how pirates might have interacted with each type of creature. On Physical Properties of Seawater day, we discussed weather and it's impact on sailing, the different layers of the ocean, water movement (tides, currents, waves, mixing, seiches, and tsunamis), as well as buoyancy and it's impact on building ships. Ocean Chemistry day involved activities on the different properties of saltwater versus brackish and freshwater. Including an introduction to the organic and inorganic substances found in seawater and how various organisms use those materials. The consequences of climate change were introduced in regards to the impact on ocean acidification. For Marine Geology, the students built a model of the seafloor and we discussed the different types of rocks, plate tectonics, deep-sea hydrothermal vents, cold seeps, and beach formation. Students also looked at different sand samples under a microscope. Lastly, Pirate History and the Conservation of Artifacts were introduced with assistance from the staff at the Queen Anne's Revenge Conservation Lab. Students visited the lab and were able to learn about the science of

preserving items that have been on the seafloor for almost 300 years and see actual artifacts from Blackbeard's flagship during the different stages of conservation.

Kristi Walters
Owner
Big Bear Science
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Ward, Gyles. *Turtle Trouble: Engaging Students in Real World Research, the Schutte STEM Enrichment Program*

The session would present an easy way to provide educators with a format to use with local research institutions to implement a program to engage students in real world research. The session would start with an informal presentation of why we need to give students these research opportunities in HS and how we started the process. I would have numerous sample posters and a format that they can use to apply to any institution. I would present the way to make posters and strategies to get and keep students engaged.

Meghan Ward
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Ashley Hall School
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Wehunt. *Teaching Your Students to Manage a Global Fishery*

I describe the three parts of the unit as I teach it. First I discuss Tragedy of the Commons and how the ocean is the current commons. Then I show an activity I use with the students to get them to understand fisheries and commons connection. Finally I share the rules of the culminating activity and share the excel programs I designed for the final activity.

David Wehunt
Teacher
Soddy Daisy High School
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Wells. *Effective Lessons for the Ocean Classroom*

In over 30 years of ocean education, my students and I have conducted a diverse number of activities. Many teachings are active, hands on/minds on lessons, designed to create long-term durable memories for the students. However, memories are not enough. With our planet in peril, ocean-educators need to support the development of students who will become the "stewards of the seas". In my praxis as an ocean educator, I have fine-tuned several important lessons for the development of student's ocean literacy. Within this presentation, I will focus on

three main themes, Ocean Cruises, The Intertidal Zone and Classroom/Laboratory Activities.

Within the Ocean Cruise section, I will review two types of cruises in which students from my school have participated. The first is an introductory ocean ecology education cruise and the other, a shark-tagging adventure. Both of these activities offer unique opportunities for learning and contain several pros and cons.

The Intertidal Zone, my personal favorite location, offers the students the ability to examine diversity, zonation, marine plastics, population biology, invasive species, and ecological niches. To complete tasks promptly, I have participants review a website that details the on-site planned activities. Using standardized techniques provides a window into the world of scientists who study this unique site of ecological transition. The intertidal zone is an exceptional location for field work, social learning, and it always has a great supply of exciting discoveries.

To conclude, I will present several activities that engage learners and develop an understanding of the physicochemical properties of the ocean. Ocean acidification and the warming ocean are of prominent global concern. I have two activities which have a lasting impact on students understanding of the anthropogenic changes currently occurring in the oceans.

For a review of the lessons within this presentation, I encourage you to visit this website, for support materials and photos:

<https://sites.google.com/a/nlesdonline.ca/wells/home/nmea>

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Wharton, Bader. The Association of Zoos and Aquariums is a 230+ institution professional organization dedicated to the “advancement of zoos and aquariums in the areas of conservation, education, science, and recreation.” AZA is the preeminent international accrediting body for zoos and aquariums, holding them to the highest standards of animal care, education, and conservation science. AZA institutions reach over 185 million visitors every year, more than the attendance of the NFL, NBA, NHL and Major League Baseball combined. For the first time, AZA institutions have come together to leverage their massive collective expertise, experience, and audiences to halt the slow walk to extinction through the AZA SAFE Initiative. SAFE (Saving Animals From Extinction) takes a “One Plan” approach that brings together stakeholders from inside and outside a species’ natural range to create a single, collaborative and interdisciplinary conservation plan that combines research, community engagement, policy action, and field conservation projects. AZA has selected ten signature species (or species groups): African penguins, Asian elephants, black rhinoceroses, cheetahs, gorillas, Western pond turtles, sea turtles, sharks/rays, and vaquita porpoises. Several of these species are

significant components of NMEA member messaging and curricula.

Recognizing the scope and influence of their audiences, AZA has made Public Engagement a priority project within each of the ten species' Conservation Action Plans (CAPs). Reaching over 185 million visitors, AZA professionals can have a powerful impact with clear, consistent messaging about the threats facing species in the wild and the specific conservation actions that can be taken by citizens. Member institutions are leaders and convening spaces within our communities that can influence personal behavior, community actions, and even legislation.

