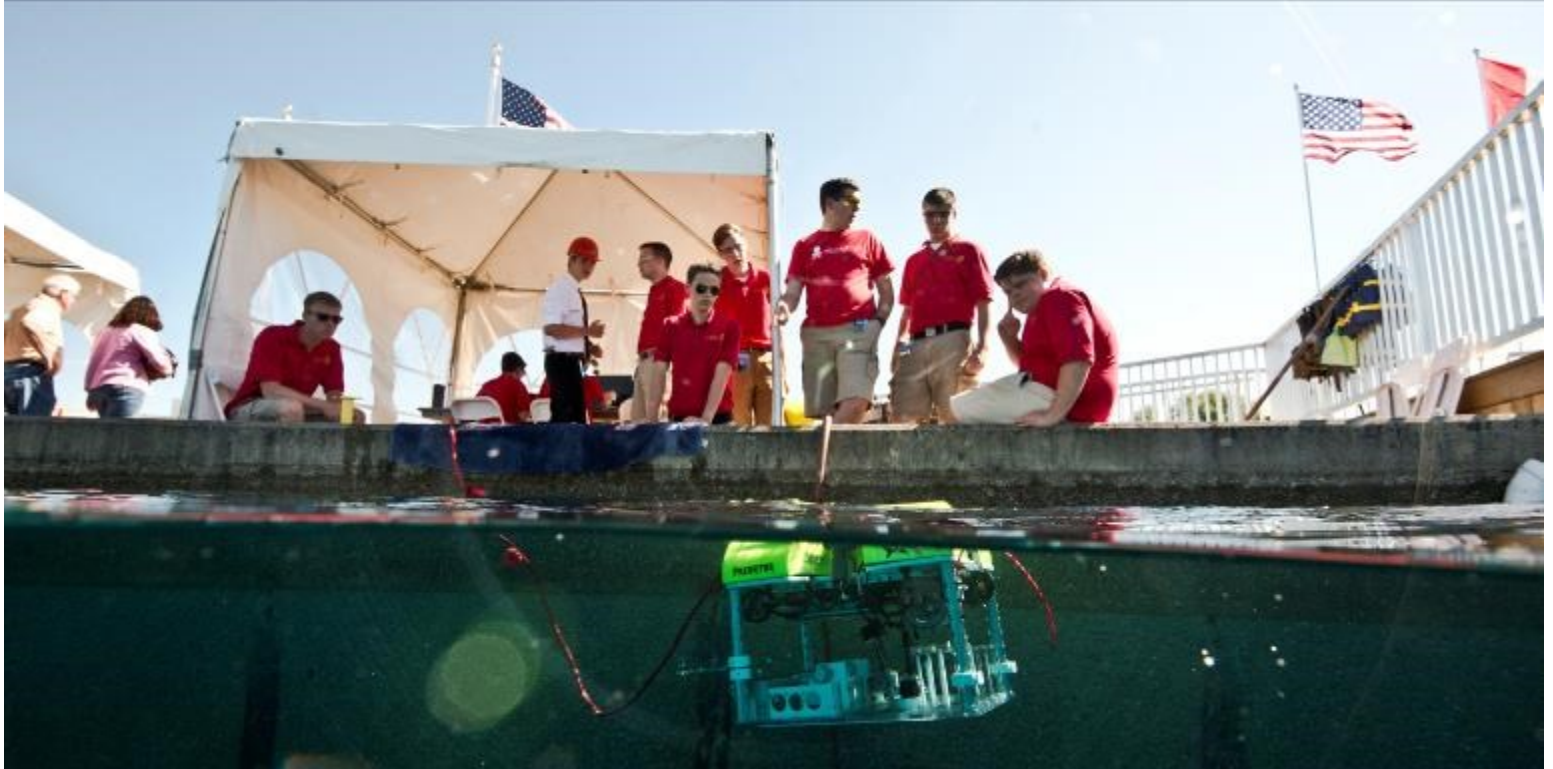




# NOAA

National Oceanic and Atmospheric Administration



# NOAA EDUCATION ACCOMPLISHMENTS REPORT Fiscal Year 2014



### On the Cover

**Top:** Students showcase the robot they designed for underwater exploration in Thunder Bay National Marine Sanctuary at the Annual International Student ROV Competition

**Bottom Left:** Students conduct research with the Seven Tepees Youth Program at the Gulf of the Farallones National Marine Sanctuary.

**Bottom Middle:** A San Francisco Bay Area fisherman displays yesterday's catch to teach a classroom of students about rockfish ecology.

**Bottom Right:** Students snowshoe to collect winter water quality data with their teacher and staff from the Lake Superior NERRS and Fond du Lac Resource Management.





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Above: Middle school students gain STEM skills and learn about maritime heritage at the Monitor National Marine Sanctuary.


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Above: A young girl goes ice fishing for rainbow trout in Alaska as part of the Kachemak Bay NERRS Families in Nature fishing program.

Right: Enjoying the view during the Angel Island in San Francisco Bay overnight trip with Seven Tepees Youth Program.

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## Letter from the Director



**Above:** At Seattle's NOAA Science Camp, a camper separates bones from a marine mammal diet sample.

**Below :** Educators participating in the Climate Change and Traditional Environmental Knowledge workshop at Norrie Point Environmental Center learn about fish species past and present by seining (and releasing) fish samples.



### **Dear Friends and Partners of NOAA Education,**

NOAA is a global leader in Earth system science and our observations, forecasts, and assessments affect millions of American's every day. It is the mission of NOAA education to use our information and expertise to build an environmentally-literate public and develop a diverse workforce skilled in science, technology, engineering, and mathematics.

An environmentally-literate public is crucial to the health and continued success of our nation to ensure informed decision-making regarding the many environmental problems and issues that we currently face, including severe weather, climate change, and threatened ecosystems and coasts. In 2014 NOAA oversaw the growth of new weather and climate preparedness programs, stewardship efforts, and professional development training for students and educators across the country.

The America COMPETES Act has given NOAA a broad mandate to educate the public about ocean, coastal, Great Lakes, and atmospheric science, service, and stewardship. These education efforts are facilitated across NOAA, often with the collaboration and support of external partners, to advance NOAA's core missions of science, service and stewardship by implementing unique, cutting-edge, and innovative formal and informal educational programs.

Our success would not be possible without the many fruitful, ongoing partnerships with educational institutions, business, organizations, and individual volunteers who work tirelessly to support our vision of a scientifically-informed nation. We thank you for your time, effort, and interest in NOAA Education and are excited to continue working with you in the future as we grow and adapt to the challenges we face.

We are excited and proud to share examples of NOAA's education efforts over the past year. These stories highlight the broad scope and effectiveness of our far-reaching efforts to promote environmental literacy and inspire future generations of earth scientists. We are proud of what we accomplished in 2014.

Sincerely,

Louisa Koch, Director, NOAA Education



# Education in Support of NOAA's Mission

## NOAA's mission :

*To understand and predict changes in climate, weather, oceans, and coasts,*

*To share that knowledge and information with others, and*

*To conserve and manage coastal and marine ecosystems and resources.*

## A Mandate to Educate

Education investments are a vital component of the National Oceanic and Atmospheric Administration's (NOAA's) science, service and stewardship functions. NOAA programs invest resources in education activities as required by legislation and as a means of meeting their broader program mission. The mandate to educate appears in authorizing legislation\* for individual programs such as the National Sea Grant College Program Act, the National Marine Sanctuaries Act, and the Coastal Zone Management Act, dating back to 1966. Complementing these mandates, the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education and Science (COMPETES) Act, most recently reauthorized in 2011 (P.L. 11-358), provides NOAA with a broad, agency-wide authority for education. Combined, they form a robust education portfolio that takes advantage of NOAA's unique assets.

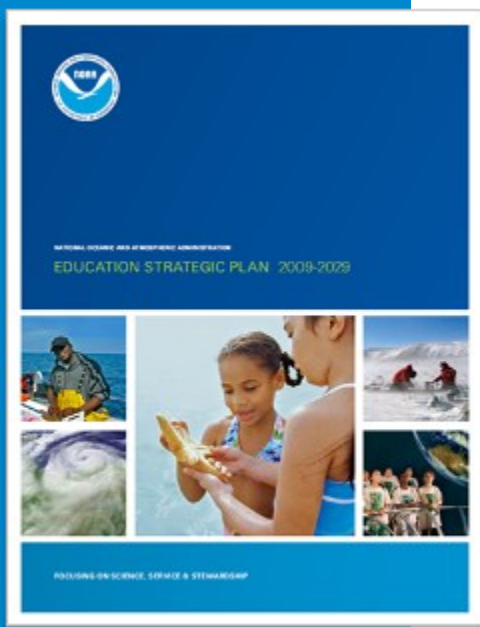
In this report, we highlight examples from across the Agency that illustrate how education investments support NOAA's mission in fiscal year 2014 (FY14, October 1, 2013 – September 30, 2014).

## NOAA's Goals in Education

As required by the America COMPETES Act, NOAA developed an agency-wide education strategic plan. The NOAA Education Strategic Plan supports the Agency's mission with the following two goals:

- 1. Environmental Literacy:** An environmentally literate public supported by a continuum of lifelong formal and informal education and outreach opportunities in ocean, coastal, Great Lakes, weather, and climate sciences.
- 2. Workforce Development:** A future workforce, reflecting the diversity of the Nation, skilled in science, technology, engineering, mathematics, and other disciplines critical to NOAA's mission.

\*Coral Reef Conservation Act (P. L. 106-562); Coastal Zone Management Act (P. L. 109-58), § 1461, National Estuarine Research Reserve System; Magnuson-Stevens Fishery Conservation, and Management Act (P.L. 109-479); National Marine Sanctuaries Act (P.L. 106-513, Sections 1431 et seq.); National Sea Grant College Program Act (P. L. 107-299)





# Education in Support of NOAA's Mission

## The importance of partnerships

NOAA's accomplishments in education could not be attained alone. NOAA works with hundreds of federal, academic, nonprofit and private partners, all of whom contribute to the common performance measures. Throughout this report, we highlight partners to acknowledge the broad array of organizations that work with NOAA toward science, service, and stewardship. Through these partners, NOAA creatively leverages assets to extend the Agency's reach.



Above: Small groups of students applied their new-found skills and knowledge learned at the Hawaii Fisheries Science Camp in a culminating Challenge Event.

In conjunction with the strategic plan, NOAA has been focused on developing the capacity to demonstrate effectiveness of NOAA education activities and position education programs to meet strong accountability requirements. As part of this process, NOAA collects common measures across major education programs to communicate the reach of our investments. Here are NOAA-wide accomplishments from FY14\*:

### Support an environmentally literate public

- Over **108 million people** visited museums, zoos, aquariums, and other informal education institutions hosting NOAA supported exhibits or programs. NOAA partners with informal learning institutions to make NOAA sciences, data, and other information widely available to the American public through interactive exhibits and programs.
- Over **420 institutions** increased educational capacity through NOAA-funded interpretive/educational centers, exhibits or programs. These institutions are uniquely equipped to make the distinct and significant resources of our mission-driven, scientific agency accessible to the American people.
- Over **2.6 million** lifelong learners participated in NOAA supported informal education programs. Such programs aim to enhance understanding and use of ocean, coastal, Great Lakes, weather, and climate environmental information with the goal to promote stewardship and increase informed decision making.

- Nearly **570,000 preK-12 students** participated in NOAA supported formal education programs. For America to be competitive in the global marketplace, we need bright, creative minds. Our job is to see that we give as many young people as possible many opportunities to learn, stretch in new directions, develop critical thinking, ingenuity, and scientific expertise.

\* Estimates represent our best available data when this report was published. Performance measures from FY14 are not considered final until FY15.





# Education in Support of NOAA's Mission



Above: 8th grade students learn about weather, plate tectonics, and global circulation using NOAA's Science On a Sphere as a visual aid.

Right: NOAA's National Hurricane Center and the 403rd Wing's 53rd Weather Reconnaissance Squadron, promotes hurricane awareness during the Caribbean hurricane awareness tour attended by more than 4000 people.

- Over **36,000 educators** participated in NOAA supported professional development programs. Educating our educators in science, technology, engineer, and math (STEM) and other disciplines will help them understand their world and provide useful scientific advances to society. In turn, they prepare learners with the critical thinking skills they need to get better jobs with better pay for a brighter future.

- Over **25 million people** visited NOAA Education websites that support a broad spectrum of educational activities and provide critical information to the Nation. NOAA's products and services help explain real-world issues such as climate change, oil spills, extreme weather and weather safety, appropriate management of coastal environments, and overfishing.

## Develop a diverse workforce

- Over **3,400 postsecondary students** trained in NOAA-mission related sciences through NOAA-funded higher education programs that prepare students for career paths at NOAA and related organizations. Through scientific rigor, cutting-edge research, and integrated education, NOAA is committed to developing and attracting the next generation of scientists who will drive the scientific and technological innovation our country needs to stimulate the economy and create jobs.

- Over **580 postsecondary degrees** in NOAA-related disciplines awarded to students who were supported by NOAA in higher education programs. NOAA is proud and pleased to play a role in the effort to prepare the next generation of scientists for tomorrow.





