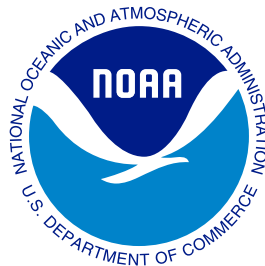


NOAA Education Accomplishments Report

Fiscal Year 2015





On the cover

Top left: Students of a NOAA Climate Stewards educator participate in a hands-on activity to understand the impacts of ocean acidification. Credit: D.J. Kast.

Top right: Juneau, AK students identify invertebrates in a touch tank at the NOAA Fisheries Sea Week activities. The Alaska Fisheries Science Center's Auke Bay Laboratories host all kindergarteners and sixth graders in the Juneau School District for hands-on activities illustrating NOAA science. Credit: Bonita Nelson, NOAA.

Bottom left: Students from the Lawrence School in Falmouth, MA take water quality samples as part of their project to raise awareness about the coastal pond near their school. Credit: Kate Condon, myObservatory.

Bottom right: A group of students take a photo with Dr. Dionne Hoskins from Savannah State University, part of the NOAA Educational Partnership Program Living Marine Resources Cooperative Science Center. Credit: NOAA.

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Partners and Friends of NOAA Education:

Each year we bring you stories that highlight the work we do in education. This year, we are especially proud to share our accomplishments – 2015 was a big year for NOAA Education! We are pleased to announce that we have updated our Strategic Plan, the culmination of years of collaborative work across all of NOAA's education programs. In this update, we maintain our focus on science literacy and workforce development, while further addressing our unique role in conservation, stewardship, safety, and preparedness. The Education Strategic Plan also gives us a unifying framework in which to track and report progress. We begin by sharing these accomplishments with you, presented for the first time under the umbrella of our new Strategic Plan.

This is an exciting time for science education. Movements like citizen science, crowdsourcing, and hands-on maker faires have created new opportunities for learning and collaboration. We continue to explore technological approaches, such as games and distance learning, while maintaining traditional, face-to-face events. With access to ships, labs, aircraft, satellite data, information, and experts, NOAA is in an excellent position to inspire the next generation of innovators and problem-solvers.

At the same time, the environmental challenges we face are intensifying. 2015 was the warmest year on record. The Arctic experienced a new low in peak sea ice extent, with scientists warning that climate change is having profound effects on the marine ecosystem and the communities that rely upon it. People across the country are experiencing the impacts of a changing climate, whether facing drought or floods, extreme heat or cold, loss of commercial species, or the emergence of new economic opportunities.

NOAA's work and the work of our partners has never been more important. Our scientific partners help conduct research and monitoring to support resilient communities. Our educational partners help reach people so that they better understand the changes the Earth system is undergoing and are prepared to take action when necessary. Ultimately, we hope that the people we reach become our lifelong partners as well. To all of our friends and partners, we are grateful for the work that you do.

Sincerely,



Louisa Koch

Director, NOAA Education



NOAA

2015 NOAA Education Accomplishments

Why does NOAA educate?



SANCTUARY CLASSIC

Mason Nunn from Colorado gets a little help from his dad on a big fish while fishing in Channel Islands National Marine Sanctuary in California.

The National Oceanic and Atmospheric Administration (NOAA) supports resilient communities, ecosystems, and economies. Our reach extends from the surface of the sun to the depths of the ocean floor as we work to keep citizens informed of their changing environment. From severe storm warnings and climate monitoring to coastal restoration and marine commerce, NOAA's products and services support economic vitality and stability.

NOAA has a vested interest in supporting and building a science-informed society. Whether working as a maritime professional or checking the daily weather forecast, people benefit from accessing and understanding the information that NOAA provides. This relationship is a two-way street. Resource management, planning, and responding to hazards benefit from the two-way engagement between NOAA and the stakeholders we serve. The systems NOAA observes not only influence many aspects of our lives, but also have the capacity to inspire and empower. Education, therefore, plays an important role in supporting NOAA's mission.

For this reason, education is built into the fabric of our agency. NOAA's role in science education is defined in the America COMPETES Act (P.L. 110-69), which provides broad authority for educational activities. The Act states: "The Administrator of the National Oceanic and Atmospheric Administration shall conduct, develop, support, promote, and coordinate formal and informal educational activities at all levels to enhance public awareness and understanding of ocean, coastal, Great Lakes, and atmospheric science and stewardship by the general public and other coastal stakeholders, including underrepresented groups in ocean and atmospheric science and policy careers. In conducting those activities, the Administrator shall build upon the educational programs and activities of the agency."



2015 NOAA Education Accomplishments

The America COMPETES Act complements standing mandates that authorize education in NOAA's programs, such as the National Marine Sanctuaries System, the National Sea Grant College Program, and the National Estuarine Research Reserve System (see the full list below). These statutes acknowledge the importance of education in fulfilling the distinct laws that NOAA executes, while the America COMPETES Act provides a unifying mandate for educational activities across the agency.



Students and their teacher plant trees during a stream restoration field trip supported by a NOAA Bay Watershed Education and Training grant.

NOOKSACK SALMON ENHANCEMENT ASSOCIATION

- America COMPETES Act – 2007, 2010
- National Sea Grant College Program Act – 1966, 1976, 2002, 2008
- National Marine Sanctuaries Act – 1972, 1980, 1984, 1988, 1992, 1996, 2000
- National Estuarine Research Reserve System, Coastal Zone Management Act – reauthorized or amended eight times since 1972-1996
- Magnuson-Stevens Fishery Conservation and Management Act – 1976, 2006
- Ernest F. Hollings Scholarship Program, Consolidated Appropriations Act – 2005
- Coral Reef Conservation Act – 2000
- Tsunami Warning and Education Act – 2006
- Marine Debris Research, Prevention, and Reduction Act – 2006
- Federal Ocean Acidification Research and Monitoring Act, Omnibus Public Land Management Act – 2009
- Ocean Exploration and Research, Omnibus Public Land Management Act – 2009

In this report, we highlight examples from across our agency that illustrate the myriad ways in which education supported NOAA's mission in fiscal year 2015 (FY15).

2015 NOAA Education Accomplishments

Education Strategic Plan

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

Goal 1: Science-Informed Society

An informed society has access to, interest in, and understanding of NOAA-related sciences and their implications for current and future events.

Goal 2: Conservation and Stewardship

Individuals and communities are actively involved in stewardship behaviors and decisions that conserve, restore, and protect natural and cultural resources related to NOAA's mission.

Goal 3: Safety and Preparedness

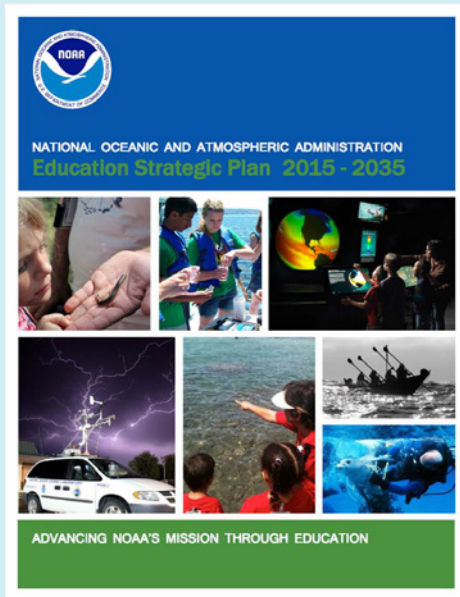
Individuals and communities are informed and actively involved in decisions and actions that improve preparedness, response, and resilience to challenges and impacts of hazardous weather, changes in climate, and other environmental threats monitored by NOAA.

Goal 4: Future Workforce

A diverse and highly-skilled future workforce pursues careers in disciplines that support NOAA's mission.

Goal 5: Organizational Excellence

NOAA functions in a unified manner to support, plan, and deliver effective educational programs and partnerships that advance NOAA's mission.



Students learn about marine creatures in the lab.

NATUREBRIDGE

2015 NOAA Education Accomplishments

NOAA Education by the numbers

As part of the Strategic Plan, we developed evidence of progress to help demonstrate the value of NOAA's work in education. NOAA's common measures are part of this evidence of progress. We collect common measures from programs across NOAA to communicate the reach of our investments.

- Over **61 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 science, data, and other information widely available to the American public.
- Nearly **530 institutions** increased educational capacity through NOAA-funded interpretive and 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. These programs aim to enhance understanding and use of ocean, coastal, Great Lakes, weather, and climate environmental information to promote stewardship and increase informed decision making.
- Over **360,000 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 give as many young people as possible opportunities to learn, stretch in new directions, and develop critical thinking skills, ingenuity, and scientific expertise.



NASA

NOAA's Deep Space Climate Observatory (DSCOVR) Satellite successfully launched on February 11, 2015.



A middle school student examines fish bones during a NOAA Science Camp activity in Seattle, WA.

LISA HIRUKI-RARING, NOAA FISHERIES

2015 NOAA Education Accomplishments

NOAA Education by the numbers

- Over **25,000 educators** participated in NOAA-supported professional development programs. Educating our educators in science, technology, engineering, math (STEM) and other disciplines will help them understand their world and provide useful scientific advancements 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 **31 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 sustainable fishing.
- Over **4,000 postsecondary students** trained in NOAA-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.
- Nearly **570 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.



DR. CHRIS CHAMBERS

Regina McCormack, 2009 NOAA Hollings Scholar, interned with NOAA Fisheries under the mentorship of Dr. Chris Chambers.

The importance of partnerships

NOAA works with a wide array of partners including federal, academic, not-for-profit, and private partners to achieve the common performance measures as well as individual education accomplishments. Throughout this document, we highlight partners to acknowledge the organizations we work with to advance NOAA's mission of science, service, and stewardship. Our education portfolio also relies on extensive collaboration within NOAA. For each effort in this report, we list the lead program or office first, followed by the other NOAA collaborators.

NOAA Education Council

The Education Council is the forum in which representatives from NOAA's major education programs coordinate activities, increase capacity for NOAA educators, and monitor progress under the framework of the Strategic Plan. Council members represent Line Offices and Staff Offices within NOAA's organizational structure. Council members submitted stories from their education portfolios to share in this report.

National Environmental Satellite, Data, and Information Service

National Environmental Satellite, Data, and Information Service Education

National Marine Fisheries Service (NOAA Fisheries)

NOAA Fisheries Education

NOAA Teacher at Sea Program

National Ocean Service

National Ocean Service Education

Office for Coastal Management

National Estuarine Research Reserve System

Office of National Marine Sanctuaries

Dr. Nancy Foster Scholarship Program

National Weather Service

National Weather Service Education

Warning Coordination Meteorologist Education

Office of Oceanic and Atmospheric Research

Oceanic and Atmospheric Research Education

Climate Communications and Education Program, Climate Program Office

National Sea Grant College Program

Ocean Exploration and Research Program

Office of Education

Environmental Literacy Program

Educational Partnership Program with Minority Serving Institutions

Ernest F. Hollings Undergraduate Scholarship Program

NOAA Bay Watershed Education and Training Program (B-WET)



DISCOVERY SCIENCE CENTER

Goal 1: Science-Informed Society

An informed society has access to, interest in, and understanding of NOAA-related sciences and their implications for current and future events.