The SAFE initiative is still young. CAPs have only been completed for a few of the original ten signature species. SAFE leadership is looking to their key stakeholders and communities (including, and especially marine educators) for key messages and strategies for supporting the conservation of these critical species. In this session, participants will learn the basics about AZA and SAFE and work in discussion groups with the Public Engagement Coordinators from the Sharks/Rays CAP and the Vaquita CAP to brainstorm and strategize key messages and actions that will contribute to the development of national and international messaging and actions for these species groups. This is important foundational work that will have a meaningful influence on how each of these conservation plans will be executed.

David Bader
Director of Education/ President Elect NMEA
Aquarium of the Pacific
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Wojcieszek, Borowiak. Teaching large groups of students has always been difficult, especially when the complexity of a learning process and different modes of learning are taken into account. Additional difficulties arise when an educator does not have much time to establish rapport with the audience or, in case of young children (3-6 years), to develop a bond that facilitates communication and therefore learning. As a result, making informal marine education effective and meaningful is a challenge.

Although, VAK (visual, auditory, kinesthetic) modes of learning approach is widely discussed or even controversial, it still provides us with a broad set of tools that help marine educators at the Gdynia Aquarium reach and educate large groups of visitors. The proposed workshop was designed to help educators engage most senses in the teaching-learning process and help them effectively pass their knowledge on to diverse audiences. With examples and exercises developed based on our own experience, ranging from working with school students of various background, through fostering integration of local ethnic groups to handicapped students education, we present our VAK approach to informal marine education.

The workshop is designed for max 40 people. Before attending the workshop, each participant will be asked to take a VAK test (provided by the workshop organizers), in order to assess their dominating learning style. The workshop will consist of a series of exercises highlighting the

difficulties, as well as advantages of visual, auditory and kinesthetic cues involved in teaching and learning processes.

Workshop outline:

1. I see sea – visual presentations in marine education
2. I hear sea – does the audience understand when we talk?
3. I become sea – using your body in teaching marine science
4. Summary and final mini-project

The workshop requires both team and independent work. Active participation such as public speaking, reading and performing is a crucial part of most of the exercises. The participants will receive workshop packages that will include a worksheet and series of images and stickers to lead them through all exercises.

Wu, Yen. *How to Measure Student Affection of Ocean Literacy Survey*

The ocean literacy survey is an important topic for promoting ocean literacy in the world. Taiwan Marine Education Center established in 2013 which was sponsored from Ministry of Education, Taiwan. The purposes of the center are (1) Cultivating marine specialists and raise citizens' marine knowledge. (2) Constructing an integrated service platform to assist Ministry of Education to integrate, analyze research, propose, and promote the related marine education policies. Besides, the intuition aims to coordinate the development of local marine education and to ensure it is stable and sustainable. (3) Building up (a) the estimated mechanism of labor supply and demand; (b) the transformation mechanism of special marine knowledge into general education; (c) the sustainable integrated coordination institution of marine education.(4) Position as a national institution to Integrate Ministry of Education and local government marine related resources. In 2015, Taiwan Marine Education Center conducted the first national ocean literacy survey from grade 6 and grade 9 students. The review of the survey lead to some problems need to be solved. In this session, we would like to discuss about "How to measure student affection of ocean literacy survey". The procedure includes:

1. 2015 Taiwan ocean literacy survey result.
2. The future planning of ocean literacy survey in Taiwan.
3. The problems of the national ocean literacy survey.
4. Open discussion of ocean literacy affection survey.

The session expect to raise up the practical problem of Taiwan ocean literacy survey in 2015 and discuss the solution to propose a better measurement of ocean literacy. The results will be very important to all the countries would like to promote marine education or conduct ocean literacy survey.

Chin-Kuo Wu
Professor/ Director

National Taiwan Ocean University Teacher Education Center /Taiwan Marine Education Center

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Yen, Chang. *Marine Micro World: Observing Marine Microorganisms and the Relationship Between Environmental Pollution in Intertidal Area*

This project based on the marine popular science education and ocean literacy principles which using mobile microscope to observe the marine microorganism and the relationship between environmental pollution in intertidal area. The ocean literacy campaign take marine education seed teachers to understand the marine microorganism osmotic balance mechanism and marine microorganism of ocean literacy concept principle 6 and principle 7. Collocation with mobile microscope and personal mobile devices, leading participants to observe the microorganism in ten intertidal area. The observation will upload to the marine education social network and discuss the analysis results and feedback. The project also help the marine educators to use the project to assimilate marine science education into the curriculum. The results expect to inspire marine educators and their students' marine interests, proenvironmental behavior intention and ocean stewardship.

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