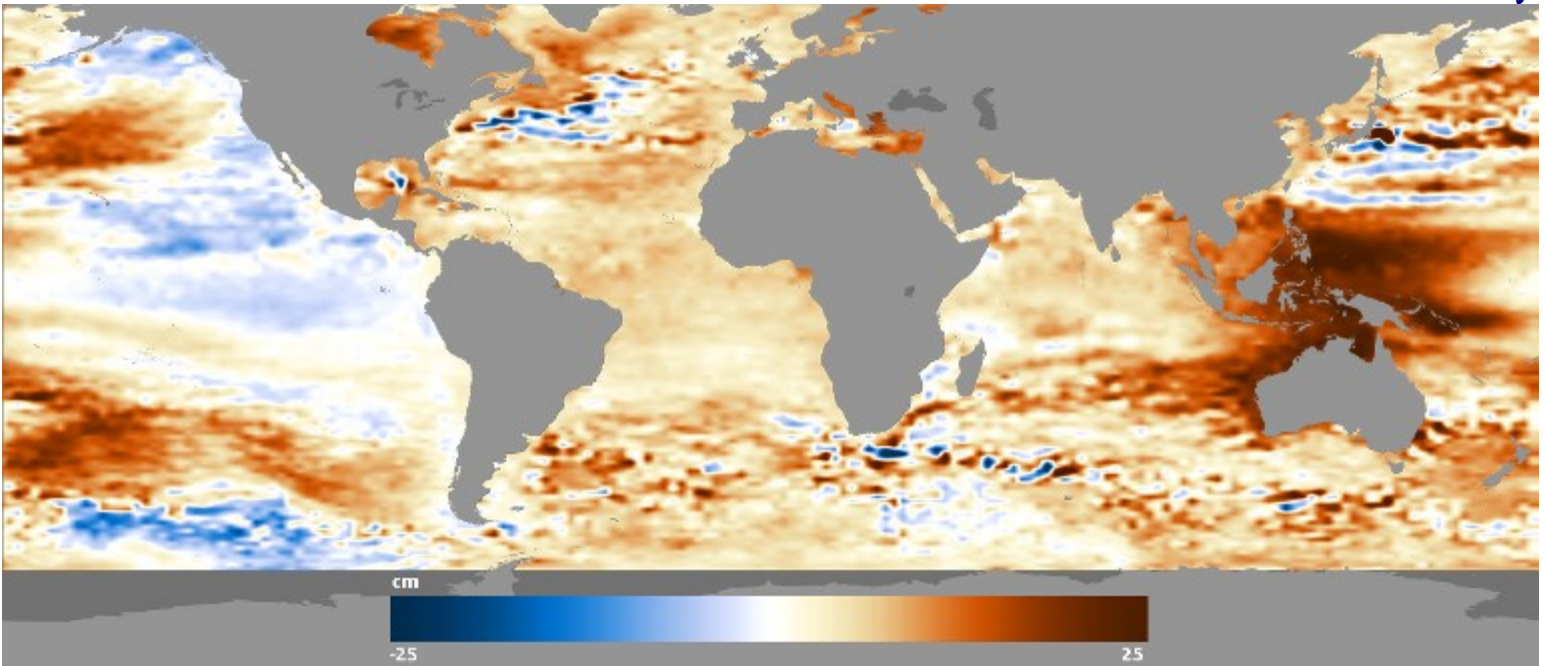
# NOAA Education Goal 1: Environmental Literacy

**An environmentally-literate public supported by a continuum of lifelong formal and informal education and outreach opportunities in ocean, coastal, Great Lakes, weather, and climate sciences.**

NOAA Education's goal of fostering an environmentally-literate public is an important component of achieving NOAA's mission. NOAA defines an environmentally-literate person as someone who has a fundamental understanding of the systems of the natural world, the relationships and interactions between the living and non-living environment, and has the ability to understand and utilize scientific evidence to make informed decisions regarding environmental issues. An educated public is needed to serve as stewards of the natural environment, take appropriate action in the case of severe weather, and participate in the national discussion about complex issues such as climate change. NOAA plays a key role in advancing this understanding through its educational programs, products, outreach efforts, and collaborations, supported by the agency's extensive breadth and depth of scientific resources.

In the following section, we share examples of how environmental literacy supports and promotes the broader NOAA mission by organizing our FY14 accomplishments according to the Agency's strategic goals in the Next Generation Strategic Plan (2010):

-  Climate Adaptation and Mitigation
-  Weather-Ready Nation
-  Healthy Oceans
-  Resilient Coastal Communities and Ecosystems



## Education in Support of Climate Adaptation and Mitigation

Above: Total sea level rise, in cm, from 1993-2013 shown in NOAA View. Dark red indicates a large rise in sea level, while blue indicates regions where sea level has fallen. Data was collected using NESDIS satellites by the [NOAA Laboratory of Satellite Altimetry](#)

### Informing society to anticipate and respond to climate and its impacts

Here we highlight NOAA's education efforts in increasing climate literacy through funding grants, hosting workshops and professional development training, collaborating between agencies, and promoting stewardship. NOAA's climate education engages communities to prepare them for risks associated with climate hazards and reach NOAA's Next Generation Strategic Plan's (NGSP) objective of, "a climate-literate public that understands its vulnerabilities to a changing climate and makes informed decisions."

The NGSP states that NOAA cannot accomplish this goal alone and must engage with interagency, academic, and private sector partners. NOAA's education efforts towards this goal have included more than 50 external partners in these highlighted stories alone. Because climate change is already having profound implications across society, climate literacy is a key factoring in preparing for, responding to, and mitigating the local and regional impacts of these global changes.



## Education in Support of Climate Adaptation and Mitigation

### Partners include:

Acuario de Veracruz,  
Mexico  
Audubon Aquarium of the  
Americas  
Texas State Aquarium  
The Connection Partners,  
Inc.  
The Dauphin Island Sea  
Lab  
The Harte Research  
Institute for Gulf of Mexico  
Studies, Texas A&M  
University, Corpus Christi  
The Institute for Marine  
Mammal Studies  
The University of Southern  
Mississippi Marine  
Education Center

**Below:** The Florida  
Aquarium hosts an activity  
for participants to learn  
about ocean acidification.

### **Aquariums promote ocean and climate literacy in the Gulf of Mexico region**

The Climate Change Community Outreach Initiative Project, funded by NOAA's Environmental Literacy Grants Program, enabled its collaborators to explore a Gulf of Mexico-wide approach to engaging audiences in climate content. Because the United States Geological Survey projects that at least 55% of the Gulf Coast shoreline is at very high risk from sea level rise, it is critical to educate and inform the communities and the five million people that live in this region of the potential hazards and consequences of climate change and accompanying sea level rise. With evaluated programs, exhibits, and websites in place, six aquariums each developed content emphasizing local ecosystems and the consequences of climate change, tailoring stewardship activities to address the communities specifically.

Through this project, the Florida Aquarium, Audubon Aquarium of the Americas, Dauphin Island Sea Lab, Institute of Marine Mammal Studies, Texas State Aquarium, and Veracruz Aquarium employed the use of a digital game, social media, outreach events, meet-the-scientist talks, and storytelling to open the doors to communication to help their audiences contribute to locally meaningful climate change action. By focusing the content on a local level, the program was able to engage individual communities across the Gulf Region on a more personal level, increasing the effectiveness of the project. The

5-year project culminated in 2014 and supported 20 workshops to build formal and informal educators' capacity to deliver climate-related messages. The workshops were attended by 360 educators, and over 14,000 people have been engaged in outreach events through the project in 2014.





## Education in Support of Climate Adaptation and Mitigation

### Partners include:

National Wildlife Federation

Smithsonian Museum of Natural History

University of Maryland, Baltimore County

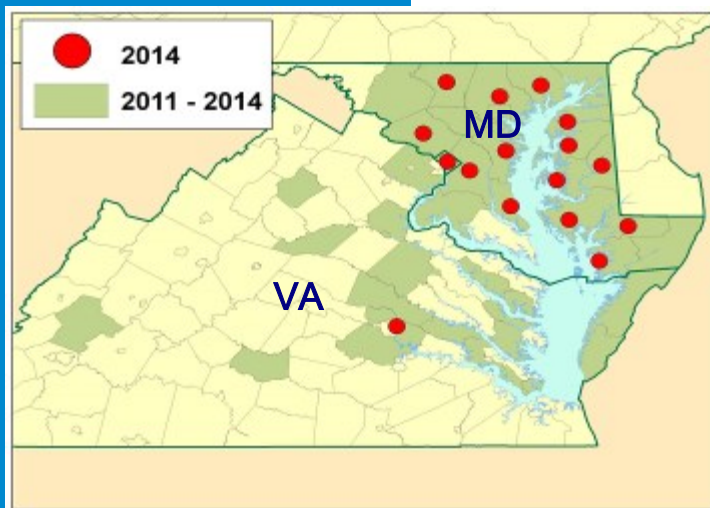
### **NOAA Environmental Science Training Center provides professional development opportunities for environmental educators in the Chesapeake Bay region**

The NOAA Environmental Science Training Center (ESTC) provides training and learning experiences for environmental education professionals in the Chesapeake Bay region to deepen their scientific understanding of significant local environmental issues and

raise awareness of NOAA and partners' science, data, and education resources. The primary audience for ESTC programming is Bay Watershed Education Training (B-WET) grantees and their education staff. ESTC programming strives to increase the effectiveness of the investment of grant funds by supporting not only the broadened knowledge base of grantee organizations but also the development of rigorous education programming and connections amongst the environmental literacy community. In 2014, the ESTC-with partners from the National Weather Service,

National Climatic Data Center, Climate Program Office, National Ocean Service, and the NOAA Office of Education- developed and implemented two multi-day workshop series, "Weather-Ready Chesapeake" and "Chesapeake Bay in the Anthropocene Epoch".

The Weather-Ready Chesapeake Workshop Series brought together weather science professionals and educators to build understanding of weather in the region and the many ways it influences personal and professional lives. The Chesapeake Bay in the Anthropocene Epoch series explored how humans affect the Chesapeake, on both a local and global scale, and how changes in climate, land use, human populations, and more will have profound effects on our approach to restoring, conserving, managing, and teaching about the Chesapeake Bay and its watershed. These programs directly support NOAA's mission areas of a Weather-Ready Nation and Healthy Communities and Economies. (cont'd p. 14)



Above: Impact sites of Environmental Science Training Center programs around the Chesapeake Bay region.



## Education in Support of Climate Adaptation and Mitigation

Right: Environmental Science Training Center Workshop participants learn about measuring elevation change in a coastal wetland.



Weather-Ready Chesapeake and Chesapeake Bay in the Anthropocene are the latest workshops in the ESTC's ongoing efforts to connect environmental education professionals with NOAA's science and expertise. Since ESTC's establishment in 2010, it has hosted over 500 participants in a wide variety of programs, including climate change, fisheries issues, restoration science, and weather. Every ESTC program engages scientists from NOAA and partner organizations to prepare content about their work, identifies educational opportunities, and develops relationships with the environmental education community to support the integration of content in education programming. As a result of these trainings and the relationships developed between the science and environmental education communities, ESTC program participants have integrated NOAA and our partners' science, data, and expertise within their programming for teachers and students, increasing their understanding of the Chesapeake Bay and its relationship to those who live in the region.



# Education in Support of Climate Adaptation and Mitigation

## Partners include:

Climate Literacy and Energy Awareness Network (CLEAN)  
 College of Exploration  
 International Arctic Research Center  
 Museum Institute for Teaching Science  
 NASA Langley Research Center  
 NASA's Innovation in Climate Education  
 National Center for Science Education  
 Old Dominion University, Virginia Space Grant Consortium  
 Paleontological Research Institution  
 The Polar Learning and Responding Climate Change Education (PoLAR) Partnership  
 TERC  
 Will Steger Foundation

Right: The NCA teaching resources page of Climate.gov

## NOAA developed digital guides for educators to highlight key concepts from the 2014 National Climate Assessment

NOAA's Climate Program Office (CPO) partnered with leading climate education networks to connect educators to the resources they need in order to teach about climate change under new science standards. The National Climate Assessment (NCA), released in May of 2014, offers a wealth of actionable, cutting-edge science regarding the causes, effects, risks, and possible responses to climate change. CPO and partners developed a series of guides for the Climate.gov Teaching Climate section that highlight key aspects of the NCA for teachers. These guides also connect the NCA to the Next Generation Science Standards (NGSS), the most current, research-based method of educating students in Science, Technology, Engineering, and Math (STEM) and preparing them for careers in those fields.