NOAA's actions – such as issuing severe weather warnings, providing reliable climate science, and maintaining safe and productive fisheries – protect people's lives and livelihoods. In this section, we highlight NOAA Education programs and efforts that increase the public's ability to access, understand, and use the science and services that NOAA provides. NOAA is committed to creating a science-informed society through collaborations and partnerships with educators and decision makers for both K-12 and higher education. We also work with informal education institutions, such as museums, aquariums, zoos, and science centers that share our mission. Together with our partners, we incorporate NOAA assets into education programs that engage youth and adults from all backgrounds in locally and globally relevant, inquiry-based learning opportunities. These opportunities include support for curriculum development, NOAA-related exhibits and displays, and citizen science projects that collect data for research and resource management. Goal 1 lays the groundwork to support society in making sound environmental decisions and being responsible stewards of the natural resources that NOAA manages.

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

New England B-WET
Maine Sea Grant
National Weather Service

PARTNERS

University of Maine Senator
George J. Mitchell Center
University of Maine Climate
Change Institute
Schoodic Institute, Acadia National
Park
U.S. Geological Survey

National Weather Service scientists, partners in this project, train teachers in reading a rain and snow gauge using a hands-on water balloon game.

What is the *Future of Four Seasons* in Maine? Students are helping scientists find out

Snow in Maine – it's not just a nuisance. Snow supports recreation, creates habitat for animals, and provides migration cues and drinking water. Change in snow cover is underfoot evidence of climate change in Maine. Funded by New England B-WET and the University of Maine, the Schoodic Institute at Acadia National Park's *Future of Four Seasons* in Maine directs high school students in the study of snowpack and climate. Students pair their own research questions with the data collection needs of climate scientists from NOAA's National Weather Service, the U.S. Geological



HANNAH WEBBER, SCHOODIC INSTITUTE

Survey, and more. While students investigate questions about maple syrup production, animal food availability, or fresh water resources, they provide additional sampling sites for the scientists, who in turn teach them how snowpack data are used to gauge long-term trends and insights into global climate change.

High school teachers and students are trained in authentic data collection following strict protocols. In addition to providing data for partner scientists, data are provided to the Community Collaborative Rain, Hail, and Snow (CoCoRaHS) Network, a national volunteer network collecting high-quality precipitation data beyond the scale that would be achievable by a typical scientist's research project. "Our students develop background understanding about weather and climate, create hypotheses, develop a collection strategy, collect data, and analyze them," said Sarah Nelson, University of Maine Principal Investigator of the project. "We discovered that students learned a lot through hands-on field investigation and authentic data collection and analysis."

Annually, 300 high school students and their teachers from 13 schools across Maine partner with climate scientists for this project. Over 100 records are provided to CoCoRaHS each year. Teachers appreciate the opportunity to learn how to "wrangle" real data in the classroom, and value the service component of this project, which is validated by appreciative scientists who conduct in-person and virtual visits to their classrooms.



HANNAH WEBBER, SCHOODIC INSTITUTE

Students at Cobscook Community Learning Center, an alternative high school in Downeast Maine, collect data about recent snowfall in their local watershed.

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

NOAA Teacher at Sea Program

NOAA Fisheries

Office of Marine and Aviation Operations

Southeast Fisheries Science Center

2015 NOAA Teacher at Sea Julia West, a high school science teacher at a distance learning school based in Vermont, stands at the helm of NOAA Ship *Gordon Gunter*.

“Water — particularly freshwater — is such a huge issue. And it’s a way to connect the students, too. They’re all over the world, but we’re discussing the one world ocean they all share.”

- Julia West

NOAA Teacher at Sea

A plankton sample collected on board NOAA Ship *Gordon Gunter*.



JULIA WEST

2015 NOAA Teacher at Sea Julia West shares research at sea with students around the world

Julia West has a unique teaching arrangement for a high school science teacher: she is based in Vermont, but her students are located around the country and the world, from the Bahamas to Singapore. Oak Meadow School is a distance learning school with courses taught at individual paces. The students, mostly homeschooled, have a great range of backgrounds. With no opportunity to take her class into the lab or field, Ms. West looks for creative ways to engage her students in science.



JULIA WEST

Ms. West learned about NOAA’s Teacher at Sea Program from her daughter, a NOAA Hollings Scholar, and applied for the 2015 season. In March 2015, Ms. West sailed on a winter plankton survey in the Gulf of Mexico. While on board NOAA Ship *Gordon Gunter*, she continued teaching her students through her blog, posing math challenges, and responding to questions about life at sea. Ms. West quickly saw a valuable role for teachers to help communicate NOAA scientists’ knowledge of their specialized fields, realizing “how important it was for teachers to take this and connect it to the ‘big picture’ for their students.”

Engaging students through her blog exposed some topics that needed clarification. “I found that, even though we’d covered the topic of plankton, nobody really knew what it was,” Ms. West relates. She and her students were surprised to learn that “plankton” comprises all creatures that drift in the ocean: not just algae, but also fish eggs, even jellyfish. Ms. West is excited about using dissolved oxygen data that NOAA scientist Kim Johnson provided to teach her students about eutrophication, which occurs when excess nutrient runoff causes plankton to grow very quickly and then use up all of the available oxygen when they die and decompose. Ms. West plans to tie the Gulf of Mexico “Dead Zone,” a particularly hypoxic (low-oxygen) region that cannot support marine life, to eutrophication events around the world, bringing the issue closer to her students.

Since her experience, Ms. West rewrote the curriculum for Oak Meadow’s environmental science course. “Ocean science is becoming a huge part of the course, when it wasn’t before,” she says. “Water – particularly freshwater – is such a huge issue. And it’s a way to connect the students, too. They’re all over the world, but we’re discussing the one world ocean they all share.”

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

Flower Garden Banks National Marine Sanctuary

Office of National Marine Sanctuaries

PARTNERS

Aquarium at Moody Gardens

Angleton Library

The Reef on the Road traveling exhibit (right) about Flower Garden Banks National Marine Sanctuary won a best of show award at the 2014 Association of Zoos and Aquariums Conference in Orlando, FL.

Reef on the Road brings the Flower Garden Banks to a town near you!

Flower Garden Banks National Marine Sanctuary is located over 100 miles off the Texas-Louisiana coast and is difficult for most people to access. As a result, only scuba divers and fishermen are ever likely to visit and see this underwater jewel. This makes it difficult to raise interest and awareness of the sanctuary and its beautiful coral habitats. In addition, two-thirds of the United States lies within the watershed of the Gulf of Mexico, where the sanctuary is located. That means that millions of people impact the water quality of the Gulf of Mexico and the diverse habitats it encom-



KELLY DRINNEN, FLOWER GARDEN BANKS NATIONAL MARINE SANCTUARY

passes, whether they realize it or not. Several years ago the sanctuary developed a traveling exhibit that would share the sanctuary with a greater variety of venues and audiences. This new exhibit, Reef on the Road, was completed in September 2014 and premiered at the Association of Zoos and Aquariums Conference, where it took home an award for best display in the exhibit hall.

Since its premiere, Reef on the Road has been to The Aquarium at Moody Gardens in Galveston, TX, and Angleton Library in Angleton, TX. As part of the exhibit plan, a sanctuary educator visited with each host site to provide staff and volunteer training about the sanctuary and the exhibit messages. In addition, sanctuary education staff have worked with each venue to provide programming for the community at large. Reef on the Road has been very well received by guests and host sites alike.

“The Reef on the Road traveling exhibit has given us new avenues to promote our collection.”

- David T. Thrash

Library Director for the Brazoria County Library System

David T. Thrash, Library Director for the Brazoria County Library System, says, “The Reef on the Road traveling exhibit has given us new avenues to promote our collection. In addition to information talks, we have been able to promote books in our collection, databases, joint programming with local groups like the Texas Master Naturalist Cradle of Texas Chapter, and an event with Jesse Cancelmo, author of *Texas Coral Reefs*. All of these have focused attention and heightened awareness of Flower Banks National Marine Sanctuary and the information and resources our library can provide to the public.”



KELLY DRINNEN

FLOWER GARDEN BANKS NATIONAL MARINE SANCTUARY

Visitors to the Reef on the Road exhibit in the Aquarium at Moody Gardens in Galveston, TX, were first captivated by video highlights of Flower Garden Banks National Marine Sanctuary, then continued their exploration to learn about reef residents, reef challenges, and sanctuary research.

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

Office of Education

Connecticut Sea Grant

Coral Reef Conservation Program

Jacques Cousteau National Estuarine Research Reserve

National Ocean Service

NOAA Fisheries

North Carolina Sea Grant

San Francisco Bay National Estuarine Research Reserve

PARTNERS

Lawrence Hall of Science of the University of California, Berkeley

Rutgers, the State University of New Jersey's Institute of Marine and Coastal Sciences

Scripps Institution of Oceanography University of California, Santa Cruz

University of Connecticut

University of San Diego

University of Washington

Sixth grade students engage in activities and games to understand the greenhouse effect (below) and the carbon cycle (right). The activities are part of the NOAA-funded Ocean Sciences Sequence.



CATHERINE HALVERSEN, LAWRENCE HALL OF SCIENCE

Two nationally field-tested curricula bring ocean and climate sciences into classrooms

The ocean plays an important role in our daily lives whether we live near the coast or far from it. However, few elementary and middle school curricula addressed concepts critical to understanding this role. To address this need, NOAA's Office of Education invested in the development of two nationally field-tested curricula, the Ocean Sciences Sequences for Grades 3-5 and 6-8, which are part of the Lawrence Hall of Science's Great Explorations in Math and Science series. Both curricula focus on the fundamental concepts of the Ocean Literacy Framework, including the ocean's role in weather and climate. Both involved NOAA scientists and science educators in their development and incorporate NOAA data and visualizations.

The Ocean Sciences Sequence for Grades 6-8 (OSS 6-8) is particularly well positioned to respond to the changes recommended by the National Research Council's Framework for K-12 Science Education and the Next Generation Science Standards (NGSS), which



CATHERINE HALVERSEN, LAWRENCE HALL OF SCIENCE

16 states and District of Columbia have adopted and are in the process of implementing. The National Research Council's Framework was published during the development of the curriculum and informed its design. As a result, the OSS 6-8 was recently recommended by WestEd K-12 Alliance to teachers participating in California's NGSS Early Implementation Project.

To date, seven school districts in five states have adopted one or both of these curricula. Additionally, each has been leveraged by other education projects. NOAA's California B-WET Program has supported implementation of the Ocean Sciences Sequence for Grades 3-5 by the Santa Barbara Unified School District, while a recent NOAA Environmental Literacy Grant has supported the adaptation of Ocean Sciences Sequence for Grades 6-8 in pre-service teacher education courses at five universities. Beyond NOAA, two Climate Change Education Partnerships funded by the National Science Foundation have used OSS 6-8 in their professional development programs for educators. Working with curriculum developers is one strategy NOAA Education employs to ensure projects supported with Environmental Literacy Grants are topically relevant and pedagogically sound, while addressing the agency's mission and education goals.

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

NOAA Teacher at Sea Program

NOAA Fisheries

Office of Marine and Aviation Operations

Southeast Fisheries Science Center

2015 NOAA Teacher at Sea Jeffrey Miller, who teaches science at a community college in Arizona, demonstrates the proper way to hold a sharpnose shark.

2015 NOAA Teacher at Sea Jeffrey Miller brings the sea back home to the desert

At Estrella Mountain Community College in Buckeye, AZ, Jeffrey Miller teaches biology, anatomy, and physiology to students of all ages and diverse backgrounds. In 2014, Mr. Miller decided to use his sabbatical year to develop a marine science course. But real world experiences with marine organisms and environments are hard to come by in Arizona. “Many of my students haven’t gone out and seen a whole lot,” he explains. “I wanted to give them a feel for – an appreciation for – the ocean.” He was excited to learn about NOAA’s Teacher at Sea Program online and thrilled to be accepted into the 2015 class.

“Many of my students haven’t gone out and seen a whole lot. I wanted to give them a feel for — an appreciation for — the ocean.”

- Jeffrey Miller
NOAA Teacher at Sea

In August 2015, Mr. Miller set sail on a 15-day shark survey in the Gulf of Mexico. On board NOAA Ship *Oregon II*, he learned a great deal about the nature of research at sea – in particular, the teamwork, organization, and preparation required for each cruise. “Once you’re at sea, you can’t run back for something you forgot,” he relates. As Mr. Miller and the scientists sailed along the Gulf Coast, they noticed dramatic variation in the number of sharks caught at each survey station. Mr. Miller explained in his Teacher at Sea blog that a key factor influencing shark distribution is the amount of dissolved oxygen in the water.

Back in Arizona, Mr. Miller is designing an introductory-level marine biology course, through which he plans to build basic ocean literacy among his desert-based students and share what it’s like to conduct research at sea. The experience “gives me more credibility,” Mr. Miller explains. Inspired by his voyage, he is creating lessons on ocean habitats and on the Gulf of Mexico “Dead Zone,” an area where dissolved oxygen is too low for sharks and other marine life to survive. He looks forward to introducing his students, many with military connections or interests, to the career opportunities in the NOAA Corps. In sharing his experience, he “hope[s] to foster greater curiosity and excitement about marine science, and help students see why it is so important to protect and conserve the ocean’s resources for future generations.”



JEFFREY MILLER

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

National Ocean Service
Climate Program Office
Earth Science Research Laboratory
Mississippi-Alabama Sea Grant
National Centers for Environmental Information
National Estuarine Research Reserve System
NOAA Fisheries
Office of the Chief Scientist
Ohio Sea Grant
Pacific Marine Environmental Laboratory
Washington Sea Grant

PARTNERS

Eckerd College
National Center for Atmospheric Research
National Renewable Energy Laboratory
National Science Foundation Ice Drilling Program
North Carolina Sentinel Site Cooperative
North Shore Community College
Office of Science and Technology Policy
U.S. Forest Service
University Corporation for Atmospheric Research
Will Steger Foundation
U.S. Geological Survey National Ice Core Laboratory

A NOAA Climate Stewards Educator's students see the effects of melting glaciers on sea level using a water cycle model in a hands-on activity in their classroom.

NOAA Climate Stewards: Expanding national reach and impact

Our understanding of the global climate is constantly evolving. Climate research builds off of advancements across many disciplines, from physics and oceanography to archaeology and social science. The complex subject matter and the frequent new discoveries make climate a challenging subject for teachers to tackle in their classrooms. To address this need, the NOAA Climate Stewards Education Project helps educators better understand and communicate climate processes occurring in our planet's ocean and atmosphere to increase informed decision-making about the environment.



KOTTIE CHRISTIE-BLICK

In FY15, Climate Stewards grew to over 800 formal and informal educators, more than doubling participation from the previous year. Educators engaged in online and face-to-face opportunities including online seminars and multi-day workshops. Over 1,200 educators attended live monthly broadcasts given by nationally recognized scientists, educators and communicators, and video archives were viewed over 600 times. Post-event evaluations indicate that 86% of attendees intend to use what they learned in their work over the next year.

Building on these distance learning opportunities, 390 formal and informal educators participated in one- to three-day face-to-face Climate Stewards workshops in Seattle, WA; St. Petersburg, FL; Boulder, CO; Silver Spring, MD; and at the National Science Teachers Association national conference in Chicago, IL. All attendees interacted with climate science education and communication experts, participated in hands-on education activities, and visited facilities to explore technologies and innovations in Earth-system science. Each workshop focused on the regional concerns of climate change as well as national and global perspectives. Post workshop evaluations indicated attendees were significantly more knowledgeable in workshop content, and that all planned to address the topics presented in the workshops within the next year, sharing the information and resources with over 10,000 colleagues, youth, and adults.

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

Hawai'i B-WET

PARTNERS

Hawai'i Institute of Marine Biology

Hawai'i State Family Courts

Myron B. Thompson Academy

U.S. Fish and Wildlife Service

University of Hawai'i Center for Microbial Oceanography: Research and Education

Windward Community College

"I just wanted to thank you for everything that you have done for me. ... I'm really excited about what the future has to give me and I am willing to work hard and commit to these programs no matter what it takes."

- Jaychelle

NALU Studies high school student, age 15

The following summer, Jaychelle successfully completed the six week research program to earn four college credits and a \$1000 scholarship. She will return as a NALU mentor.

NALU Studies: Surfing high risk and gaining high value

In Hawai'i, the language contains clues to knowledge handed down between generations and among communities. The Hawaiian word "nalu" has many meanings, including ocean waves or surf, the fluid surrounding a baby in the womb, or as a verb, to meditate or ponder. Therefore, it is a special program that can call itself, the NALU (Nature Activities for Learning and Understanding) Studies Program. The NALU Studies Education Center was established in 2010 in response to a growing need for effective experiential education programs in Hawai'i to redirect the lives of adjudicated (convicted of a crime and possibly facing detention) and high-risk 13-18 year old students.



NALU STUDIES

The NALU studies program combines experiential education in marine and environmental sciences, mentoring relationships with scientists and indigenous Hawaiian cultural practitioners, eco-therapy, peer mentoring, and leadership training. The program strives to help high-risk youth develop new skills, cultivate academic confidence, enhance self-esteem, identify potential careers, and change how they perceive their role in society. With support from NOAA's Hawai'i B-WET and other partners, in 2015 the NALU Studies Education Center was able to redirect the lives of over 105 Hawai'i's high-risk youth through applicable, place-based educational activities in this year's mentoring sessions. The NALU Academic 101 and 102 curriculum enabled NALU students to receive both high school and college credit.

NALU students gain a better understanding of possible careers, leadership strategies, Native Hawaiian culture, Hawai'i's unique ecosystem, and their roles as Hawai'i's future responsible leaders. Due to high demand for these educational opportunities, the NALU program is expanding to reach at risk youth on the Waianae coast, and on the island of Kauai. The NALU program lives up to its name as it helps the children of Hawai'i navigate their own way to become the next generation of environmental stewards and community leaders who make profound impacts upon the environment and their communities.



NALU STUDIES

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

Office for Coastal Management
American Samoa National Marine Sanctuaries Ocean Center
NOAA Fisheries
Office of Marine and Aviation Operations
Southeast Fisheries Science Center

PARTNERS

American Samoa and Hawai'i Department of Education
Imiloa Astronomy Center in Hawai'i
Ka Waihona Charter, Hawai'i
Kea'au Middle School, Hawai'i
Matafao Elementary School, American Samoa
Polynesian Voyaging Society
The Bernice Pauahi Bishop Museum

Science on a Sphere® bridges distances, partners, and climate change conversations for American Samoa and Hawai'i students

Climate change issues are challenging for teachers and students. Dynamic visuals and peer inquiry are an important tool for engaging students in challenging discussion about topics related to risk management. Over 200 students from American Samoa and Hawai'i interacted with each other via a live Google hangout, utilizing Science on a Sphere® – a room-sized, global display system that illustrates planetary data. Held on September 25th, the interactive gathering showcased NOAA datasets related to climate change and footage from the Polynesian Voyaging Society.



NOAA

Aimed at encouraging coastal stewardship among young people, and engaging students on the Polynesian Voyaging Society's current worldwide voyage and its theme of Malama Honua, Taking Care of Island Earth, the event also included a live question and answer session open to all participants, both on-site and online. In addition to the Polynesian Voyaging Society, the hangout was made possible through a partnership between the American Samoa and Hawai'i Department of Education, participating schools – Matafao Elementary in American Samoa, Ka Waihona Charter and Kea'au Middle Schools in Hawai'i – the Bishop Museum and Imiloa Astronomy Center in Hawai'i, and many of NOAA's offices in the Pacific Islands

The multifaceted event provided an opportunity to simultaneously bolster and broaden the Office for Coastal Management's current partnership networks in the Pacific, and to foster coastal stewardship by engaging new audiences with Office for Coastal Management's suite of data, tools, and products. The students had an opportunity to empathize with other communities that are dealing with hazards in their own background.

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

Office of Ocean Exploration and Research

Marine National Monument Program

NOAA Fisheries

NOAA Inouye Regional Center

Pacific Islands Regional Office

PARTNERS

College of Charleston's Science Center

Hawai'i Institute of Marine Biology

Northern Mariana Islands and Guam Public School Systems

University of Hawai'i, Manoa

Waikiki Aquarium

Educators on Oahu visit the NOAA Ship *Okeanos Explorer* during an Ocean Exploration and Research professional development workshop.

Educators in Saipan learn through "learning objects" about why NOAA explores the ocean.



HEIDI HIRSH

Educators learn why NOAA explores the South Pacific

In late spring of 2015, the NOAA Ship *Okeanos Explorer* headed to Hawai'i for the Campaign to Address Pacific Monument Science, Technology, and Ocean Needs (CAPSTONE). CAPSTONE is a multi-year science effort focused in deep waters of U.S. Marine Protected Areas in the central and western Pacific to collect baseline data to support science and management needs around the U.S. Marine National Monuments and other protected areas. The CAPSTONE expeditions provide a unique opportunity to reach educators in the South Pacific with on-site professional development to enhance understanding of the importance of ocean exploration, as educators in remote locations can be underserved due to limited access.



MARK HECKMAN, HAWAII INSTITUTE OF MARINE BIOLOGY

To introduce CAPSTONE, educators from Saipan and Guam participated in a professional development course titled *Why Do We Explore the Marianas Trench Marine National Monument?* The 8-hour course introduced educators to the 2015 Hohona Moana: Exploring Deep Waters off Hawai'i Expedition, the first in the CAPSTONE series.

Educators learned about submarine features and ecosystems within the Marianas Trench Marine National Monument. Topics included climate change, ocean acidification, submarine volcanoes, and hydrothermal vents. They learned about how the remotely operated vehicle, *Deep Discoverer*, reveals new discoveries in real time through telepresence. Nearly all said they were going to use the education materials, anticipating that nearly 6,800 students would be reached. Educator professional development was also held on Oahu in partnership with the Waikiki Aquarium and Hawai'i Marine Biology Institute during which the expedition's principal Investigator, Dr. Christopher Kelley, discussed importance of exploration in this region.

Two new shore-based telepresence-enabled ship-to-shore Exploration Command Centers were established at the University of Hawai'i, Manoa, and NOAA's Inouye Regional Center, enhancing participation from shore by scientists, students and the public. Students and faculty at the College of Charleston's Science Center joined the dives in a modified Exploration Command Center, enabling students to observe ocean exploration in real time in the deep Pacific Ocean off Hawai'i from a college laboratory located on the coast of the Atlantic.

GOAL 1: Science-Informed Society

NOAA COLLABORATORS

National Ocean Service

National Weather Service

NOAA Fisheries

Office of Ocean Exploration and Research

PARTNERS

Koshland Science Center

PBS NOVA Labs

Updated games website showcases new games from NOAA and partners.

Young Meteorologist game increases knowledge about severe weather events.