The NGSS were released in 2013 and have quickly been adopted by 12 states and the District of Columbia, with more on the way over the next few years. The NGSS establish high benchmarks for delivering effective STEM education. Curriculum providers and professional developers face the challenge of providing the instructional support necessary to make the NGSS accessible to educators. Under the NGSS, climate change is a disciplinary core idea for all grade levels, including an emphasis on anthropogenic, or "human-caused" effects,

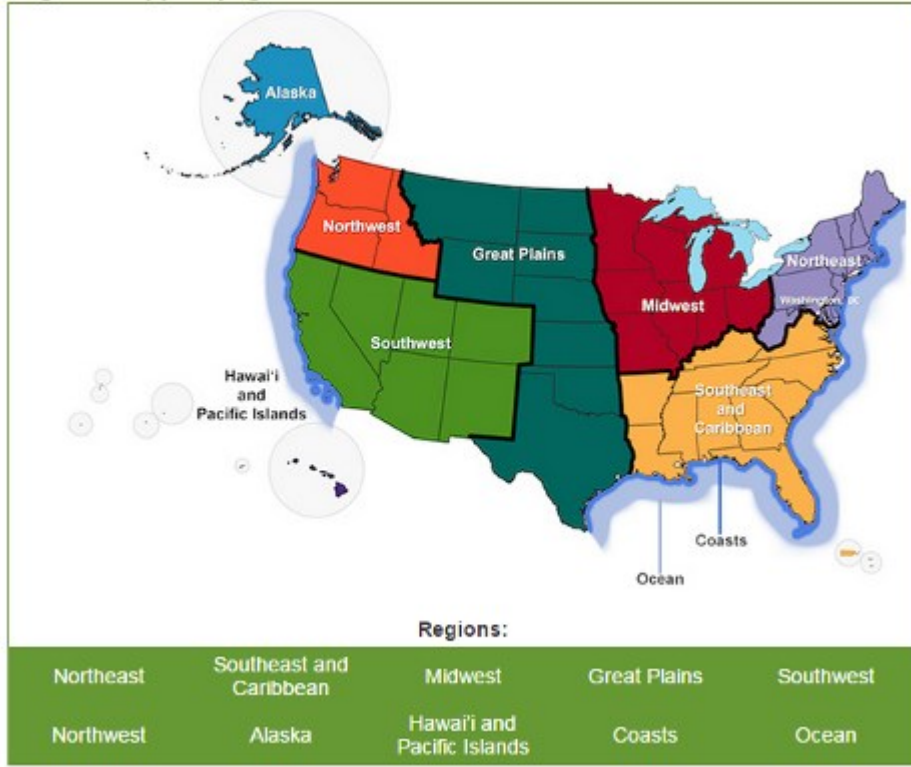
marking the first time that climate has been included in U.S. science curricula. The novelty of the subject matter combined with the complexity of climate science creates an additional challenge for educators seeking to integrate climate into their classrooms. (cont'd p. 16)





# Education in Support of Climate Adaptation and Mitigation

Regional support pages



Above: Climate.gov provides support pages that highlight regionally specific education resources of the newly developed National Climate Assessment guides to help teachers incorporate relevant concepts into the classroom.

The NCA summarizes current and future impacts of climate change on the U.S. Recognizing that the NCA is a resource that emphasizes integral core ideas to the NGSS but does not include further instructional support, the NOAA Climate.gov team and partners identified NGSS performance expectations that connect with the NCA and identified sections and figures in the NCA to support those performance expectations. The NCA learning pathways support educators in exploring the assessment as a supporting resource for those implementing the NGSS. This report collects, integrates, and assesses

observations and research from around the country, helping teachers and their students to see what is actually happening and understand what it means for our lives, our livelihoods, and our future. This report advances our understanding of climate change and the need for the educators, their students, and their families to prepare for and respond to its far-reaching implications. Combined with the research-based effective learning standards in the NGSS, the NCA's content provides a strong foundation for building a climate-literate nation.





## Education in Support of Climate Adaptation and Mitigation

### Partners include:

American Meteorological Society  
National Science Teachers Association  
Project Indigenous  
U.S. Forest Service  
U.S. Ice Drilling Program

### NOAA Climate Stewards project grows by 50%

NOAA's Climate Stewards Education Project (CSEP) provides opportunities for local, state, and regional education partners to work with NOAA in responding to environmental challenges and inspire our youth to pursue careers in science, technology, engineering, and mathematics (STEM), creating a more scientifically literate public while developing the next generation of scientists and educators. In 2014, CSEP grew from 200 to 300 educators, and these members learned ocean and climate science and joined a collaborative online learning community for active stewardship projects.

CSEP provides many in-service opportunities that include online and face-to-face seminars, symposia, short courses, and mini-conferences. Upon successful completion of a climate stewardship project, along with 15 training hours (professional development), the educator is awarded a "climate steward" certification. Educators from K-12 schools, colleges, and informal institutions now represent 43 states, Washington D.C., Guam, the U.S. Virgin Islands, and Panama. CSEP educators completed 2,060 hours of professional development during 2014 through webinars, book discussions, and workshops.



Above: Educators learn about estuary vegetation and invasive species at a climate workshop on the Hudson River at Norrie Point Environmental Center. Climate Stewards educators learned about regional impacts of past and present climate change and the Project Indigenous staff provided context about the history and importance of stewardship.

Past participants report that CSEP has positively affected their work in many ways, including increasing the understanding of climate science by providing access to climate science experts, encouraging additional educational approaches, and acquiring support from NOAA and their local organizations. CSEP members have applied their training to develop teaching modules, redirect projects toward a climate-ocean-weather focus, organize workshops, and plant gardens. In the classroom, these educators have engaged students by adding climate topics to earth science and scientific method courses, participating in a global carbon footprint study, and integrating real-time data into their lessons. CSEP has empowered educators to more effectively communicate climate science and engage students in environmental stewardship.



# Education in Support of Climate Adaptation and Mitigation

## Partners include:

NASA Langley Research Center

National Science Foundation Directorate for Geosciences

## **NOAA, NASA, and NSF convene climate change education grantees to enhance collaboration and collective impact**

Over 125 grantees representing 75 projects focusing on climate change education attended the 3rd Annual Tri-agency Climate Change Education Principal Investigators (PI) meeting. PIs funded by NASA, the National Science Foundation (NSF), and NOAA's Environmental Literacy Grants, including leading scientists and educators in the field, came together to share their approaches and findings. The meeting represents a key element in an overall strategy to facilitate synergy and collaboration among grantees to expand their projects' impacts and to leverage results. Attendees learned about current climate change science findings, how communities are responding to those findings, and how projects can be scaled up and sustained.



Above: Grantees attending the NOAA-NASA-NSF Climate Change Education Principal Investigators meeting consider the implications of the science and policy panel.

Embracing the spirit of the America COMPETES Act, which encourages coordination of federal science, technology, engineering, and mathematics (STEM) education activities and programs, NOAA, NASA, and NSF have been working together to increase the impacts of projects focused on climate literacy and education in formal and informal learning environments through fostering collaborations among awardees. As a result, a strong national network for effectively presenting climate science to diverse audiences has been created. Highlights of the FY14 grantee meeting included presentations by Dr. Don Wuebbles of the University of Illinois on the Working Group I contribution to the Intergovernmental Panel on Climate Change 5th Assessment Report, Dr. Don Boesch of the University of Maryland on President Obama's Climate Action Plan, and Dr. Robert Summers, Secretary of the Environment and Chair of the Maryland Climate Change Commission, on state-level planning for climate change. The cross-agency discussions enabled by the meeting have yielded new collaborations and synergies that have produced a more cohesive federally funded portfolio of projects with a greater overall impact than any one agency could achieve on its own. Furthermore, this effort has directly supported NOAA's efforts to create an informed society anticipating and responding to climate and its impacts.





## Education in Support of Climate Adaptation and Mitigation

### Partners include:

Anchorage School District  
Alaska Bureau of Land Management

California State University  
Campbell Creek Science Center, Anchorage, AK

Carteret County Public School System

Cooperative Institute for Research in Environmental Science, Boulder, CO

Grossmont College

Hardin School, Crow Indian Reservation

Henry Doorly Zoo and Aquarium

Institute of Arctic Research, University of Alaska, Fairbanks

Little Big Horn College

Montana State University  
Museum of Science and Industry

North Carolina Maritime Museum

Northern Illinois University

Oak Park Unified School District, Ventura County Office of Education

**Right:** Students and teachers participate in the Climate Change Student Summit.

### Students and teachers explore the science and impacts of climate change

Teachers and students from urban, suburban, and rural areas around the United States learned and shared the science and impacts of climate change through a series of professional development workshops and student summits. The workshops brought teachers up to date on the most recent climate science developments, a pressing need in the community, which textbooks alone cannot fill because they are updated and adopted periodically and typically lag behind the most recent information. Through professional development workshops for roughly 450 educators and 800 student presentations to their peers, this Environmental Literacy Grant-funded project integrated NOAA scientific data and other resources into classroom teaching and learning among students in grades 4-12.



This 5-year project concluded in winter 2014. Building off a pilot project that developed the program model, this project leveraged the scientific expertise of the NSF-funded Antarctic geologic drilling (ANDRILL) program, NOAA data, and other climate resources, to educate middle and high school teachers and their students about the science and impacts of climate change. The project was geographically diverse, reaching roughly 450 teachers and 800 students directly, and communities in Omaha and Lincoln, NE; Blacksburg, VA; Seattle, WA; Chicago, IL; San Diego and Ventura, CA; Bozeman, MT; Beaufort, NC; and Fairbanks, AK. (cont'd p. 20)



# Education in Support of Climate Adaptation and Mitigation

## Partners, continued:

San Diego Unified School District

Scripps Institution of Oceanography

University of Alaska, Fairbanks

University of Alaska, Juneau

University of California, San Diego

University of California, Santa Barbara

University of Colorado

University of Michigan

University of Nebraska, Lincoln

University of North Carolina, Institute of Marine Sciences

University of Washington

Virginia 4-H Youth

Virginia Cooperative Extension

Development

Virginia Bioinformatics Institute, Virginia Tech

**Top** : A student presents her research to her peers, parents, teachers, and scientists at the Omaha C<sup>2</sup>S<sup>2</sup>.

**Right**: Students at the North Carolina C<sup>2</sup>S<sup>2</sup> present on ocean acidification.



Professional development workshops prepared educators to integrate climate change topics into their classroom teaching using hands-on, inquiry-based activities that addressed climate and ocean literacy concepts through an Earth-systems approach. These same educators' students were then asked to investigate some aspect of climate change and share their knowledge at an ANDRILL regionally held Climate Change Student Summit (C<sup>2</sup>S<sup>2</sup>) attended by their peers, parents, teachers and scientists. This program contributed to NOAA's goal of a science literate public, as outcomes included improved knowledge about climate science concepts, as well as increased confidence of both the teachers and students in mastery of climate and ocean knowledge and communication skills.





## Education in Support of Climate Adaptation and Mitigation

### Partners include:

U.S. Agency for  
International Development  
U.S. Department of State

Below: Government leaders in Vietnam use a simulation to discuss coastal resilience and weather uncertainties.

### NOAA partners with the U.S. Department of State to test new climate education methods

NOAA is an international leader in climate science, and in partnership with the Department of State, NOAA's National Ocean Service (NOS) education developed and piloted training materials about climate science and adaptation for leaders in Vietnam provinces. The project was started in response to a request from Vietnam to the State Department for federal science specialists to work with the U.S. Embassy in Hanoi to utilize best practices of the U.S. in promoting climate literacy. The program consisted of a one-day pilot training for 70 top government officials from Thanh Hoa province and incorporated websites, resources, and new simulation strategies from NOAA and NOS, along with relevant local information and climate predictions for Vietnam. The country is one of the most hazard-prone countries in the Asia-Pacific region due to the combination of its long coastline, large coastal population, and geographic location. Training content included regional climate change, adaptation and mitigation strategies, disaster risk reduction, coastal resilience, and Green Growth, which is the sustainable utilization of natural resources to drive economic growth.



The workshop was a clear success, and pre- and post self-reporting assessments showed a significant growth in attendees' understanding of basic climate principles. Post workshop data showed that participants felt they understood better the causes of climate change, increasing from 48% with little or no knowledge (before) to 95% know and know well (after). The training met the expectations of 86% of respondents, and 100% of the participants believed that the training is necessary. In addition to the educational support provided to Vietnam, new strategies such as climate and coastal simulations were developed and tested that will be used to promote climate literacy among Americans in the summer of 2015.



## Education in Support of a Weather-Ready Nation

Above: Lightening strikes along the coast of south Florida.

### Preparing the Nation for severe weather-related events

In this section, we highlight examples of NOAA's efforts to inform and educate the public about the weather and weather-related events. These efforts include new and easily accessible data visualizations for understanding our planet, as well as programs that inform individuals and organizations about weather preparedness.

The entire country is subject to extreme weather events, and the National Center for Atmospheric Research has reported that \$485 billion of the country's GDP could be affected by weather. Weather-related events affect "economic activity in every state and every sector." Because of the wide-reaching effects, NOAA has attempted to engage as many communities, people and organizations as possible in an effort to understand and reduce risk and increase resilience following severe weather-related events. Improving environmental literacy is an integral component in building a Weather-Ready Nation by helping the Nation prepare for and respond to environmental threats that affect safety, health, the environment, economy, and security.





## Education in Support of a Weather-Ready Nation

### Partners include:

American Meteorological Society  
 American Red Cross  
 Center for Disease Control  
 COMET® Program  
 Federal Alliance for Safe Homes  
 Federal Emergency Management Agency  
 First Lego League  
 Insurance Institute for Business and Home Safety  
 International Association of Emergency Managers  
 National Emergency Management Association  
 National Environmental Education Foundation  
 National Weather Association  
 Plan!T NOW  
 The Weather Channel  
 United States Geological Survey

**Right:** Lt. Col. Keith Gibson interacts with students from Gilchrist Elementary School during the Tallahassee Hurricane Awareness Tour May 22, 2014, at the Tallahassee Regional Airport, FL.