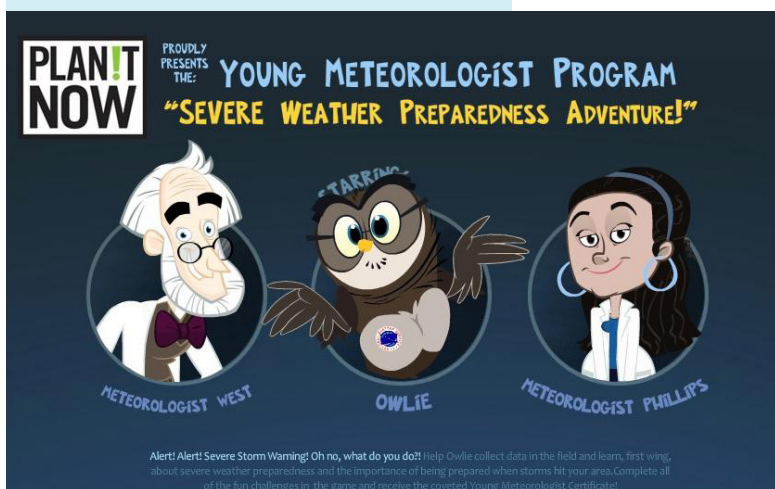
NOAA Games website is redesigned and updated

Games are increasingly used to help inspire curiosity, creativity, collaboration and problem-solving in a wide variety of audiences. Serious games address real-world challenges, encourage systems thinking, and promote active engagement. NOAA develops games to help students increase strategic thinking, interpretive analysis, problem solving, collaboration, and critical thinking. With the rapid increase in the amount of and use of games in education, games.noaa.gov has a new look to showcase new games and simulations developed by NOAA and its partners.



New NOAA game links on the site include the Young Meteorologist from the National Weather Service, My Submarine Explorer from the NOAA Office of Exploration, and Atlantic Sturgeon from NOAA Fisheries. NOAA partnered with the Koshland Science Center in Washington, DC, and PBS NOVA Labs to provide links to the Extreme Events and the Energy and Cloud Labs games. A special section showcasing climate games and new coastal resilience simulations is planned for in 2016 in partnership with the Smithsonian National Museum of Natural History.

The site was visited by over 621,000 K-12 students during FY15, almost tripling the number from FY14 of 237,000. This increased traffic is an indication of both the growth of gaming in education and the interest in NOAA content.



GOAL 1: Science-Informed Society

NOAA COLLABORATORS

Office of Ocean Exploration and Research

NOAA Teacher at Sea Program
Puerto Rico Sea Grant

PARTNERS

Puerto Rican Tourism Company

This rare dumbbo octopus (*Cirrothauma murrayi*) is often called the Blind Octopod due to the lack of a lens and reduced retina in its eyes. The eyes can detect light, but cannot form images.

Educators in San Juan, Puerto Rico learn first hand about NOAA ocean exploration

As the NOAA Ship *Okeanos Explorer* sailed from home port in Rhode Island to Puerto Rico in early spring 2015, education materials, including the lesson *Explorando EN VIVO con el Barco Okeanos Explorer de NOAA* (Exploring LIVE With the NOAA Ship *Okeanos Explorer*) and the supporting video, *¿Por Qué Exploramos?* (Why Do We Explore?), were translated into Spanish in preparation for an educator professional development offered the ship reached the island. The *Oceano Profundo 2015: Exploring Puerto Rico's Seamounts, Trenches and Troughs Expedition* provided a unique



NOAA OFFICE OF OCEAN EXPLORATION AND RESEARCH 2015 OCEANO PROFUNDO

opportunity for the Office of Ocean Exploration and Research to reach Puerto Rico's educators with on-site professional development to enhance understanding of the importance of ocean exploration, as educators in remote locations like the Caribbean can be underserved due to limited access.

Planned in partnership with Puerto Rico Sea Grant and held at the Puerto Rican Tourism Company in Old San Juan, educators learned why we explore the ocean through the context of ocean and human health, climate change and energy, and how NOAA uses science with technology aboard the *Okeanos Explorer* to systematically characterize areas of the unknown deep ocean. Educators and students joined the expedition in real time via telepresence as scientists explored previously unseen deep ocean areas off Puerto Rico using the ship's remotely operated vehicle, *Deep Discoverer*. Theresa Paulsen, a high-school science teacher from Wisconsin, was on board and blogged, "My goal is to learn as much as I can on this expedition! There is no better way to motivate students to become lifelong learners and scientific thinkers than to show them how exciting real research can be."

"There is no better way to motivate students to become lifelong learners and scientific thinkers than to show them how exciting real research can be."

- Theresa Paulsen
NOAA Teacher at Sea



NOAA OFFICE OF OCEAN EXPLORATION AND RESEARCH 2015 OCEANO PROFUNDO

Educators in Puerto Rico learn how multibeam mapping is used on board the NOAA Ship *Okeanos Explorer* to explore the ocean.



LAKE SUPERIOR NATIONAL ESTUARINE RESEARCH RESERVE

Goal 2: Conservation and Stewardship

Individuals and communities are actively involved in stewardship behaviors and decisions that conserve, restore, and protect natural and cultural resources related to NOAA's mission.

Conservation and stewardship are vital aspects of NOAA's mission. NOAA is charged with upholding the conservation laws that protect ecosystems and economies, conserving marine species, and promoting the sustainable use of living marine resources. The stories in this section represent just a few of the educational methods and practices that NOAA uses to promote environmental problem-solving and stewardship behaviors. These efforts involve hands-on scientific inquiry, civic engagement, and environmental restoration, fostering an educated public with an improved capacity to make scientifically informed decisions. Many of NOAA's stewardship and conservation programs are place-based education experiences that immerse the learner in local heritage, culture, landscapes, and history. Stewardship education is also an important component of co-managing natural resources with Native groups. Stewardship education is intended to help navigate conflicts by engaging the public early and often in decisions and actions that affect the resources they use and care about.

GOAL 2: Conservation and Stewardship

Florida students learn the value of fishing to their community's heritage and economy

NOAA COLLABORATORS

NOAA Fisheries

National Weather Service

Office of Ocean Exploration and Research

Southeast Regional Office

PARTNERS

Admiral Farragut Academy

Commercial and recreational fishing are important industries in the Tampa Bay, FL, area. In 2014, 33 million dollars in commercial fishing landings were delivered to the ports of Tampa Bay and St. Petersburg. Also In 2014, over 6.5 million anglers fished recreationally in the marine waters of Florida. Even though fishing is a common activity for Florida families, students may not realize its significance in their community. When social scientists from NOAA Fisheries' Southeast Regional Office teamed up with educators to guide students through the process of collecting oral histories from local recreational and commercial fishermen, students gained a greater understanding of social science research methods and the value and importance of fishing in their own community.

Eighth grade marine science students in St. Petersburg, FL, learned to capture fishing history by gathering oral histories of local fishermen and members of the fishing industry. Through this NOAA Fisheries-funded project, students preserved a part their community's history and learned firsthand about fishing and how it has changed over time in the greater Tampa Bay area. Captured oral histories were archived on NOAA's Voices from the Fisheries website, an online oral history database where the interviews will be available to researchers and the public. Twenty-eight students and their teacher gained greater perspective on the recreational and commercial fishing sectors in their community through this project's two interview days (in March and September of 2015) with fishermen and members of the fishing industry.

Florida students interview a fisherman to learn the value of fishing to their community's heritage and economy.



SARI DIETCHE

This project represents the second year of the 'Voices of the Fisheries' partnership with Admiral Farragut Academy in St. Petersburg, FL. The first year of work was funded by a NOAA Preserve America grant.

GOAL 2: Conservation and Stewardship

NOAA COLLABORATORS

NOAA Fisheries

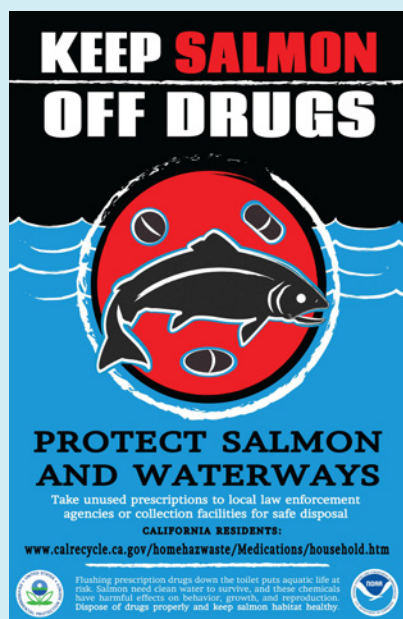
West Coast Regional Office

PARTNERS

Pacific Northwest College of Art

U.S. Environmental Protection Agency

Grace Murphy and Beryl Alee's illustration on littering is part of a social media campaign, #CitizenOfYourWatershed, which uses animations and illustrations to show the importance of human actions on watersheds.



STEPHANIE J. FOGEL

Stephanie Fogel designed a multi-media campaign, "Keep Salmon Off Drugs" to highlight the effects of pharmaceuticals in our water sources and emphasize the importance of stewardship of clean waterways.

Salmon water quality mural created by Esteban Camacho Steffensen, a 2015 Science in Studio Award recipient.

NOAA partners with Pacific Northwest College of Art and EPA to bridge science and conservation with art

To reach individuals in a new and innovative way, NOAA Fisheries partnered with the Pacific Northwest College of Art and the U.S. Environmental Protection Agency (EPA) to establish the Science in Studio Award, which showcases through art how our actions affect the health of our ecosystem. The 2015 award focused on water quality and the impacts of toxins on our landscape, expanding on a 2013 NOAA Fisheries-Pacific Northwest College of Art collaboration. In 2015, four artists undertook three projects that addressed the impacts of pharmaceuticals and toxic runoff in watersheds and outlined stewardship actions people can take to maintain healthy waterways:



GRACE MURPHY

- #CitizenOfYourWatershed social media "Think Before You Toss" campaign using animations and illustrations to show the impact of human actions on watershed health.
- A multi-media campaign, "Keep Salmon Off Drugs," focusing on keeping watersheds clean, and the presence of pharmaceuticals in our water sources and their effects on salmon.
- An educational salmon water quality mural, focusing on protecting watersheds from toxic runoff. The mural can be mass-produced and distributed as a color poster, and can also be used as a plan to facilitate the creation of murals based on the poster.

The reach of the projects is substantial: NOAA Fisheries' West Coast Regional Office Facebook page showed that the "Think Before You Toss" animation reached 27,000

and the "Keep Salmon Off Drugs" poster reached 15,000 people. The salmon mural included an educational curriculum on salmon health; the artist recently painted the mural with the help of elementary students in Corvallis, OR. The projects from the Science in Studio Award reach out to audiences who may be new to NOAA, fostering stewardship through art.



ESTEBAN CAMACHO STEFFENSON

GOAL 2: Conservation and Stewardship

NOAA COLLABORATORS

NOAA Marine Debris Program
Oregon Sea Grant

PARTNERS

Oregon State University

Teachers sort through marine debris at a workshop reviewing the new STEAMSS curriculum.

The curriculum integrates science, technology, engineering, art, math and social studies (STEAMSS) to make marine debris lessons and activities easily integrated into teaching plans.

Students participate in hands-on marine debris activities as part of the new STEAMSS curriculum.



OREGON SEA GRANT

A new, web-based STEAMSS curriculum focuses on marine debris

Our ocean is filled with items that do not belong there. Huge amounts of consumer plastics, metals, rubber, paper, textiles, derelict fishing gear, vessels, and other lost or discarded items enter the marine environment every day, making marine debris one of the most widespread pollution problems facing the world's ocean and waterways. Marine debris is a threat to our environment, navigation safety, the economy, and human health. It is a complex and pervasive problem that could benefit greatly from awareness, outreach, and education.