### Building a Weather-Ready Nation: Better information for better decisions

In support of NOAA's strategic initiative of building a Weather-Ready Nation – community resilience in the face of increasing vulnerability to extreme weather and water events – NWS conducts an extensive education and outreach program. The devastating impacts of extreme weather events can be reduced through an improved understanding of hazards and how best to prepare for them. To address this need, in 2014 the National Weather Service (NWS) conducted over 9,000 education activities nationally, reaching over half a million (504,671) teachers, students, and school officials about weather, water and climate sciences, and safety preparedness. NWS education and outreach also supported the expansion of NOAA's recruitment to include the social science competencies needed for building a Weather-Ready Nation.

NOAA also recognizes it is essential to work collaboratively with external stakeholders across all levels of government, industry, non-profits, and academia. In February, 2014, NOAA launched the WRN Ambassador initiative to recognize organizations committed to working with NOAA in raising awareness about the WRN initiative. Over 1400 WRN Ambassadors promote WRN messages and themes to stakeholders and provide outreach content on various weather, water, and climate hazards. (cont'd p. 24)





## Education in Support of a Weather-Ready Nation



Above: Owlie Skywarn is the NWS's go-to owl for severe weather science and safety information. Follow Owlie on [Facebook](#) or meet him in person at a NOAA/NWS education outreach event.

Right: Owlie Skywarn pitches Weather-Ready Nation preparedness tips at a Washington Nationals baseball game.



In addition to the WRN Ambassadors initiative, NWS' hazardous weather and safety educational program, SKYWARN, had 73,928 people participate in a total of 1,904 classes at NWS offices across the Nation. The SKYWARN volunteer network has over 290,000 trained severe weather spotters who identify and describe local storms to inform quickly their local communities of potential hazards. SKYWARN information, coupled with Doppler radar technology, improved satellite data, and other resources has enabled the NWS to issue more timely and accurate warnings for tornadoes, severe thunderstorms, and flash floods. Proper training is necessary for the safety of the volunteers and to increase the speed and accuracy at which they can identify extreme weather events. Through these programs, the NWS is committed to improving the Nations' ability to prepare and respond to extreme weather events, decreasing the risk of monetary damage, reducing injuries, and potentially saving lives.





## Education in Support of a Weather-Ready Nation

### Partners include:

Cooperative Institute for Meteorological Satellite Studies at University of Wisconsin-Madison Space Science and Engineering Center

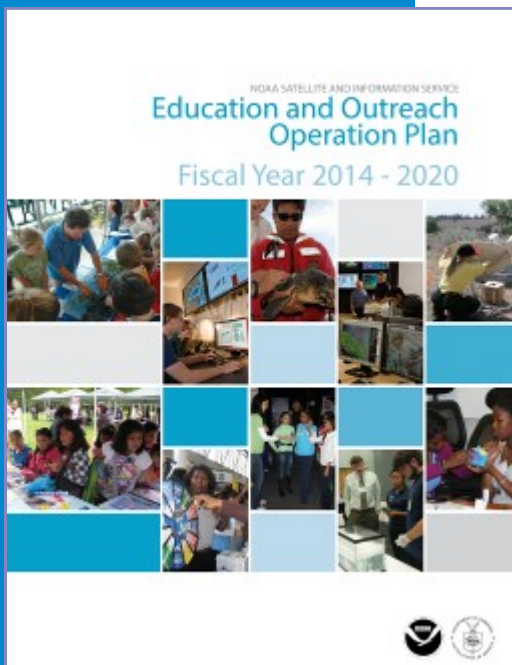
NASA Jet Propulsion Lab

**Below:** The NESDIS Education and Outreach Plan outlines how the education community can integrate next-generation satellite imagery and data into classroom activities.

### **NESDIS produces data visualization tools to create a scientifically informed public**

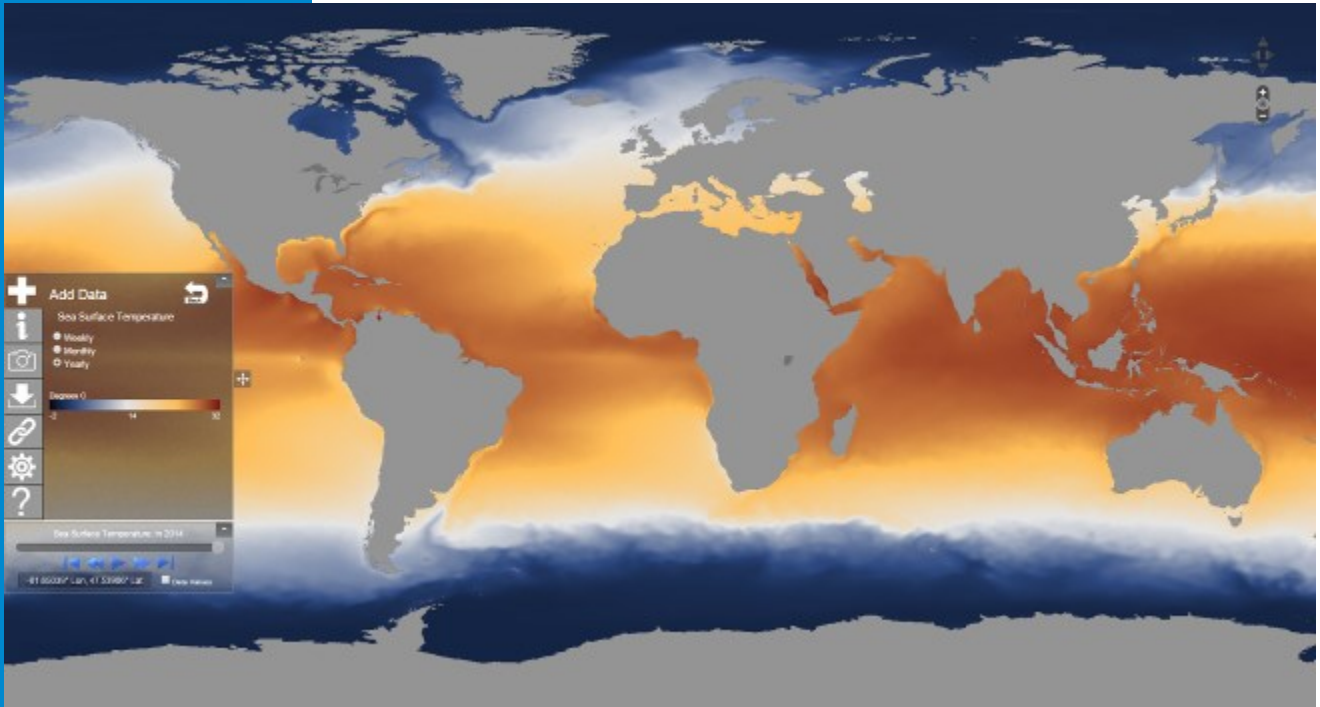
The National Environmental Satellite, Data and Information Service (NESDIS) takes the pulse of the planet and contributes to a Weather-Ready Nation by providing satellite observations necessary for reliable weather forecasting. NESDIS helps raise public awareness of NOAA's mission by promoting remote sensing and climate and atmospheric sciences through data visualization tools such as mobile and web apps that allow students, teachers, and the public to interact with NOAA's environmental data. NESDIS' goal is to incorporate next-generation satellite imagery, data and products into classroom activities and among the education community to increase understanding of hazardous weather events and changes in climate, so that information can help improve preparedness, response and resilience to such events.

NOAA View is an online data visualization tool that uses satellite data to give the public, educators, media, academia, and stakeholders throughout the Nation interactive access to NOAA environmental data, enabling unique views of the world's oceans, land, atmosphere, cryosphere and climate. NOAA View was featured in eight noteworthy media outlets last year, including SatNews, Climate Central, and the Washington Post and has significantly increased its available datasets since its release in late 2013. Previously, there was no good source of high quality data imagery from NOAA, and now over 1,000 people per day access the site, representing terabytes of data accessed per month. NOAA View has been introduced to a variety of communities and audiences via demonstrations at numerous conferences and museums including the National Science Teachers Association and the American Meteorological Society. This tool provides unique views of NOAA satellite data that promote understanding of Earth's weather and climate systems and makes previously difficult to access data available to everyone. (cont'd p. 26)





## Education in Support of a Weather-Ready Nation



**Above:** Global sea surface temperatures in NOAA View. The online interface allows users to view NOAA data, such as temperature, cloud cover, and ice coverage and select time frames of interest.

**Right:** An illustration of the Joint Polar Satellite System JPSS-1 satellite, which orbits Earth 14 times per day and produces some of the high resolution images available on NOAA View.

In addition to NOAA View, NESDIS develops – in collaboration with our partners – mobile apps, lessons plans and activities for grades 6 –12 teachers and students, illustrating the use of satellite data and information. These successful education and outreach resources teach students, teachers and the general public about meteorology, space science, earth-observing satellites, weather phenomena, and the benefits that earth-observing satellites provide to society by supporting forecasts and advanced warnings of weather events in order to protect life and property. NOAA visualization products that easily display large, previously inaccessible datasets are one way that NESDIS is working to improve the scientific knowledge of the public.





## Education in Support of a Weather-Ready Nation

### Partners include:

Boulder Valley School District

National Center for Atmospheric Research

### Using Science on a Sphere helps teachers create flood-prepared and resilient communities

Promoting NOAA's vision for the future of creating resilient communities, Science On a Sphere® (SOS) – a six foot animated globe, installed in 118 museums globally and developed by the NOAA's Earth System Research Lab (ESRL), Global Science Division (GSD) – hosted a series of workshops in February and August 2014 on flash floods for the Boulder, CO community. The workshops were prompted by the historic Boulder floods of September 2013. Using visualizations and resources available from the SOS database, SOS educational specialists with ESRL, partnered with the local National Weather Service (NWS) Weather Forecast Office to support local area school teachers in developing lesson plans for educating students about flash floods. For example, satellite infrared frames with weather icons animated over the top, for the time period of the flood, were used to make a spherical weather movie of the event and shared on YouTube for teachers to access.



Above: Teachers attending a Science On a Sphere workshop work together to develop educational materials from the resources available on the SOS website.

Many Boulder teachers and students visited SOS on field trips with questions about the September 2013 flood event. To address their questions, SOS was used to explain the weather and environmental conditions leading to the floods. It quickly became apparent that this was also an opportunity to teach about the hazards of flash floods to help create a more resilient community. In addition, the SOS team conducted a summer elementary school teachers workshop for five Colorado school districts and 15 teachers, which focused on utilizing scientific, global data visualization in the classroom. The annual summer teacher programs continue to broaden the reach of NOAA's data and visualizations, utilizing the power of SOS, and forge partnerships with a larger geographic pool of Colorado educators. It is the education partnerships from the annual workshops that allowed the SOS team to quickly pull together the flash flood workshop series for local teachers. These flash flood education workshops have had a positive impact on science curricula – specifically for elementary weather & landforms unit – in Boulder County schools.



## Education in Support of Healthy Oceans

Above: A sea otter prepares for an afternoon nap.

### **Sustaining healthy, productive, and diverse marine fisheries, habitats, and ecosystems**

Education lays the groundwork for building trust and collaboration within communities that use marine and estuarine resources. Education efforts also leverage the special places that NOAA manages, including National Marine Sanctuaries and National Estuarine Research Reserves. Here we highlight NOAA's education activities that support Healthy Oceans by sharing examples of enhancing ocean literacy through partnerships, engaging educators, and building understanding of watersheds that impact marine resources.

NOAA's goal of Healthy Oceans requires managing and understanding ocean resources and the habitats that support them. Ocean literacy is a foundation for maintaining healthy oceans because it helps stakeholders and the public understand the research and science behind management decisions. Ocean literacy includes an understanding of complex connections among organisms, physical processes, and cultural and economic factors. Therefore, a strong understanding of ocean and estuarine ecosystems supports NOAA's approach to management.



## Education in Support of Healthy Oceans

### Partners include:

City and County of Honolulu, Department of Parks and Recreation  
 Friends of Hanauma Bay  
 Hawai'i State Department of Land and Natural Resources  
 Hui Ku Maoli Ola  
 Make-A-Wish Foundation  
 Mālama Maunalua

**Right:** Hanauma Bay Nature Preserve, HI.

**Below:** A Hanauma Bay Education Program volunteer educates kids on conservation and good stewardship practices.



### **Hawai'i Sea Grant educated 780,000 visitors on marine resource conservation and stewardship at the Hanauma Bay Nature Preserve**

The Hanauma Bay Nature Preserve on O'ahu, Hawai'i is a popular tourist destination because of its beautiful natural scenery and abundant marine life. In 1967, it became Hawai'i's first Marine Life Conservation District and has developed a reputation as one of the premier snorkeling and tourist destinations in Hawai'i. Hanauma Bay has also evolved into an ideal site to promote marine education and coastal stewardship to the thousands of tourists, residents, schools, and community groups who visit on a daily basis.