OREGON SEA GRANT

Curricula play an important role in helping teachers and students understand the impacts of marine debris on coastal resources. Funded by the NOAA Marine Debris Program, Oregon Sea Grant at Oregon State University developed a comprehensive, online curriculum for fourth to twelfth grade students, focusing on marine debris through experiential, hands-on activities. The curriculum integrates science, technology, engineering, art, math and social studies (STEAMSS) to make marine debris lessons and activities easily integrated into teaching plans.

Addressing this topic through the lenses of several different academic subjects, this curriculum provides teachers with a useful resource to inform students about marine debris and get them involved in the solution. Selected educators participated in a workshop and then field-tested the curriculum in their classrooms. After getting valuable feedback from these teachers, the curriculum was finalized in FY15 and is now freely available online. This unique and free resource enables teachers to create in-depth, project-based learning units, work with partners across disciplines, and engage their students in classroom and field experiences that will help explore the issue and impacts of marine debris and engage in stewardship actions.

This comprehensive marine debris curriculum can be found free of charge at: <http://oregoncoaststem.oregonstate.edu/marine-debris-steamss>.

GOAL 2: Conservation and Stewardship

NOAA COLLABORATORS

Weeks Bay National Estuarine Research Reserve

PARTNERS

Spanish Fort High School

Peggy Duck, Secondary Science Coordinator for Baldwin County Schools, leads a stewardship activity during the Teachers on the Estuary workshop.

Teacher workshop inspires new policies at a Mobile Bay school to foster coastal stewardship

Balloons are among the most abundant types of marine debris littering our coasts and pose a significant threat to marine animals, which can ingest or become entangled in them. When the Weeks Bay National Estuarine Research Reserve in Alabama learned that event balloon releases have been identified as one of the common sources of marine debris in the Gulf of Mexico, they decided to develop a teacher workshop to help increase awareness around the issue.



MARGARET SEDLECKY, WEEKS BAY NATIONAL ESTUARINE RESEARCH RESERVE

Teachers on the Estuary, a teacher professional development program offered at National Estuarine Research Reserves around the nation, is a research and field-based teacher training initiative that promotes coastal stewardship. During the 2015 Weeks Bay Reserve Teachers on the Estuary workshop, teachers learned about the ecology of Mobile Bay and its connections to the Gulf of Mexico, reserve research and monitoring efforts, as well as human impacts to estuaries. Marine debris data were presented to the teachers from local coastal clean-up events, highlighting the prevalence of balloons. After sharing information on the impacts of balloon releases to marine life, the workshop culminated in a stewardship project planning activity where teachers worked in small groups to develop a plan to help students design and implement a strategy to solve this problem at their school and communities.

Following the workshop, the 14 teachers returned to their local schools inspired to tackle the issue with their students. The teachers from the Spanish Fort High School, in Spanish Fort, AL, worked with students and administrators to teach them about the coastal impacts of balloon releases and to develop a new school policy that prevents all balloon releases on their school campus.

GOAL 2: Conservation and Stewardship

NOAA COLLABORATORS

Chesapeake B-WET
Chesapeake Bay Office
Environmental Science Training Center

PARTNERS

Chesapeake Bay Foundation
Virginia Beach City Public Schools

The “MWEE” goes systemic in Virginia Beach City public schools

How can environmental literacy be fully embedded into a large school system and replicated in other systems? The NOAA B-WET Program supported development of a model project with the Chesapeake Bay Foundation and Virginia Beach City Public Schools to do just this.

Through an intensive five-day summer institute in 2015, and multiple shorter courses throughout the school year, the project provided professional development to 31 middle and high school science teachers focused on developing classroom lessons that integrate hands-on learning about their coastal resources into the curriculum. This approach supports teachers in building their students’ capacity to investigate policy decisions about the Chesapeake Bay watershed using the lens of scientific inquiry. To enhance understanding of the watershed, the program exposes the teachers to NOAA sciences, content, and resources, such as the online NOAA learning platform, “Chesapeake Exploration.” To efficiently reach teachers school system-wide in this large school system, the project also employed peer-to-peer sharing among educators, allowing the teachers who participated in the Chesapeake Bay Foundation program to in turn provide training for an additional 79 science teachers.



CINDY DUNCAN



CINDY DUNCAN

Teachers from Virginia Beach Public Schools sift through the catch of a trawl during a Chesapeake Bay Foundation training in summer, 2015 (right).

Virginia Beach teachers take notes while paddling the James River during a week-long MWEE professional development (left).

The Meaningful Watershed Education Experience (MWEE) is a comprehensive student experience embedded into formal school learning. MWEEs are rooted in science and foster stewardship for watersheds through issue investigation, outdoor field experiences, student action projects, and data analysis.

NOAA B-WET has enabled this project to be fully integrated in Virginia Beach City Public Schools, and the lessons learned form a blueprint for any school division developing a systemic environmental literacy program. Several school divisions in Virginia are now joining with the Chesapeake Bay Foundation to apply this replicable model – a promising sign that NOAA-supported education is taking hold in the Commonwealth.

GOAL 2: Conservation and Stewardship

NOAA COLLABORATORS

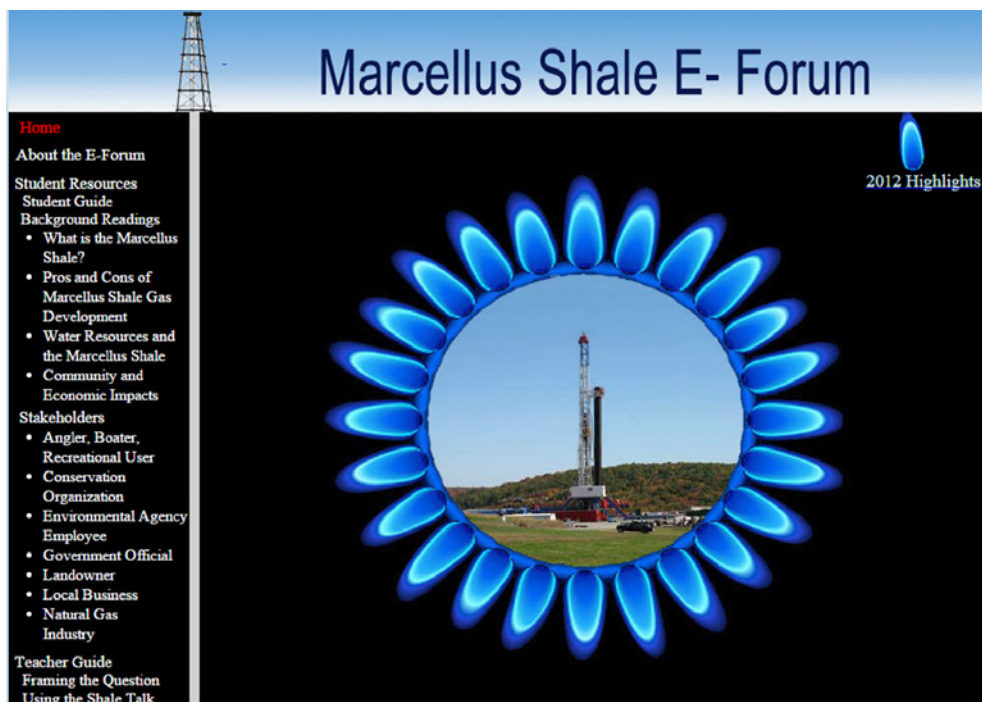
Pennsylvania Sea Grant
Chesapeake B-WET

PARTNERS

Cacapon Institute Potomac
Highlands Watershed School
Chief Oil and Gas
Mid-Atlantic Highlands Action
Program
Pennsylvania Fish and Boat
Commission
Susquehanna River Basin
Commission
Western Pennsylvania
Conservancy

Marcellus Shale E-Forum website takes a balanced approach to investigating the impacts of natural gas development

Situated over one of the largest natural gas deposits in North America, Pennsylvania is at the forefront of natural gas development and has become a laboratory for the U.S. gas industry. While advances in drilling techniques have made natural gas extraction more practical, controversy about economic and environmental impacts persisted. Pennsylvania Sea Grant developed the Marcellus Shale E-Forum website (<http://easternpasea-grant.org/marcellus>) to meet a need for a balanced educational tool for high school environmental science and biology students to learn about natural gas formation and the environmental and political issues that surround its development.



Modeled after Cacapon Institute's Potomac Highlands Watershed School, the E-Forum website provided news and journal articles, videos, and essays to help students gain a better understanding of how exploration could benefit local economies and provide a domestic source of clean energy. In addition to supporting Pennsylvania Sea Grant's climate adaptation and mitigation goal, the website materials complemented Pennsylvania Sea Grant's conservation and stewardship education strategy by helping students examine the latest science to determine potential impacts of hydraulic fracturing on water resources, future climate, and aquatic biodiversity.

With 4,375 views and 3,583 unique visitors in FY15, the Marcellus Shale E-Forum page was the most popular destination on Pennsylvania Sea Grant's Delaware River Program website. The site also saw high visitation from residents in other states impacted by natural gas development, including Texas, New York, New Jersey, California, and Ohio. Website resources helped students develop critical thinking skills to view a real environmental issue from a number of perspectives.

GOAL 2: Conservation and Stewardship

NOAA COLLABORATORS

Olympic Coast National Marine Sanctuary

PARTNERS

Hoh Tribe Natural Resources

Hoh Tribe Youth Support Services

A traditional community feast allowed tribal members an opportunity to celebrate the journey of Hoh youth.

Hoh youth voyaged 30 miles down the Hoh River watershed, a river that has sustained their tribe for millennia.

Olympic Coast National Marine Sanctuary celebrates Chalá-at: People of the Hoh River

NOAA's Olympic Coast National Marine Sanctuary, in partnership with the Hoh Tribe, conducted a four-day rafting and overnight Watershed Adventure Camp strengthening Hoh Tribal participants' connection with their culture, treaty rights, traditional resources and harvesting, while learning about climate change and its influence on the Hoh River watershed. NOAA, along



OLYMPIC COAST NATIONAL MARINE SANCTUARY

with other federal governments, has a trust responsibility to Native American tribes. NOAA works directly with Washington's Coastal Treaty Tribes on a government-to-government basis to promote a healthy ecosystem in the waters adjacent to the Olympic Peninsula for the support and enhancement of tribal treaty rights and resources, cultural resources and activities, tribal self-determination and sovereignty.

The journey commenced at Olympic National Park in the Hoh Rainforest where tribal members harvested native plants and berries while learning about traditional uses. The group then voyaged 30 miles down the Hoh River, a river that has sustained the tribe for millennia. Anthropologist Jay Powell, who studied the Hoh culture and the Quileute language for nearly 50 years, and his wife Vickie Jensen, were an integral part of the camp, providing Quileute language lessons, as well as identifying important and traditional resource harvesting sites within the tribe's Usual and Accustomed area. In the evenings, tribal members joined the youth, including Hoh tribal elder Vivian Lee who told the story of the origin of "Those-Who-Live-on-the-Hoh." The camp culminated at the mouth of the river, near the traditional village site overlooking Olympic Coast National Marine Sanctuary. A traditional community feast, attended by over 80 of the approximately 130 tribal members who live on the reservation, celebrated the journey and its significance to Hoh tribal culture.