Due to the popularity as a tourist destination, Hanauma Bay had experienced a significant decline in water quality, coral coverage, and related sea life by the late 1980's. In 1990, in response to this problem, Hawai'i Sea Grant partnered with the City and County of Honolulu to develop and administer the Hanauma Bay Education Program (HBEP). (cont'd p. 30)



## Education in Support of Healthy Oceans

### Partners, continued:

Network of Volunteer Leaders, Hawai'i Chapter Service Systems Associates

The Nature Conservancy Hawai'i

University of Hawai'i Kapi'olani Community College

University of Hawai'i Marine Option Program

University of Hawai'i School of Travel Industry Management

HBEP staff and volunteers manage the daily operation of the education program and develop resources that enhance ocean literacy and marine resource conservation in visitors to the bay. They also staff an information booth on the beach to answer visitor questions and show a mandatory orientation film in the theater viewed by all visitors prior to their entrance. The film covers topics such as bay formation, important ocean safety information, an introduction to some of the marine life they may encounter, and describes stewardship actions that visitors can employ to help protect and preserve the fragile reef.

In 2014, 779,669 visitors were educated by HBEP on the value of conserving marine resources and stewardship practices that reduced their environmental impact at Hanauma Bay. Since its inception, HBEP has reduced the amount of visitors that trample the coral reef from 50% to less than 2%. By educating every visitor upon their arrival

to the Bay, HBEP is able to drastically reduce this highly destructive action. In addition to educating visitors to Hawai'i, HBEP hosted 44 weekly public presentations for 1,062 community members. It also hosted 347 school and community groups totaling 5,929 individuals. HBEP's 125 volunteer docents contributed 11,115 hours, and eight school groups totaling 244 students participated in service learning activities at Hanauma Bay. A newly introduced education program by the Hanauma Bay Nature Preserve staff in partnership with the Make-A-Wish® Program served 121 families (560 persons) with individualized education programs by HBEP



staff and volunteers and free or reduced cost park services this past year. The local coral reef ecosystems are inextricably linked to Hawaiian culture and community, and HBEP is educating visitors and community members on the necessary actions to preserve these vital ecosystems for generations to come.

Above: Students engage in a tidepool scavenger hunt at Hanauma Bay, HI



## Education in Support of Healthy Oceans

### Partners include:

University of St. Francis  
 The College of Exploration  
 National Marine Sanctuary  
 Foundation  
 PolarTREC  
 Project Maury  
 Smithsonian  
 Environmental Research  
 Center  
 Smithsonian Natural  
 History Museum, Sant  
 Ocean Hall and Q?rius

Below: NOAA Teacher at Sea Denise Harrington assisted in operating the crane which moves boats up over the ship.



### Teacher at Sea program provides real-world ocean research experiences to K-12 and college educators

In 2014, 29 teachers from around the U.S. participated in NOAA's Teacher at Sea program. Combined, these teachers performed over 5,000 hours of research at sea working as part of a NOAA science team. In addition, this year more than 300 Teacher at Sea program alumni used NOAA science and data in the classroom, reaching thousands of students. The program continued to support NOAA's mission through its science communications, outreach, activities, workshops, online technology, and teacher-created educational products.

In the last 25 years, NOAA gave over 700 K-12 and college level teachers from around the Nation unique insight into oceanographic, hydrographic, and fisheries research by facilitating partnerships between the teachers and our world-renowned scientists. Teachers at Sea reported that their enthusiasm for science and research was "exponential," they "learned about the complexity of the ocean planet," and are excited to "share their thirst to learn more" with their students and the community. Numerous scientists appreciated having the opportunity to work with a teacher and explained that "it's useful for us

as scientists to explain what we are doing" to teachers as they "lend a fresh perspective to our work and a youthful approach to the research as it is being conducted." To date, teachers who participated in the NOAA Teacher at Sea program spent over 95,000 research hours at sea collecting an extensive amount of data that directly supports NOAA's mission and the Nation.



## Education in Support of Healthy Oceans

### Partners include:

Anahuac National Wildlife Refuge

### Houston area teachers and students gain deep insight in the importance of coastal ecosystems through real-world scientific research



Above: Students view their microbial cultures, collected from a local Houston bayou and learn about the relationship between microbes and wetland and coastal watershed health. Data collected from such laboratory experiments is used in University of Houston, Downtown research scientists' studies.

In 2014, the University of Houston Downtown's Bay Watershed Education and Training (B-WET) project, Watershed Wonder, held a two day preparation session and a one week camp to provide teachers and high school students with meaningful learning experiences in biology, chemistry, physics, and environmental science. The program provided a research-based summer experience mentored by Ph.D. scientists and undergraduate students. Participants collect and analyze data for use in studies targeting the Trinity River and San Jacinto River Watersheds.

Focal areas of the experience included supporting and fostering environmental problem-solving and stewardship among students from underrepresented groups with interest in science related to the San Jacinto River and Harris County watersheds. The project included a two-day preparation session to introduce teachers to the relevant scientific process and concepts, data collection methods, and online professional sharing wiki (the University of Houston Downtown [HUNSTEM](#) portal). In addition, teachers participated in a curriculum development project, which helped them to prepare lessons to integrate what they learned through the summer reach projects into their classrooms. The experience culminated with a week-long summer research camp which paired teachers with high school students, undergraduates, and university research scientists to collect and analyze data in the field and lab. Through this project, teachers and students worked to test hypotheses and draw conclusions about the function and importance of watersheds and the inextricable link between humans and the environment. To date, 14 teachers and 16 high school students have been trained by undergraduate mentors and university researchers and additional students and teachers will be reached in FY15. The real-world research experience obtained through this project provided an engaging and exciting learning opportunity and built awareness of potential research careers.





## Education in Support of Healthy Oceans

### Partners include:

Washington State Sea Grant, Institute for Systems Biology

### Those interested in ocean acidification can now go straight to the SOARCE

In 2011 a poll revealed that only 7% of Americans were aware of ocean acidification (OA). In 2012, in an effort to increase understanding and awareness of ocean acidification, NOAA's National Marine Sanctuaries convened a workshop for scientists to identify effective practices for communicating about acidification to the public, the government, and stakeholders. A year and a half later, in March 2014, the NOAA Ocean Acidification Program and National Marine Sanctuaries kicked off the Sharing Ocean Acidification Resources for Communicators and Educators (SOARCE) webinar series to provide OA communication tools to formal and informal educators and stakeholders across the country.



One of the series' primary goals was to promote a more integrated and effective OA education community by sharing OA education and communication activities virtually. With awareness and access to these resources, the OA education and communication community is able to utilize and continue to create cutting edge communication tools that incorporate current scientific and

communication research in order to inform society about our changing ocean. Because OA is a large environmental and economic issue, NOAA is dedicated to improving the public's OA literacy to make better informed decisions in the face of this global problem. To date, over 300 educators have attended the series to learn about OA communication approaches, curricula, and resources. Many new partnerships have come to fruition from this series and the webinar archives from this series will be made available on a virtual portal to all of those interested in educating others about ocean acidification science and promoting stewardship.



## Education in Support of Healthy Oceans

### Partners include:

Alaska Department of Fish and Game's Division of Sport Fisheries

Below: A child in Homer, AK uses an auger to drill a hole in the ice.



### Families in Nature fishing programs grow anglers in Alaska

The 28 reserves that are part of the National Estuarine Research Reserve System provide ideal settings for families, and children in particular, to experience our nation's estuaries and learn about these living classrooms. Today's youth are challenged by fast-paced lifestyles and, for many reasons, often lack ties to family and nature. The reserves offer families an opportunity to be inspired to get outside and get active. The Families in Nature angler program—developed by staff members of Alaska's Kachemak Bay National Estuarine Research Reserve—actively encouraged more than 300 Alaskans living in the Homer area and beyond to go fishing in 2014. Striving to overcome society's barriers to getting youth and families outdoors, this reserve helped youngsters and their parents develop lifelong fishing skills and an appreciation for wild places within the Kachemak Bay estuary through programs like the rod loaner program, guided family ice-fishing outings, and fishing-themed discovery labs.

A child learning to fish builds angling and other life skills and gets the physical, mental, and spiritual health benefits of spending time outdoors. In addition, fishing connects children to nature and educates families on the state's fishing laws and regulations, which promote sustainable fishing, a practice of great importance to Alaskan communities. Engaging Alaska's residents with their local environmental resources not only promotes stewardship, but it also contributes to the economy in coastal communities through increased sport fishing license sales and expenditures at local businesses. These activities help build lifelong connections to nature, all while promoting concepts that will help to maintain Alaska's recreational fisheries for years to come.

In 2014, more than 400,000 youth and adults visited a reserve. By engaging parents and children in lifelong outdoor activities, reserves are promoting stewardship and sustainable practices that can continue for generations.



## Education in Support of Healthy Oceans

### Partners include:

Alaska Fisheries Development Foundation  
 Alaska Seafood Cooperative  
 Alaska Seafood Marketing Institute  
 American Seafoods Group  
 At-Sea Processors Association  
 Freezer Longline Coalition  
 King County Maritime  
 KIRO Radio 97.3FM/  
 Seattle Kitchen Radio Show  
 National Fisherman Magazine  
 North Seattle Industrial Association  
 Northwest Fisheries Association

**Right:** A Seafood 101 information booth was set up at a local Whole Foods.

### Seafood 101 in Seattle brings together diverse partners to showcase the value of seafood to our health, environment, and economy

The 2014 Seafood 101 program created a unique partnership between community organizations, maritime industry, and NOAA to describe the journey of seafood from sea to market to table, drawing attention to NOAA Fisheries' role in responsible management of fisheries to ensure sustainable U.S. seafood. The program was included in local school curricula and special events, cooking demonstrations, and tours of Seattle's port and fishing vessels were held for the public. (cont'd p. 36)





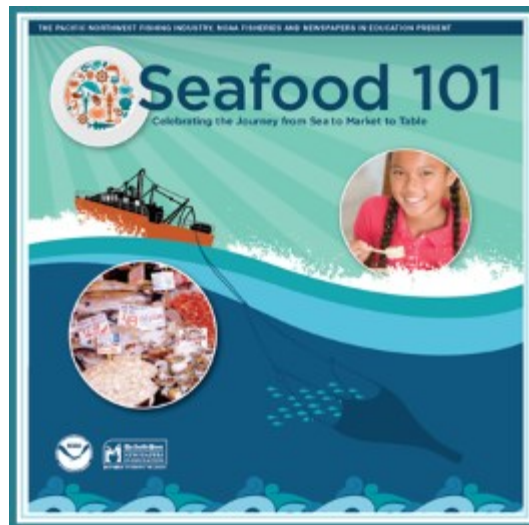
## Education in Support of Healthy Oceans

### Partners, continued:

Ocean Beauty Seafoods  
Pacific Marine Expo  
Port of Seattle  
Saunderson Marketing Group  
Seafood Nutrition Partnership  
Seattle Propeller Club  
Seattle Times  
Trident Seafood  
University of Washington Center for Ecogenetics and Environmental Health  
Washington Sea Grant  
Washington State Department of Health  
Whole Foods

Right: Front page of the Seattle Times special education supplement on Seafood 101.

The Seafood 101 program aimed to increase the public's understanding of seafood as a healthy diet choice, NOAA's role in sustainable management of fisheries, and how government, business, and community leaders work together to maintain a sustainable, safe, and viable fishing industry. Seafood 101 celebrated events such as the Fishermen's Fall Festival in September, National Seafood Month in October, and the annual Pacific Marine Expo in November, linking them with weekly programming including a 12-page educational supplement in the Seattle Times newspaper; seven cooking demonstrations; Seattle Kitchen (a local radio show) live event appearance; radio interview with representatives of NOAA, Port of Seattle, and Whole Foods Market; tours of the Port of Seattle; and panel discussions at the Pacific Marine Expo. The Seattle Times supplement covered the following key topics: seafood is healthy; seafood safety tips; cooking tips for kids; sustainability; economics, jobs, and community; and the centennial of Fishermen's Terminal. Distribution of the supplement to the Seattle Times' Newspapers In Education educator network of over 1000 classrooms in Washington State and the Seattle Times' Sunday circulation of over 800,000 people, as well as the Alaska Dispatch News' Newspapers In



Education network of almost 1900 classrooms across Alaska, ensured wide coverage in the Pacific Northwest and Alaska. The Seafood 101 program was highlighted by educators and public alike as a way to learn and teach about seafood sustainability, a critical component of the Nation's food security and economic well-being.



## Education in Support of Healthy Oceans

### Partners include:

American Association for the Advancement of Science

American Geosciences Institute

American Meteorological Society

Association of Science Technology Centers

Association of Zoos and Aquariums

Consortium for Ocean Leadership

### Getting to the heart of the matter: Education outreach support services capture attention and invite engagement

The Education and Outreach support function within the Office of Education has reached nearly 500,000 people in 2014 through collaboration and partnering with programs represented by the NOAA Education Council, field-based NOAA Education and Outreach personnel, and the external broader education and outreach community. This includes organized youth groups, federal and state governmental agencies, and grantees. These collaborations are served through the NOAA Outreach Center, the [Education Resource Website](#), and consulting services to internal and external customers. (cont'd p. 38)

Right: NOAA staff with Teacher at Sea Alumni and Climate Stewards at a National Science Teacher Association (NSTA) annual conference.