OLYMPIC COAST NATIONAL MARINE SANCTUARY

GOAL 2: Conservation and Stewardship

NOAA COLLABORATORS

Apalachicola National Estuarine Research Reserve

Guana Tolomato Matanzas National Estuarine Research Reserve

Rookery Bay National Estuarine Research Reserve

PARTNERS

Florida Department of Environmental Protection

Rookery Bay National Estuarine Research Reserve interns and volunteers collect critical information on sea turtle nests to assist with Florida's sea turtle conservation efforts.

“A key component to species management is good data, which in this case would not have been possible without so many excellent partnerships and volunteer hours.”

- Kevin Claridge

Director of Florida Department of Environmental Protection's Coastal Office

Citizen scientists play key role in Florida's sea turtle nest patrol and outreach

All six sea turtle species that frequent United States beaches are designated as either threatened or endangered under the Endangered Species Act. Florida's coastline is vital to sea turtle conservation efforts, with its beaches hosting over 90% of all sea turtle nests in the continental United States. Florida's three National Estuarine Research Reserves play a key role in supporting sea turtle conservation by engaging volunteers.



ROOKERY BAY NATIONAL ESTUARINE RESEARCH RESERVE

Understanding sea turtle nesting success rates requires covering miles of beach repeatedly during the nesting season. It would be challenging for researchers to cover all nesting beaches alone, so trained citizen scientists play an integral role in research and outreach. Through the National Estuarine Research Reserve System, Florida's Department of Environmental Protection, and other partnerships, volunteers are trained to participate in surveys with the sea turtle patrol program. Annually more than 1,800 biologists, interns, and trained citizen science volunteers patrol Florida's 199 nesting beaches to identify and monitor nests. In addition, they provide outreach and education about sea turtle conservation by educating the public they interact with during the nesting surveys.

Due in part to the hundreds of hours contributed by interns and citizen scientists, this year 1,270 total nests were reported in Florida's three National Estuarine Research Reserves. Each reserve reported an increase in total nests over the previous year, including over 30 rare, green sea turtle nests. Additionally, the Apalachicola Reserve provided sea turtle conservation information to over 1,000 visitors who participated in the "Turtle Talks" outreach program. Sea turtle citizen scientists not only contribute critical information about sea turtle nesting rates, they become stewards of one of Florida's most threatened resources.



ROOKERY BAY NATIONAL ESTUARINE RESEARCH RESERVE

GOAL 2: Conservation and Stewardship

NOAA COLLABORATORS

Papahānaumokuākea Marine National Monument, Mokupāpapa Discovery Center
Hawai'i Sea Grant

PARTNERS

Ala Kahakai National Historic Trail
Coral Reef Alliance
Kanu 'O Ka 'Āina
Liquid Robotics Inc.
Puako Community Association
The Nature Conservancy
University of Hawai'i, Hilo

Students participate in citizen science to help refine conservation methods for the Puako community in Hawai'i.



NĀKOA GOO, MOKUPĀPAPA DISCOVERY CENTER

Aloha 'Āina citizen science project develops conservation methods for Hawai'i community

Puako Bay on Hawai'i has one of the island's most well developed fringing reefs and ecosystems, but for many years, the 60 to 70 historic cesspools dotted along the 2.5 mile coast have been leaching sewage and waste water into the bay. The poor water quality has led to the decline of up to 35% of corals and fish stocks in the bay. Because of this problem, Aloha 'Āina Citizen Science Day Project brings together students, researchers, the community, and marine resource managers to test, develop and refine conservation methods for the Puako community. Additionally, it allows individuals to make informed conservation related decisions based upon scientific data filtered through a cultural, place-based lens.



NĀKOA GOO, MOKUPĀPAPA DISCOVERY CENTER

The Papahānaumokuākea Marine National Monument Mokupāpapa Discovery Center worked with Liquid Robotics, Inc. on a water quality citizen science case study project entitled "Aloha 'Āina" or "Love of the Land". This project also worked with the University of Hawai'i at Hilo, Puako Bay Council, Hawai'i Sea Grant, The Nature Conservancy, Kanu 'O Ka 'Āina Public Charter School and Ala Khaki National Historic Trail. The Liquid Robotics Wave Glider was used to collect near shore turbidity and salinity data while University of Hawai'i, Hilo, students, high school students, and the Puako community gathered on shore water samples.

Data from the Aloha 'Āina project will be shared with the community. The data will be compared and displayed within a Mokupāpapa Discovery Center informational kiosk. Additionally, the water quality data collected from Aloha 'Āina will be archived online by Pacific Islands Ocean Observing System for community and scientific use. The Aloha 'Āina project is scheduled to occur again in 2016 bringing together public, private and nongovernmental organizations to bring greater awareness to ocean conservation.

GOAL 2: Conservation and Stewardship

NOAA COLLABORATORS

Waquoit Bay National Estuarine Research Reserve

PARTNERS

Lawrence Junior High School

Students build interpretive trail for community inspired by Waquoit Bay National Estuarine Research Reserve

Engaging students in community service and environmental stewardship projects provides students and communities with many benefits, including enhancing students' academic skills and knowledge while involving them in opportunities to become active, positive contributors to society. Addressing the value of service learning, the National Estuarine Research Reserve designed their Teachers on the Estuary professional development program to encourage teachers to conduct coastal stewardship projects with their classes.

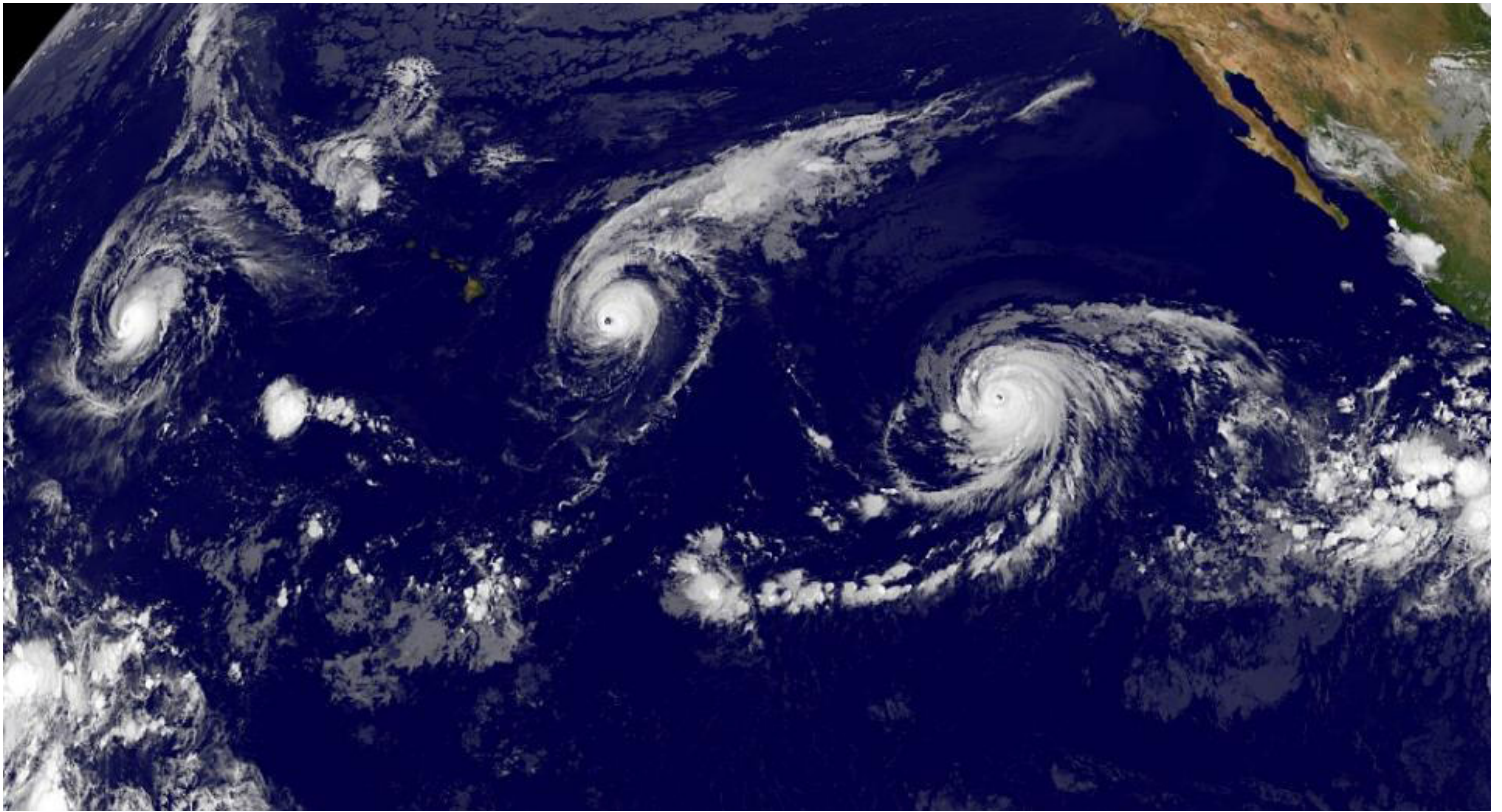


KATE CONDON, MYOBSERVATORY

Students from the Lawrence School in Falmouth, MA, collect water quality samples as part of their project to raise awareness about the coastal pond near their school.

Teachers at the Lawrence School in Falmouth, MA, frequently partnered with the nearby Waquoit Bay National Estuarine Research Reserve to provide coastal education to their junior high school students. However, it wasn't until two teachers participated in a recent Teachers on the Estuary workshop that they were able to help their students put their coastal education into community action. After the workshop, the teachers returned to the Reserve with their students to participate in a field trip to explore stewardship project ideas. The students were inspired by the interpretive trails at the Reserve and developed their own interpretive signs for a coastal pond in the town's center that they have been studying.

Using information and research provided by the Reserve and other community organizations, the teachers and students designed and built six signs with the goal of helping to build environmental awareness and stewardship of their local area. The project allowed the teachers and students the opportunity to work with community organizations and share their knowledge with the broader community.



NOAA

Goal 3: Safety and Preparedness

Individuals and communities are informed and actively involved in decisions and actions that improve preparedness, response, and resilience to challenges and impacts of hazardous weather, changes in climate, and other environmental threats monitored by NOAA.

NOAA is committed to building a Weather-Ready Nation to protect lives and property and to support a strong economy. NOAA Education provides safety and preparedness information in conjunction with NOAA's science of understanding, forecasting, and responding to weather, water, climate, and marine threats. These stories highlight examples of safety and preparedness education efforts. These efforts are an example of integrated STEM education, emphasizing the connections between science and its relevance to daily life. It is critical that the public be knowledgeable on how to respond to hazards, and education is a key component of a safe, prepared, and resilient country. NOAA is increasingly aware that human responses to a threat are as diverse as people themselves. Social science, risk communication, and education all contribute to a safe and prepared nation. NOAA Education helps to ensure that these important messages reach a broader audience.

GOAL 3: Safety and Preparedness

NOAA COLLABORATORS

National Weather Service
National Ocean Service

PARTNERS

Smithsonian Institution

Weather Lab introduced by NOAA and the Smithsonian Science Educational Center

What conditions lead to a Nor'easter? Or create thunderstorms in the Southwest? Accurately predicting the weather is a notoriously complex and difficult task, but there are some reliable patterns – and you don't need to be a professional meteorologist to understand them. To help the public understand how the interactions between Earth's atmosphere and oceans create weather patterns over the United States, NOAA partnered with the Smithsonian Institution to develop Weather Lab, a new weather app that shows how the weather impacts our daily lives.

NOAA's National Weather Service and National Ocean Service provided scientific expertise and partnered with the Smithsonian Science Education Center to provide students across the country and around the world with a captivating, first-hand learning experience. In the app, users can mix and match air masses and ocean conditions, try to predict the outcomes, and then watch weather conditions play out over the country. Since being published, it has had nearly 6,000 views, with users staying on the page for an average of almost four minutes, indicating that they are engaging with the content. This interactive program is designed to be tailored to the complex interactions between air masses and ocean currents, but like all models, it represents probable outcomes.

Weather Lab is a tool to help visualize how North America's weather is formed. This lab is designed to model the complex interactions between air masses and ocean currents, but like all models it represents probable outcomes. Each prediction you make is for possible outcomes during Spring.

OCEAN CURRENT

- Pacific Ocean Gyre
- Gulf Loop
- North Atlantic Gyre
- North Atlantic Gyre and Trade Winds

Pacific Ocean Gyre
A slow warm ocean current. It is made up of cold water currents flowing from Japan. When the cold water current crosses the Pacific Ocean it warms and splits to flow south along the coast of California and North towards Alaska.

AIR MASS 1

- mTropical
- cTropical
- mPolar
- cPolar

AIR MASS 2

- mTropical
- cTropical
- mPolar
- cPolar

Choose one ocean current from the green box, and an air mass from each of the orange boxes. Then make a prediction about how you should prepare for the day's weather. If you are correct you will see an animation of a weather event. Click RESET to clear the map and start over.

RESET

What happens when ocean currents and air masses interact? Find out in Weather Lab! Take on the role of a meteorologist by predicting spring weather and how people should dress for it in particular regions of the United States.

Partnerships like this help the public become more aware of severe weather events in their community, a step towards achieving a Weather-Ready Nation. The partnership advocates for scientifically-based data and best practices that offer science education programs for grades K-10. Weather Lab provides an opportunity to change students' attitudes, improve outcomes, and inspire students to future careers in the STEM disciplines.

GOAL 3: Safety and Preparedness

NOAA COLLABORATORS National Weather Service

Students take a picture with Flat Owlle, the National Weather Service mascot.



Owlle Skywarn's adventures in social media and on the World Wide Web

Children are great multipliers of information. They not only bring their knowledge home and teach their families, but they also carry the information into adulthood. This makes children an important audience for building a Weather-Ready Nation, but the trick is capturing their imagination.

By significantly increasing the visibility of the mascot, Owlle Skywarn, the National Weather Service grabbed the attention of children everywhere. Owlle's social media account posts science and safety information daily, including Trivia Tuesday, Fact Friday, and frequent posts about educator and student opportunities. To go along with the energetic social media cam-



MARY FAIRBANKS

paign, the National Weather Service remodeled its education website. The website contains various activities including Owlle's Weather-Ready Activity, Owlle's Journal, Flat Owlle, the Young Meteorologist Game, and partner resources, and are now broken down by target audience. The National Weather Service has also utilized social media to launch a Back to School campaign. Since the National Weather Service launched Owlle's social media presence in September 2013, Owlle has attracted over 6,500 followers and has also been welcomed into the fold of the federal mascots. Owlle participated in a 'Safety Friends Unite for Preparedness' live Twitter chat with numerous federal mascots focused on various weather hazards, where he was joined by Smokey Bear, Ready Wrigley, Sparky the Fire Dog, Lassie, and more.



Children are essential building blocks in creating a Weather-Ready Nation, and the National Weather Service has found creative ways to reach such an important audience using National Weather Service mascot, Owlle Skywarn. Follow Owlle daily on Facebook and Twitter @NWSOwlleSkywarn.

GOAL 3: Safety and Preparedness

NOAA COLLABORATORS

National Weather Service
National Weather Service
Communications Office
Weather Forecast Office, Tulsa,
OK

PARTNERS

KNWA and FOX24
Plan!T NOW
Fayetteville Public Library

Students participate in a floodplain demonstration at WeatherFest.



National Weather Service mascot, Owlie Skywarn, plays the Young Meteorologist Game with students in a library at WeatherFest in Fayetteville, AR.

Teaching students about severe weather and preparedness at WeatherFest

Educating and preparing children for severe weather is important to help keep kids safe in dangerous situations. Online games and activities are a great way for children to learn about many topics, including severe weather. The National Weather Service provides many fun and interactive online resources that share information, reinforce lessons learned in the classroom, and provide opportunities for families to share knowledge. However, students without Internet access at home may miss out on such educational activities. To address this need, the National Weather Service, in partnership with PLAN!T NOW and local weather media stations, presented the Young Meteorologist WeatherFest at the Fayetteville, Arkansas Public Library in April 2015.



BRANDI HOLT

The event combined hands-on activities with an opportunity for children to play the Young Meteorologist Game in the library's computer lab. The Young Meteorologist Game takes the child on a severe weather preparedness adventure learning about weather science and safety. Local TV stations KNWA and FOX24 gave children face time with their trusted on-air meteorologists. In-person activities included a portable TV studio where children could present a forecast and a visit from the National Weather Service mascot Owlie Skywarn. There were also hands-on activities including an interactive flood plain demonstration and a tornado simulator.

This event shows the power of libraries as an alternative venue to give students opportunities to learn about severe weather and safety, especially for students without Internet access at home. Arkansas was a great location for this event, as over 37% of people do not have Internet access at home. Planning for 2016 events are underway and this model will be expanded to other states.



NOAA

GOAL 3: Safety and Preparedness

NOAA COLLABORATORS

Weather Forecast Office, El Paso, TX

"The sun heats the Earth, the Earth heats the air." Educational materials are provided in both English and Spanish.

Weather Forecast Office serves the needs of bilingual communities

Each year, the Southwest faces weather hazards such as severe thunderstorms, flooding, and extreme heat. Warnings and educational materials are primarily delivered in English, but over 70% of residents in some counties, including El Paso, TX, primarily speak Spanish. To help meet the needs of a bilingual community, the Weather Forecast Office in El Paso started a multi-language Google Hangout that invites schools to participate, in either English or Spanish, and learn more about weather, water, and climate.



WEATHER FORECAST OFFICE EL PASO, TX

The El Paso Weather Forecast Office hosted 16 events in 2015, reaching 42 schools and over 2,100 students. Over 200 students participated in Spanish. Because social media is an effective way to reach all types of educators, the forecast office used their social media pages to advertise these events and get schools to register. The local forecast office offered the events in three formats. The first format was a Weather Basics course that covers atmospheric basics that they are learning in their lessons at school. The second format was a "Teach the Teacher" course which had 20 teachers go through the training. The final format was the Ask-A-Meteorologist live video chat which hosted 400 students from seven schools. Six more Ask-a-Meteorologist presentations are planned for the end of the school year, and this activity will continue into 2016.

This event is just one of many regionally relevant activities provided by the National Weather Service's 122 field offices. The Weather Forecast Offices' Warning Coordination Meteorologists work to reach the specific communities they are serving in support of creating a Weather-Ready Nation.



WEATHER FORECAST OFFICE EL PASO, TX

Meteorologist Jason Laney presents to students in the El Paso, TX area by webcast.

GOAL 3: Safety and Preparedness

Staying safe on the water: Beach hazards and water safety

NOAA COLLABORATORS

Weather Forecast Office,
Chicago, IL

Weather Forecast Office, Grand
Rapids, MI

Weather Forecast Office, Northern
Indiana

Indiana-Illinois Sea Grant

Minnesota Sea Grant

PARTNERS

Great Lakes Surf Rescue Project

The Great Lakes are an important recreational resource, but the water can be treacherous. Over 400 people have drowned in the region since 2010. To help residents safely enjoy these resources, the Great Lakes Surf Rescue Project developed safety messages about hazards like currents and waves and demonstrated how the public can use weather forecasts to stay informed about beach safety. This project included partnerships between the Indiana-Illinois Sea Grant, Minnesota Sea Grant, local emergency management, and the Weather Forecast Offices in Grand Rapids, MI; Chicago, IL; and Northern Indiana.

Educational content included dangerous currents, waves, National Weather Service beach hazards forecasts and statements, and the newly developed beach safety messaging. Additional speakers reviewed recent projects, daily beach operations, sociological research on target high risk groups, recently deployed beach safety equipment, and new apps for beach forecast information. Participants included beach managers, state and national park personnel, water safety task forces, non-profit organizations, Departments of Environmental Quality and Management, local media, and the general public.

The first Great Lakes Surf Rescue conference was a success, but much still remains to be done. Feedback from the conference was positive and many participants requested another event in future years. A community of practice was developed after the conference to improve collaborative efforts within the water safety community in the Great Lakes.



GREAT LAKES SURF RESCUE PROJECT

As part of a Weather-Ready Nation, the public needs to be informed of the hazards of the water and how to stay safe. This partnership and event is similar to the work of other National Weather Service offices from the 122 field offices, six national centers, and seven regional and headquarters offices, all of which have participated in thousands of events reaching hundreds of thousands of people in the past year. They continue to participate in events and create tools and resources that promote safety and preparedness to reduce the loss of life and property.

GOAL 3: Safety and Preparedness

NOAA COLLABORATORS

Office for Coastal Management
National Estuarine Research
Reserve System

Digital Coast provides useful tools for teacher trainings addressing climate change

Many coastal educators face the challenge of effectively teaching about climate change impacts, such as increases in storm damage, sea level rise, habitat loss, and saltwater intrusion. Teacher needs assessments conducted by the National Estuarine Research Reserves have revealed that teachers specifically need help in identifying the most beneficial data, tools, and resources for informing and educating students about coastal impacts of climate change.

Digital Coast, one of the Office for Coastal Management's keystone programs, is a website focused on helping communities address coastal issues. The website provides not only coastal data, but also the tools and information needed to make these data truly useful. Research reserve educators have begun incorporating tools and resources from Digital Coast to meet the climate change needs of the educators they train. In particular, the Sea Level Rise Viewer was found to be a helpful tool to demonstrate



The Sea Level Rise Viewer allows the user to select a geography and use the slider bar to simulate various sea level rise scenarios (from one to six feet above the average highest tides) and the corresponding areas that would be impacted by flooding.

the risks of sea level rise, storm surge, and flooding along most of the United States. Teachers were able to model potential marsh migration due to sea level rise and examine how tidal flooding will become more frequent with sea level rise. The user-friendly map services allow teachers to explore geospatial data with students while engaging them in a dialogue about the coastal impacts of climate change on communities.

In 2015, the Sea Level Rise viewer reached approximately 55 teachers at research reserve teacher trainings workshops around the nation. Teachers are now more aware of age-appropriate materials and ways to use sea level rise visualizations with their students. The incorporation of Digital Coast tools into the teacher training supports the research reserves continued effort to empower teachers with the knowledge and resources to teach about climate change.

GOAL 3: Safety and Preparedness

NOAA COLLABORATORS

Weather Forecast Office,
Shreveport, LA

Weather Forecast Office, Pleasant
Hill, MO

Weather Forecast Office, Lake
Charles, LA

Weather Forecast Office, Little
Rock, AR

NOAA COLLABORATORS

Barksdale Air Force Base

Caddo Parish, LA emergency
managers

Local television stations

SciPort Museum

Making the weather workforce stronger: National Weather Service engages women and girls in STEM

Women make up nearly half of our country's workforce, but only about 25% are employed in STEM fields. In the National Weather Service, the numbers are even lower, with women comprising about 14% of the meteorologists. Across the country, Weather Forecast Offices are engaging in numerous STEM activities.