## Education in Support of Healthy Oceans

### Partners, continued:

Howard University  
Summer Science Camp  
Illinois Science Teachers Association  
KID Museum at Silver Spring Maker Faire  
National Association for Interpretation  
National Marine Educators Association  
Nation Science Teachers Association  
North American Association for Environmental Education  
Presidential Awardees for Excellence in Math, Science, and Technology Science Olympiad  
Science Teachers Association of Texas  
The Society for Science & the Public  
USA Science and Engineering Festival  
Virginia Science Teachers Association

**Right:** Educators at the NOAA exhibit booth at the 2014 National Science Teacher Association Conference in Boston, MA.

In FY2014, the Outreach Center received over 1,900 unique requests from formal and informal educators, students, researchers, emergency managers, public audiences, and employees for NOAA hard copy products and resources, connections to websites or subject matter experts, speaker requests for classrooms, professional development workshops, or community events. STEM conference planning, staffing, and education materials supported direct engagement with 20,000 formal and informal educators in Denver, CO; Annapolis, MD; Charlotte, NC; Portland, OR; Reno, NV; Boston, MA; and Springfield, IL. We partner with NOAA Teacher at Sea and the Climate Stewards Education Program to have alumni-teachers at the exhibit booth communicating suggested integration of our education products into their classroom through use of Ocean and Climate Literacy Essential Principles, Next Generation Science Standards, and state standards. The NOAA booth at the USA Science and Engineering Festival held in Washington, DC was visited by 5,000 attendees.

The continuing partnership and support of the NOAA Education Council has provided continuous development of themed education collections on the website, which had 729,045 page views in 2014. The site has been designed to focus educators and students on NOAA sciences through accessible data, lesson plan materials, multimedia, professional development opportunities, and career exploration. By collaborating with many NOAA educators and external partners these efforts support the NOAA mission of a science-informed society and increase conservation and stewardship in the public.





# Education in Support of Healthy Oceans

## Partners include:

National Marine Sanctuaries Foundation  
The College of Exploration  
The European Marine Science Educators Association  
The National Marine Educators Association



Above: Outline of the program “Deep-sea Discoveries in the Atlantic Onboard the NOAA Ship *Okeanos Explorer*. An Online Workshop to Advance Transatlantic Ocean Science Literacy.”

Right: The NOAA *Okeanos Explorer* ship maps the ocean floor and conducts education outreach programs from sea.

## Deep-sea discoveries in the Atlantic onboard the NOAA Ship *Okeanos Explorer*: An online workshop to advance and discuss transatlantic ocean science literacy

NOAA’s [Office of Ocean Exploration and Research](#) (OER) offered a five-week long online workshop, for educators and other interested parties, entitled *Deep-sea Discoveries in the Atlantic Onboard the NOAA Ship Okeanos Explorer. An Online Workshop to Advance Transatlantic Ocean Science Literacy*. The workshop served as a foundation for extending conversations on transatlantic ocean literacy, as called for in [The Galway Statement](#), a document signed by the United States, Canada, and the European Union and set a goal to “increase our knowledge of the Atlantic Ocean and its dynamic systems” and to promote sustainable resource management.

In addition to delving into the discoveries of the 2013 OER field season on the *Okeanos Explorer*, the workshop was utilized for planning towards a part of the National Marine Educators Association 2014 conference held in Annapolis, MD. A total of 640 participants (176 international) registered for the online workshop, representing 29 countries and at least 40 U.S. states.





## Education in Support of Healthy Oceans

### Partners include:

Joint Institute for Marine and Atmospheric Research, University of Hawai'i

### **Fisheries Science Camp allows Hawai'i students to learn what it takes to be a marine scientist**

The inaugural NOAA Fisheries Science Camp in Hawai'i introduced middle schoolers to fisheries and marine mammal research through investigative hands-on research activities. The camp was held at the new NOAA Daniel K. Inouye Regional Center, and hosted 60 middle school students and six teachers from public and charter schools around Oahu, targeting eighth graders from underrepresented communities.



Above: Campers at the 2014 NOAA Fisheries Science Camp in Hawai'i learned about the importance of accurate data recording techniques to study fish life history, including aging fish with their otoliths, or ear stones.

Over thirty scientists from NOAA and the University of Hawai'i's JIMAR conducted science activities the two-day camp, providing campers with unique hands-on experiences and introductions to marine science careers. Science modules focused on marine debris, fisheries stock assessment, fish life history, marine food webs and plankton, and Hawaiian monk seals. The camp was organized around the theme "Using Technology to Study Ocean Life and Ecosystems," tying together the six science modules and the culminating Challenge Event, which was a mystery scenario where the students were challenged to use their new-found knowledge to create a research plan to study a never-before-seen species. Campers' post-camp evaluations showed that they enjoyed the camp and 82% felt they had expanded their knowledge about marine

science, especially from the fish dissection and marine plankton modules. Several students took the knowledge and skills learned at camp and, in partnership with NOAA Fisheries scientists, expanded upon those topics for their Hawaii Science and Engineering Fair projects. NOAA Fisheries will offer this camp in future years to help fill the need for students to learn more about marine science careers and the ocean, which forms such an integral part of the life and culture in Hawai'i.





# Education in Support of Healthy Oceans

## Partners include:

National Marine Sanctuaries Foundation  
Jacobs University, Bremen, Germany  
The MicroB3 Project

**Right:** NOAA Ocean Explorer website promotes Ocean Sampling Day 2014 through a video featuring young students who participated in the program.

**Below:** Office of Ocean Exploration and Research Ocean Sampling Day lesson plan for students in grades 6-12.



## Ocean Sampling Day organizes water sample collection from the oceans and rivers around the world

Ocean Sampling Day is an international collaboration to collect water samples from ocean and rivers around the world on a single day, with the goal of developing a baseline reference data set of microbial diversity. This effort is composed of 185 sampling sites spanning 37 countries across all seven continents. In 2014, Ocean Sampling Day incorporated a worldwide collaborative citizen science effort that organized sample collection by the public and educational groups around the world to collect water samples and measure common water quality parameters such as temperature, salinity, turbidity, light penetration depth, pH, and more.

To promote and support this effort NOAA's Office of Ocean Exploration and Research (OER) developed an Ocean Sampling Day activity for grades 6-12 classroom use entitled "What a Day for the Ocean Microbes," which serves as an introduction

to microbes and explains their global scientific importance in areas such as ecosystem food webs and climate. OER also created a promotional Ocean Sampling Day video featuring young students answering questions about microbial biodiversity and developed Ocean Sampling Day webpages featured on the OER and Office of Education websites, demonstrating the effectiveness of the program in teaching young students about microbial activity. Ocean Sampling Day organizes scientists from all over the world to collect and create a "high-resolution snapshot" of our oceans to help better understand microbial activity. Now with an active citizen science component it has the opportunity to expand into the classrooms and increase both grades 6-12 and the public's scientific literacy utilizing the vast amounts of collected data for educational purposes.





## Education in Support of Resilient Coastal Communities and Economies

Above: High school students seining during Texas Camp SeaPort.

### **Creating environmentally and economically sustainable coastal and Great Lakes communities**

In this section we highlight the NOAA Education programs that further NOAA's objectives in building resilient coastal communities and economies. The economy of many coastal communities is directly tied to the health of the coastal ecosystem and NOAA is committed to increasing resiliency in these regions through professional development, hands-on learning, and stewardship programs.

Increasing environmental literacy and empowering citizens to take an active role in understanding, preserving, and restoring their coastal assets is vital to informed decision making at the local level. NOAA Education uses the wealth of NOAA data to promote environmental and economic sustainability and support resilient coastal and Great Lakes communities.



# Education in Support of Resilient Coastal Communities and Economies

## Partners include:

The University of Georgia  
Marine Extension Service

**Right:** A 6th grade student hauls away a bushel of marine debris from a Georgia tidal creek.

**Below:** A clear column filled with locally-collected marine debris shows the types of objects that end up in the Nation's watersheds and oceans.



## Project SORT gets hands-on with marine debris education in the Southeast

Project SORT, created in a partnership between The University of Georgia Marine Extension Service and the NOAA Marine Debris Program is a highly interactive and engaging program that encourages students to become environmental stewards. This project also provided teachers with curriculum and activity development, and engages middle and high school students in marine debris classroom activities, surveys, and cleanups.

Since August 2013, the Student Marine Debris Survey has engaged over 350 students in shoreline debris monitoring and cleanup projects on Skidaway Island, GA. The project, which places a heavy emphasis on stewardship, provides the students with field experience and a first-hand view of the increasing marine debris problem of our nation's shorelines. In addition to the ongoing monitoring and cleanups, Project SORT unveiled clear columns, filled with locally collected marine debris, at the UGA Marine Education Center and Aquarium on Skidaway Island, the Georgia Sea Turtle Center on Jekyll Island, and Tybee Island Marine Science Center. The displays at these high impact public institutions will reach an estimated 155,000 people throughout the region.



The project also focuses on teacher professional development, and in July 2014, the project staff hosted a workshop for twenty educators from Georgia, North Carolina, and South Carolina. The lessons from the summer workshop were already being used in classrooms less than two months later at the start of the 2014 school year. By taking a three-tiered outreach and education approach, Project SORT is able to educate and engage teachers, students, and the public on the increasing hazards and dangers of our global marine debris problem.



## Education in Support of Resilient Coastal Communities and Economies

### Partners include:

Clemson Cooperative Extension  
Colleton Middle School  
South Carolina Department of Natural Resources  
South Carolina Oyster Restoration and Enhancement Program



Above: Students plant their *Spartina* plants that they have grown throughout the school year to restore eroded salt marsh.

### Sowing the seeds of estuary health in South Carolina

Tax dollars and tourism revenues in many coastal regions are dependent on a healthy dune and estuary ecosystem. The National Estuarine Research Reserve System (NERRS) education program plays an important role in conserving the health of the estuary and increasing stewardship of marsh habitats. The Seeds to Shorelines initiative is the first saltmarsh restoration education program in South Carolina and was started in 2010 by the Ashepoo-Combahee-Edisto Basin NERRS and its external partners, to engage in hands-on science activities that address the South Carolina State Science Standards while promoting environmental stewardship and preserving the state's coastal community.

The reserve system's education program approach uses the best available science to maintain and restore healthy, productive, and resilient ecosystems that are essential to the local communities. The maintenance, restoration, and conservation of these coastal areas are conducted by local teachers, students, and community members. In fiscal year 2014, 80 seventh graders from Colleton Middle School saw the fruits (or rather, seeds) of their labor. All school year they grew *Spartina alterniflora* plants, a local seagrass, from seed. The seeds were harvested in the fall, then potted in a greenhouse at school, and finally planted in the unique Carolina Lowcountry pluff mud to reduce erosion and create a living shoreline. This project promoted science and stewardship by teaching the importance of the saltmarsh and tidal creek habitat through the cultivation and transplanting of *S. alterniflora* to eroded and degraded areas of the ecosystem, and culminated in the spring with Restoration Day, where students transplanted their *S. alterniflora* plants to a designated area of saltmarsh. With over 3500 students from 3<sup>rd</sup>-12<sup>th</sup> grade, this program has grown, since its inception in 2010, from 8 to 27 participating schools across 12 counties. Volunteers have put in 10,500 hours in restoring the marsh, which is equivalent to an in-kind donation of \$137,592, and the program has reduced erosion and created living shorelines in coastal South Carolina's fragile saltmarsh habitats.



## Education in Support of Resilient Coastal Communities and Economies

### Partners include:

The Institute for Fisheries Resources

The Pacific Coast Federation of Fishermen's Associations

### Connecting San Francisco youth with their local fishing community to hear diverse perspectives on coastal issues

Fisherman in the Classroom (FIC) provides a unique firsthand experience for high school students in the San Francisco Bay Area to hear



**Right:** A local fisherman demonstrates a commercial crab trap while talking about sustainable fishing with a Bay Area classroom.

*“It was a special experience that added relevance and excitement to our program”*

multiple perspectives on sustainable fisheries, marine protected areas, climate change, watershed restoration, and the importance of buying and eating fresh locally caught seafood. Gulf of the Farallones National Marine Sanctuary education staff teamed up with local fishermen to deliver the program to 386 local high school students in the San Francisco Bay Area during FY14.

The program is a lively, interdisciplinary program that covers subjects as diverse as biology, economics, social science, and oceanography. Teachers valued the opportunity to weave such diverse topics together and give

them real-life relevance. To deeply engage students, the teaching team brought fishing gear, videos, stories, crabs, fish, recipes, and activities to highlight the rich maritime fishing culture of the Central California Coast. This program is an exciting opportunity to bring the men and women who make a living off the sea into the classroom to discuss this vital and challenging industry with Bay Area students. This program has not only inspired students, but it has the strong support of local Bay Area fishermen, and one fisherman expressed his support by saying “I’m looking forward to every FIC class because it gives me the chance to talk about the importance of conserving what we got out there to those who will inherit it all from us – the future biologists, future legislators, and future owners/consumers of our resources, who in turn should conserve it all for their kids. What a great program!”



## Education in Support of Resilient Coastal Communities and Economies

### Partners include:

Diver Dan Underwater Recovery  
Lamar University  
Longshoreman's Union  
Moran Towing  
Port Arthur International Seafarers' Center  
Port of Beaumont  
Port of Orange  
Port of Port Arthur  
Sabine Pilots Association  
Texas A&M Galveston  
U.S. Coast Guard Station Sabine  
Waterborne Education Center

### **Camp SeaPort connects local youth with maritime industry professionals at major Texas ports**

Jefferson County, Texas has three major ports which handle millions of tons of cargo, including 25% of the Nation's petroleum products. The community of Port Arthur currently faces a 15% unemployment rate, decreasing graduation rates and population decline. Students are often unaware of port-related maritime career opportunities. To address this issue, Texas Sea Grant offered Camp SeaPort, a free weeklong summer program designed to educate local youth about career opportunities in the maritime industry.

The 8th-12th grade participants interact with a wide range of maritime professionals, all of who volunteer their time. While no two years are the same, past groups have met with tug boat and barge operators, listened to presentations from the local pilots' association, visited working shipyards and area ports, been introduced to maritime programs at nearby universities, and spent time aboard U.S. Coast Guard vessels and at the Coast Guard Marine Safety Unit.

The high school students gain knowledge about local careers and the necessary training requirements, and students are connected with college advisors and financial aid officers at schools offering maritime related training. Before Camp SeaPort most of the students were unaware of the job possibilities related to the Port. A

formal evaluation was given to 13 participants in the camp. Results indicated significant positive changes in the knowledge gained by the participants. Of the 13 participants, 100% understood the value of the Port of Port Arthur to the community and 100% of the participants would recommend Camp SeaPort to their friends. Due to increased success and visibility, Camp SeaPort will continue to introduce youth to maritime careers with the hope of building and maintaining a vibrant coastal economy.



Above: High school students on a boat tour learning about careers in the maritime industry during Camp SeaPort. Photo courtesy of Camp SeaPort.



## Education in Support of Resilient Coastal Communities and Economies

### Partners include:

Fond du Lac Resource Management

Great Lakes Aquarium  
Rivers2Lake

Wisconsin Environmental Education Board

**Right:** Students snowshoe to collect winter water quality data with their teachers and staff from the Lake Superior NERRS and Fond du Lac Resource Management.

### Teachers and students get a Superior education with B-WET

In 2014, the Rivers2Lake program, funded by a Great Lakes Bay Watershed Education and Training (B-WET) grant used year-long mentoring and in-school collaboration with teachers and researchers to integrate the Lake Superior watershed and the St. Louis River Estuary into classrooms. This program formed the core of the Lake Superior National Estuarine Research Reserve System (NERRS) education efforts. Data from 20 teachers collected and analyzed by an external evaluator over two years demonstrated that the program was effective in increasing teachers' competency in using outdoor and place-based learning, as well as their sense of place, a strong indicator for stewardship behavior and program continuation. Moreover, survey data collected from over 550 students has shown a significant increase in academic engagement for those who participate in the Rivers2Lake program. (cont'd p. 48)





## Education in Support of Resilient Coastal Communities and Economies



Above: Eighth grade students from the Fond du Lac Ojibwe School present their poster at the St. Louis River Summit.

Rivers2Lake tackles NOAA's goal of creating a science-informed society by connecting teachers and their students to their watershed by engaging them in the process of identifying local issues, collecting and analyzing data, and presenting their findings. An example of this was at the Fond du Lac Ojibwe School on the Fond du Lac Reservation near Cloquet, MN. Regular stream monitoring by 8th grade students resulted in a professional presentation at the St. Louis River Summit in February 2014, a gathering of

researchers and land managers hosted by the Lake Superior NERRS and Wisconsin Coastal Management. Using data about Otter Creek, a tributary of the St. Louis River, the students presented a valuable water quality profile of a stream that had been heavily affected by floods in 2012. Thirteen students worked over a period of four months with NERRS educators and Fond du Lac Resource Management water quality experts to collect and analyze water quality data, then create and present a poster at the St. Louis River Summit in 2014. During the Summit, the students spoke with officials from NOAA headquarters, Environmental Protection Agency leadership, university students, and even a National Geographic photographer. This 2014 work built on two successful years of implementing this comprehensive place-based education program, and the program is continually expanding as new service learning opportunities are made available by an increasing number of partners in this Great Lakes Area of Concern. To date, 36 teachers and over 1200 students have participated in Rivers2Lake, and continue to work with the NERRS long after mentoring by NERRS education staff has passed.





## Education in Support of Resilient Coastal Communities and Economies

### Partners include:

The College of Charleston

Below: Students look for microscopic organisms using smart devices and wireless field microscopes at the Guana Tolomato Matanzas Research Reserve.

### Understanding the needs of teachers and students to strengthen NERRS K-12 programs

The National Estuarine Research Reserve System's (NERRS) education sector supports a system-wide estuarine education program, targeting students in grades K-12 that enables reserve educators to provide consistent, high-quality estuary education programs. In providing this support, the reserve system uses various tools to understand teacher and student needs, monitor progress, and measure impact. From 2009 to 2013, a series of needs assessment surveys were conducted to better understand local opportunities and challenges teachers face in teaching about estuaries. In 2014, through a partnership with the National Centers for Coastal Ocean Science and the College of Charleston, the results of these surveys were combined for a national and regional trends analysis.

The trends analysis final report was completed and released using the needs assessment data from 19 reserve sites across the country. According to survey results, a factor that contributes to the lack of inclusion of estuarine topics by teachers is likely the relatively large proportion of teachers who claim that these topics are not a required part of their science teaching requirements. Survey results indicate that the teaching of scientific inquiry skills is heavily emphasized, in high contrast with "stewardship projects." With data from over 3,000 teachers, the findings present

national and regional trends that will help the reserve system maintain consistent, high-quality educational products and services while meeting the evolving needs of teachers around the Nation.





## NOAA Education Goal 2: Workforce Development

**A future workforce, reflecting the diversity of the Nation, skilled in science, technology, engineering, mathematics, and other disciplines critical to NOAA's mission**

Accomplishing NOAA's mission requires an inclusive, diverse, and effective workforce that reflects the communities it serves. The America COMPETES Act mandates NOAA to build on its historic role in stimulating excellence in the advancement of ocean and atmospheric science and engineering disciplines, and in providing opportunities for the pursuit of academic studies in science, technology, engineering, and mathematics (STEM) fields. These efforts span the entire scope and breadth of NOAA sciences – oceans, coasts, Great Lakes, weather, and climate – to expose students to career options and foster interest and excellence throughout students' education.

Across the Agency, NOAA invests in intellectual capital by providing scholarship and research opportunities to promising, early-career scientists. Workforce development also means beginning earlier in the educational pipeline. Engaging students and exposing them to career options not only builds environmental literacy, but also encourages career exploration.

We highlight 10 stories organized under the NOAA Next Generation Strategic Plan's (2010) enterprise-wide objective directed at promoting career pathways and building expertise in the next generation of NOAA's workforce.



**Diverse and constantly evolving capabilities in NOAA's workforce**



# Education in Support of Workforce Development

## Partners include:

Marine Advanced  
Technology Education

Marine Technology  
Society

National Science  
Foundation

Oceaneering



Above: An underwater ROV explores a shipwreck in Lake Huron's Thunder Bay National Marine Sanctuary.

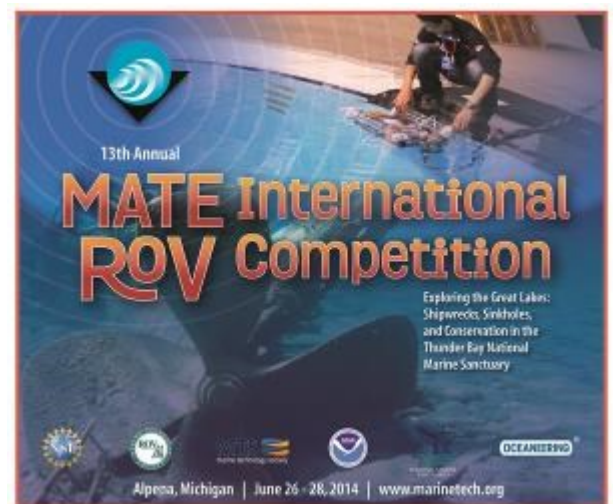
Right: The 13th annual MATE ROV Competition was held in Michigan in June, 2014.

## In the heart of the Great Lakes, the International Underwater Robotics Competition sparks interest in ocean and STEM careers

NOAA's Thunder Bay National Marine Sanctuary (TBNMS) in Michigan joined forces with the Marine Advanced Technology Education (MATE) Center for the 13th Annual International Student ROV (remotely operated vehicle) Competition. Sixty teams representing middle schools, high schools, home schools, after-school groups, community colleges, and universities from 18 states and 13 countries competed this year at TBNMS visitor center and research headquarters on the Great Lakes in Alpena, Michigan. This year's contest focused on exploring the Great Lakes: shipwrecks, science, and conservation in the Thunder Bay National Marine Sanctuary.

The competition teaches science, technology, engineering, and math (STEM) and challenges students to think of themselves as "entrepreneurs" by forming companies that design, build, and market their "product." Along the way, they learn how to manage a project, work as a team, think creatively, and problem-solve, all important 21<sup>st</sup> century workplace skills. During the event, a panel of judges, representing fields of industry, science, government, and education evaluate the company teams on their ability to effectively communicate their vehicles' design construction via underwater missions, technical reports, poster displays, and engineering evaluation interviews.

The program also encourages students to develop and apply technical, teamwork, and problem solving skills, and provides funds, materials, and technical expertise to support student learning to provide industry with skilled individuals who can fill workforce needs.





# Education in Support of Workforce Development

## Partners include:

- Ocean Inquiry Project
- Rainier Scholars
- Sail Sand Point
- Salish Sea Expeditions
- Solid Ground
- University of Washington, Joint Institute for the Study of Atmosphere and Ocean
- Washington Sea Grant



Above: Junior Leaders examine water samples during a NOAA Science Camp field trip in Seattle, WA.

## Seattle's NOAA Science Camp sparks middle schoolers' interest in real-world marine science and trains scientists to be good communicators

The 2014 NOAA Science Camp in Seattle, WA integrated NOAA science into a week-long educational program that introduced middle-school campers to the multi-disciplinary nature of scientific research through hands-on science. Scientists engaged campers in activities showing different aspects of NOAA research, explaining their science in straightforward language. Campers also learned about current events by discussing ocean acidification and its ecological effects with a panel of experts in oceanography, fisheries, and aquaculture. Researchers and educators interacted directly with camp participants to demonstrate different aspects of NOAA research in weather, oceanography, marine mammals, and fisheries, as well as diving, charting, emergency response, and habitat restoration. Participants learn about environmental and conservation issues on local and national scales, and how NOAA offices work together toward the common goal of science, service, and stewardship.

The Junior Leader Program for high school students, established in 2011 by camper request, built on skills and interests developed during Science Camp, moved teens along the "science pipeline" through experiences in leadership, investigative science, and career-building. As in past years, the 2014 NOAA Science Camp demonstrated that campers and Junior Leaders achieved a deep knowledge of NOAA careers and research. NOAA partnered with Washington Sea Grant and the University of Washington's Joint Institute for the Study of the Atmosphere and Ocean to run the camp, offered scholarships to campers with financial need, and worked with community partners to recruit campers from underrepresented communities. Over its 12-year history, NOAA Science Camp has introduced over 1000 campers to NOAA, many of who returned to the camp as Junior Leaders, camp volunteers, and assistants. The camp also improved scientists' communication skills and created a strong outreach network, facilitating joint coordination of educational activities and events.



# Education in Support of Workforce Development

## Partners include:

California State University, Los Angeles  
 Creighton University  
 Delaware State University  
 Florida A&M University  
 Hampton University  
 Howard University  
 Jackson State University  
 Lehman College  
 New York City College of Technology  
 Oregon State University  
 Savannah State University  
 University of Albany, State University of New York

**Right:** The 2014 EPP Undergraduate Scholars during orientation week in Silver Spring, MD. (Front row- left to right: Autumn Chong, Chanelle Stigger, Nishan Pressley, Olivia Poon. Top row- left to right: Joshua Bailey, Ricky Dixon, Justin Shaifer).

## Educational Partnership Program continues to increase diversity and promote STEM education in underrepresented communities

The NOAA Educational Partnership Program (EPP) supports four Cooperative Science Centers (CSCs) based at Minority Serving Institutions (Howard University, University of Maryland Eastern Shore, Florida A&M University, and The City College of the City University of New York) that involve 22 academic partners in 10 states, the District of Columbia, and Puerto Rico. The program's goal is to increase the number of students from underrepresented communities who are trained and graduate with degrees in Science, Technology, Engineering, and Mathematics (STEM) fields that directly support NOAA's mission. The CSCs collectively graduated 95 students in FY 2014, including one associate's degree, 50 bachelor's degrees, 26 master's degrees, four J.D.'s and 14 Ph.D.'s. The CSCs also funded 104 collaborative research projects which support NOAA's Next Generation Strategic Plan and produced more than 150 peer reviewed publications. (cont'd p. 54)





## Education in Support of Workforce Development

### Partners, continued:

Texas A&M, Corpus Christi

The City College of the City University of New York

University of Maryland, College Park

University of Maryland, Institute of Marine Environmental Tech

University of Maryland, Baltimore County

University of Maryland Eastern Shore

University of Miami

University of Puerto Rico at Mayaguez

University of Texas, Brownsville

University of Texas, El Paso

**Right:** Recent Graduate Science Program graduate Dr. Charlene Hurst collects water samples from the Williamson River, OR.



In FY 2014, NOAA provided scholarship funding to 11 graduating and seven incoming EPP Undergraduate Scholars who completed internships at NOAA facilities. NOAA also supported two Graduate Sciences Program students, and Scholar Charlene Hurst graduated from Oregon State University with her Ph.D. in Microbiology. Dr. Hurst is in the process of being converted to a full time employee in NOAA Fisheries. EPP funds support students pursuing degrees in NOAA mission sciences, capacity building at partner institutions, faculty and collaborative research. Since its inception, over 3,000 students have been trained through EPP, over 75% of who are from underrepresented groups.



# Education in Support of Workforce Development

## Partners include:

Farallones Marine Sanctuary Association  
 Francisco Middle School  
 Heron's Head Park  
 International Studies Academy  
 John O'Connell High School  
 Marina Middle School  
 Point Reyes National Seashore  
 Presidio of San Francisco  
 Roosevelt Middle School

## Making WAVES: Connecting at-risk students to the San Francisco Bay Estuary

Working with at-risk San Francisco youth, Seven Tepees WAVES (Watershed Advocacy via Environmental Studies) built a sense of watershed stewardship in 40 grades 6-8 and 18 grades 10-12 students, 15 science teachers, and five counselors from the International Studies Academy. The goal of the project was to connect students to the San Francisco Bay Estuary and the Pacific and engage students in environmental issues, citizen-science monitoring, and environmental careers. Combined with the high school's Environmental Education Academy and Career Technical Education in chemistry and biotechnology, students received the message and support to set themselves on a career path in marine science or other environmental jobs. With the support of staff at study sites, many students began to see college as an attainable goal.



Above: Seven Tepees students prepare for an on-the-water experience.

Project WAVES enabled students to understand their personal relationship with, as well as the human impacts on, their local watershed and how those impacts migrate through the watershed to the Pacific. Each grade level engaged in age appropriate research activities, learning the scientific method and conducting research. Students in 6th grade, for example, visited the Gulf of the Farallones National Marine Sanctuary where

they viewed and touched animals like sea stars and crabs, performed a squid dissection, and created art using squid ink. Older middle school students conducted research in the field, and high school students are both recruited to act as mentors, where they earn a stipend and credits for graduation, as well as attend the Marine Science Summer Program. To date, over 2000 students have received career counseling, 152 received Watershed Naturalist Education, 50 attended the Marine Science Summer program and 60 teachers and counselors participated in the Watershed Education Workshops for Educators. These students are provided the tools to protect their local watershed and become active stewards for the environment.



# Education in Support of Workforce Development

## Partners include:

Marine Biological Laboratory  
Sea Education Association  
University of Maryland Eastern Shore  
U.S. Geological Survey  
Woods Hole Oceanographic Institute  
Woods Hole Research Center

**Right:** A student learns about CO<sub>2</sub> in seawater by blowing bubbles into colored water.

**Below:** Students look at specimens they collected on the R/V Gemma.



## Partnership Education Program widens world view for Woods Hole students, NOAA scientists, and the larger community

NOAA Fisheries has partnered since 2004 with the Marine Biological Laboratory, Sea Education Association, U.S. Geological Survey, Woods Hole Oceanographic Institution, and Woods Hole Research Center to form a consortium committed to creating “pathways of opportunity” for members of traditionally underrepresented groups in order to attract and retain a more diverse workforce. In 2009, the Woods Hole Partnership Education Program (PEP) was formed in collaboration with University of Maryland Eastern Shore and provides summer internships with practical experience in marine and environmental science, to college juniors and seniors, 15 total in 2014, from underserved communities across the Nation.



These students participated in activities that included a four-week course on global climate change and a six to eight week individual research project under a mentor, which culminated in a public presentation of research results.

In addition to conducting research and learning about marine and environmental sciences, PEP students discover the wide range of career opportunities in marine science through seminars, interacting with scientists and other students, workshops, a day-long at-sea experience, field trips, and career development activities. The strong mentoring culture across the six Woods Hole institutions also contributes to retention of PEP students and the increasing number of PEP alumni who return for further research training opportunities. Since its first year in 2009, PEP has hosted 90 students from 57 universities, many of whom had not previously considered careers in marine science and who have since gone on to graduate school or jobs in NOAA-related fields.





# Education in Support of Workforce Development

## Partners include:

Boulder Valley School District

## Kids experience on the job science

In October 2014, NOAA Boulder Labs, in Colorado, continued a ten-year tradition and hosted 300 8th graders from 10 Boulder District schools. Students learned about research ranging from how NOAA uses lasers to probe the atmosphere, to the meteorology behind predicting weather and extreme events such as devastating floods to learning about the Antarctic ozone hole, climate change, and life at the South Pole. Enthusiastic scientists and presenters gave the students a glimpse into the science behind destructive tsunamis, earthquakes, solar flares, and avalanches, sparking their interest with cutting-edge visualizations, hands-on activities, and personal stories.



Above: Kids are inspired by cutting-edge visualization tools during 8th Grade Science Days at NOAA Boulder.

*"The parent of a former student recently told me, 'Do you remember that student who was so social in 8th grade and you thought you didn't make a difference? Well, she is now in college, and majoring in meteorology. All because you took her on the NOAA Science Day field trip where one of the presentations sparked her interest!' Thank you for doing that field trip!"*

- 8th Grade teacher

This year, two new presentations resounded with the kids; a tag-team demo in front of the Space Weather Prediction Center where they learned about geomagnetism and the importance of predicting weather in space. Some groups were also introduced to 3-D visualizations where they tried out advanced and new game technology that is being used to animate NOAA's scientific data and models. The presentations and activities effectively engaged and excited the kids by using a wall with nine flat screens, 3-D glasses, an Oculus visor, a vibrating stylus, and educational exercises with "worm holes" that lead to various virtual worlds. Each group was scheduled for NOAA's most popular tour stop (according to the teachers); a visit to Planet Theater to view NOAA's illuminated and animated Science On a Sphere. This year's demos were coordinated with teachers to customize instruction about Earth science pertaining to 8th grade learning standards. By combining science with cutting-edge technology and enthusiastic presentations, NOAA Boulder is inspiring and cultivating a new generation of scientists.



## Education in Support of Workforce Development

### Partners include:

Newport News Public Schools

*“NOAA seems like a cool place to work” - Sara K.*

Below: Students conduct plankton tows and water quality testing as part of the new curriculum, *Shipwreck of the Deep*.

### Bringing STEM into Virginia classrooms through maritime heritage

Bringing science, technology, engineering, and math into the classroom, the Monitor National Marine Sanctuary, in collaboration with Newport News Public Schools in Virginia, developed a unique semester-long course for middle school students. Utilizing a comprehensive curriculum, *Shipwreck of the Deep*, developed through the partnership, Crittenden Middle School students engaged in real-world problem solving, while learning about NOAA and the Sanctuary program.

Using a problem-based learning strategy, students were tasked to locate a fictitious shipwreck, document and survey it, and determine the best way to preserve and protect that underwater cultural resource. Throughout the semester, students investigated the Nation’s maritime heritage, used their math skills to map a shipwreck, engineered remotely operated vehicles (ROV) for ocean exploration, discovered that shipwrecks are reefs, and learned about the chemistry and complexity of conserving artifacts. To learn more about the marine environment, students built a data buoy, conducted water

quality testing and plankton tows, and complemented their work by using NOAA data. To enrich their knowledge of NOAA careers, NOAA experts and scientists interacted with the students both in the classroom and in the field. This learning experience had a profound impact on the students with each student commenting that they highly recommended the program to all future students. This new course proved to excite and motivate our future workforce.





# Education in Support of Workforce Development

*"I was able to gather graduate school advice from NOAA employees and academic research scientists. These discussions have affirmed my interest in marine studies and encouraged me to pursue a Master's degree in marine conservation or coastal management."* - Ashley Gordon, National Marine Fisheries Service

Below: The Hollings Undergraduate Scholarship Class of 2014.

## Hollings Scholarship Program begins its 10<sup>th</sup> year of developing the next generation of scientists in NOAA mission fields

The Ernest F. Hollings Scholarship program provides undergraduates in fields relating to ocean and atmospheric science with a scholarship during the academic year and a 10-week paid summer internship at a NOAA facility. Since its inception in 2005, over 1,140 students from 40 states and 310 institutions have participated in the scholarship program. In fiscal year 2014, 115 students from the incoming class of 2012 completed the Hollings Program, and NOAA provided summer internship experiences for 120 students from the class of 2013. In addition, the incoming class of Hollings Scholars for FY 2014 was selected and included 106 new students from 65 universities in 33 states.

The internship provides hands-on experiences in NOAA-mission science, technology, and educational activities. The Program is legislatively mandated to increase undergraduate training in oceanographic and atmospheric science, technology, and education; recruit and prepare students for public service careers at NOAA and related science agencies; recruit and prepare students for careers as educators in oceanographic and atmospheric sciences; and improve environmental literacy and stewardship. Awards also include travel funds to attend

NOAA Scholarship Program orientation and a scientific conference where students present their research. Hollings Scholars report that the experience improved their skills for working in NOAA mission sciences, had an influence on their academic and career path, gave them a better understanding of NOAA's mission and expanded their professional network.





# Education in Support of Workforce Development

## Partners include:

- Cognitec
- Hatfield Marine Science Center
- Hewlett-Packard
- Media Macros, Inc.
- Oregon State University



**Above:** A child interacts with an exhibit at the new Free-Choice Learning Lab at the Hatfield Marine Science Center.

## Oregon Sea Grant brings free-choice learning to the marine sciences

Since 2003, Oregon Sea Grant has led the way at Oregon State University (OSU) and nationally in bringing current research on free-choice learning to marine education efforts. Oregon Sea Grant's focus on free-choice learning has created three new graduate programs at OSU, revamped programming and exhibits at the Hatfield Marine Science Center (HMSC) Visitors Center, and developed a robust, research agenda that has supported the work of almost 40 graduate students.

Free-choice learning occurs when individuals have control over what is learned, where it is learned, how much time is spent, and with whom learning occurs. Research shows that most ocean and marine science knowledge is learned in free-choice, non-school settings. In the learning sciences, observational data is typically collected and processed by hand, a labor-intensive activity. While museums and other informal environments are rich environments in which to understand how individuals learn, it has been difficult to involve large audiences in multiple contexts over time in this research. Starting in 2010, Oregon Sea Grant partnered with Hewlett-Packard, the OSU College of Engineering, and software developers across the US to turn the HMSC Visitors Center into a true free-choice science learning research lab. Sea Grant staff and partners have adapted leading-edge face-detection, human observation, and interpretation technology to develop exhibits that not only present information, but also automatically recognize and analyze people's activities, behavior, and responses to different types of exhibits at the HMSC Visitors Center and at beta-test remote sites. The technology has proven successful for collecting large amounts of observational data rapidly and has been instrumental in leveraging additional external funding for the Sea Grant Free-Choice Learning lab and partners. The new laboratory will allow guest scholars and graduate students from academia, museums, zoos, and aquariums nationwide to conduct their own research into learning, using state-of-the-art human observation technologies.



# Education in Support of Workforce Development

## Partners include:

Citizen Science Association

Wilson Center Commons Lab



Above: Esperanza Stancioff, climate change educator for University of Maine Cooperative Extension and Maine Sea Grant, leads a rockweed monitoring training session for citizen scientists involved in the Signs of the Seasons phenology monitoring program.

## NOAA launches a community of practice to support citizen science

The NOAA Office of Education launched a NOAA Citizen Science Community of Practice in November of 2013. The field of citizen science, which involves the public engaging in authentic research, is growing rapidly, and leveraging this field is important to NOAA's mission. This Community of Practice is helping to promote NOAA-related careers and develop young scientists, as well as encourage sharing and collaboration among the over 65 citizen science projects that NOAA supports. This community has been plugged into broader efforts across the federal government and the field as a whole.

The Community of Practice is facilitated by NOAA's Office of Education and in the spirit of the citizen science field, relies on grassroots participation from community members throughout the Agency. As a science mission agency, NOAA has a rich tradition of supporting citizen science. This tradition is alive and well today with many citizen projects supported by the agency having been started in the past five years. Through these projects, hundreds of thousands of volunteers contribute to and learn more about NOAA research. The response from a needs assessment survey was overwhelmingly in favor of the formation of the community and the following three items were identified as the primary areas of focus: compiling and sharing best practices; sharing resources; and creating a searchable database of NOAA's citizen science projects.

Since its formation, the community has grown steadily with over 120 members joining up. A collaborative website was selected as the primary communication platform for the community as it provides a suite of tools for facilitating user contributions. In addition to the collaborative site, the community communicates via a listserver, quarterly webinars, and focused conversation periods in a discussion forum. A volunteer Steering Committee provides guidance on how the Community of Practice can best be supported as it continues to grow and evolve.



# Acknowledgements

## **NOAA Education Council**

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We would like to thank the many people who contributed images for this document. These images represent a sampling of the many activities, audiences, and settings which comprise the current educational programming of NOAA and its partners. Individual image credits are listed in the reference section of this document on the following page.



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