The Weather Forecast Office in Shreveport, LA, with support from the Lake Charles, LA, and Little Rock, AR, Weather Forecast Offices, hosted an open house aimed at encouraging girls to explore STEM careers. Approximately 250 students attended the GiRLS GLOW (Girls Really Love Science, Girls LOve Weather) event. The event featured hands-on activities, information about STEM careers, forecast office tours, and a weather balloon launch. Several female STEM professionals served as positive examples of success in a male-dominated field. This was a collaborative effort with female forecasters from Barksdale Air Force Base, local television stations, and emergency managers. Biographical videos from women across the National Weather Service were featured to inspire young women to pursue STEM careers. GiRLS GLOW will become an annual event, with the planning for 2016 underway.

The Weather Forecast Office in Pleasant Hill, MO, also participated in a STEM event aimed at young women. Meteorologists visited New Chelsea Elementary in Kansas City, KS, to share weather knowledge. In an effort

to engage the young women in science, the female meteorologists performed different experiments while engaging the girls about the concepts.

Promoting science education increases the ability to recruit and retain a diverse workforce in the future. Expertise in STEM fields promotes creativity, scientific discovery, and experimentation, while also opening up new job and economic opportunities. Due to technological advances, STEM jobs in the United States in the past 10 years have grown at three times the pace of non-STEM jobs, and are projected to continue growing at this pace through the next decade. Exposing

women and girls to STEM introduces them to opportunities in the National Weather Service.



NEW CHSELSEA ELEMENTARY

Linda Gilbert from the National Weather Service meets with students at Girls STEM Night at New Chelsea Elementary in Kansas City, KS.

GOAL 3: Safety and Preparedness

NOAA COLLABORATORS

Rhode Island Sea Grant

PARTNERS

Rhode Island Coastal Resources Management Council

University of Rhode Island Landscape Architecture Department

Wickford Village's historic waterfront, with its shops, restaurants, public parking facilities, municipal offices, docks, and piers, was one of the areas the University of Rhode Island Landscape Architecture students focused on for developing creative techniques to mitigate sea level rise impacts to a community.

Rhode Island Sea Grant sponsors landscape architecture students to develop creative solutions for sea level rise

Impacts of changing climate, such as increased flooding and rising sea level, are rapidly changing coastal landscapes and threatening some of the places that are important to shoreline communities – from parks and playgrounds to homes and business districts. New approaches are needed to create options for adapting to these threats. Rhode Island Sea Grant, in partnership with the University of Rhode Island Landscape Architecture Department, is putting the skills of undergraduate landscape architect majors to use developing novel coastal landscape designs that municipalities can use in adapting to sea level rise.



RHODE ISLAND SEA GRANT

Students, with guidance from their professors and Rhode Island Sea Grant extension agents, participate in listening sessions with local constituents to gain a sense of place and to hear first hand about the area's history, what people value and hold dear, and how they envision the future given the threats imposed by changing climate. Students research and develop multiple landscape design options that they feel are consistent with local historical and cultural values, protect important landscape elements from being lost, and enhance or build upon people's expressed desires for the future. The studio course culminates with students presenting their designs to constituents in an open forum.

This partnership has engaged six landscape design studios, involving approximately 100 students, in four Rhode Island municipalities. Students have brought possible solutions to life through detailed landscape design for consideration for local implementation, while gaining insight and practical experience in addressing the issues of sea level rise and flooding. Municipal leaders who have engaged landscape design studios have noted that they have opened the doors to creative solutions to address rising sea level and flooding on both short- and long-term scales.



NOAA EDUCATIONAL PARTNERSHIP PROGRAM

Goal 4: Future Workforce

A diverse and highly skilled future workforce pursues careers in disciplines that support NOAA's mission.

Building a workforce literate in STEM is crucial to maintaining America's competitiveness in a rapidly changing global economy. Stories in this section exemplify NOAA's goal of building the highly skilled and diverse workforce that we need to address the environmental challenges confronting our nation and planet. NOAA provides career exploration at all grade levels, and the science camps and scholarship programs highlighted here are just some of the ways that NOAA Education helps students pursue careers in science and technology, as well as policy, economics, communications, and other fields. NOAA strives to cultivate a workforce that reflects the diversity of the nation and has established many partnerships and collaborations to reach underserved and underrepresented groups. Here we highlight stories of programs that promote career pathways and build expertise in the next generation of NOAA's workforce.

GOAL 4: Future Workforce

NOAA COLLABORATORS

National Environmental Satellite,
Data, and Information Service

National Weather Service

Office of Education

PARTNERS

California State University, Los
Angeles

Cooperative Remote Sensing
Science and Technology Center -
West

National Aeronautics and Space
Administration (NASA)

During the recent Satellite Educators Association Conference, Owlle Skywarn, official mascot of the National Weather Service and PLAN!T NOW's Young Meteorologist Program, visited students participating in the M.Y. S.P.A.C.E. K-12 research program.

M.Y. S.P.A.C.E. research program engages students around the world with the local impacts of global environmental issues

The Multinational Youth Studying Practical Applications of Climatic Events (M.Y. S.P.A.C.E.) Program is an international collaboration of K-12 students participating in self-selected research projects concerning the local impact of global environmental issues.

Students work with trained teacher-leaders at their school sites using both locally generated and satellite-based data with support from NOAA and the National Aeronautics and Space Administration (NASA). Teams from each school meet at the annual Satellites and Education Conference to discover global trends in their collective data and present their findings. Students learn and practice techniques for scientific investigation; data processing, analysis and interpretation; leadership; and effective communication, all while working with NOAA and NASA scientists and engineers. The program also offers students a chance to apply for special internships at selected university research centers, such as the Center for Energy and Sustainability and the Center for Spatial Analysis and Remote Sensing, and the chance to participate in graduate-level research in Geosciences and Environment at California State University, Los Angeles and at other NOAA-affiliated campuses.

The M.Y. S.P.A.C.E. program has made a significant impact on the career goals of participating high school students. Surveys of the students conducted by their teachers before the students joined the program and by the conference at the conclusion of the program year clearly indicate increased interest in STEM-related careers. In the course of the program, the percent of students interested in STEM fields grew from 8% to 56% and some have gone on to pursue graduate work in related fields.



PAULA ARVEDSON

GOAL 4: Future Workforce

NOAA COLLABORATORS

National Satellite, Data, and Information Service

GOES-R Program Office

PARTNERS

Cooperative Institute for Meteorological Satellite Studies (CIMSS)

University of Wisconsin, Madison

A team of six middle and high school science teachers have developed GOES-R-related lesson plans and, in collaboration with NOAA scientists and CIMSS personnel, online applications that incorporate STEM educational goals.

An artist's conception of the GOES-R environmental satellite.

GOES-R Education Proving Ground prepares to help educators bring satellite data in to the classroom

In October, 2016, NOAA and NASA will launch the GOES-R satellite, which will provide state-of-the-art imagery to data centers around the world. Now, thanks to a handful of science teachers, the data will make it to middle and high school classrooms as well. Through the GOES-R Education Proving Ground, the Cooperative Institute for Meteorological Satellite Studies (CIMSS) – a NOAA Cooperative Institute at the University of Wisconsin, Madison – is ensuring that the education community will be “launch-ready” for exciting new capabilities coming with the GOES-R satellite series.



CIMSS EDUCATION OUTREACH TRAINING

A team of six middle and high school science teachers has developed GOES-R-related lesson plans and, in collaboration with NOAA scientists and CIMSS personnel, web applications that incorporate STEM educational goals, all accessible at <http://cimss.ssec.wisc.edu/education/goesr/>.

The use of satellite information in the classroom is a powerful tool to help students understand weather patterns and technological tools to monitor weather and climate. Participating educators have expressed appreciation for CIMSS' outreach efforts through email comments such as, “This is impressive. Thank you for sharing,” and, “Thanks for all your hard work and help! We are honored and will use it next week at the Earth SySTEM Teacher Academy.”

In 2016 the GOES-R Education Proving Ground will expand from 6 to 26 teachers. Working with NOAA and CIMSS, this network will ignite STEM initiatives across the nation by leveraging exciting improvements coming in the GOES-R era.



NOAA

GOAL 4: Future Workforce

NOAA COLLABORATORS

NOAA Fisheries

Washington Sea Grant

Alaska Fisheries Science Center

Deputy Under Secretary for Operations

National Ocean Service

Northwest Fisheries Science Center

Office of Coast Survey, Pacific Hydrographic Branch

Office of Marine and Aviation Operations, NOAA Diving Center

Office of Oceanic and Atmospheric Research

Office of Response and Restoration

Pacific Marine Environmental Laboratory

Restoration Center

Seafood Inspection

Weather Forecast Office, Seattle

West Coast Regional Office

Western Regional Center

PARTNERS

Atlantis, Inc. ROV Team

NANOOS

Ocean Inquiry Project

Rainier Scholars

Sail Sand Point

Salish Sea Expeditions

Seattle Aquarium

Seattle Math Engineering Science Achievement (MESA)

Solid Ground

Tukwila School District

U.S. Department of Commerce, Western Regional Security Office

University of Washington, Joint Institute for the Study of the Atmosphere and Ocean (JISAO)

NOAA Science Camp partners with community organizations to reach underserved audiences

A high priority for NOAA education programs is reaching out to underrepresented groups who may not have ready access to marine science education. In the past 13 years, Seattle's NOAA Science Camp has worked with partners to connect with underserved communities and offer scholarships for students to attend the camp, which engages middle and high school campers in hands-on NOAA research and real-world science.



WASHINGTON SEA GRANT

A Rainier Scholar camper (right) and his team show off their Egg Drop Invention during NOAA Science Camp's STEM Challenge activity. Rainier Scholars partners with NOAA to recruit students from underserved communities.

In 2015, NOAA Science Camp and its main partner, Washington Sea Grant, collaborated with the University of Washington's Joint Institute for the Study of the Atmosphere and Ocean (JISAO), the Seattle Math Engineering Science Achievement (MESA) program, the Tukwila School District, Solid Ground, and Rainier Scholars to recruit underserved campers. Seattle MESA and the Tukwila School District recruited 19 students from Showalter Middle School, a highly diverse school looking for science, technology, engineering, art, and math educational opportunities. With scholarships from JISAO and transportation from the Tukwila School District, students were able to commute daily to Seattle for the camp. NOAA Science Camp also hosted a camper from California with cerebral palsy, resulting in a widely diverse cohort of campers. The camper traveled over 750 miles with his mother to attend the 2015 NOAA Science Camp after researching other camps and concluding that NOAA Science Camp met both his science interests and accessibility needs. Solid Ground, a low-income housing community organization located next to the NOAA campus, and Rainier Scholars, an academic organization supporting students of color from middle school to university, also recruited campers for NOAA Science Camp, supported by scholarships from NOAA and Washington Sea Grant. To date, over 1000 campers have attended NOAA Science Camp; between 9 and 19.5% of campers are supported by scholarships each year.



LISA HIRUKI-RARING, NOAA FISHERIES

A NOAA Science Camper from California collects sightings of seal tags during a marine mammal activity at NOAA Science Camp in Seattle, WA. He and his mother traveled over 750 miles to attend the camp.

GOAL 4: Future Workforce

NOAA COLLABORATORS

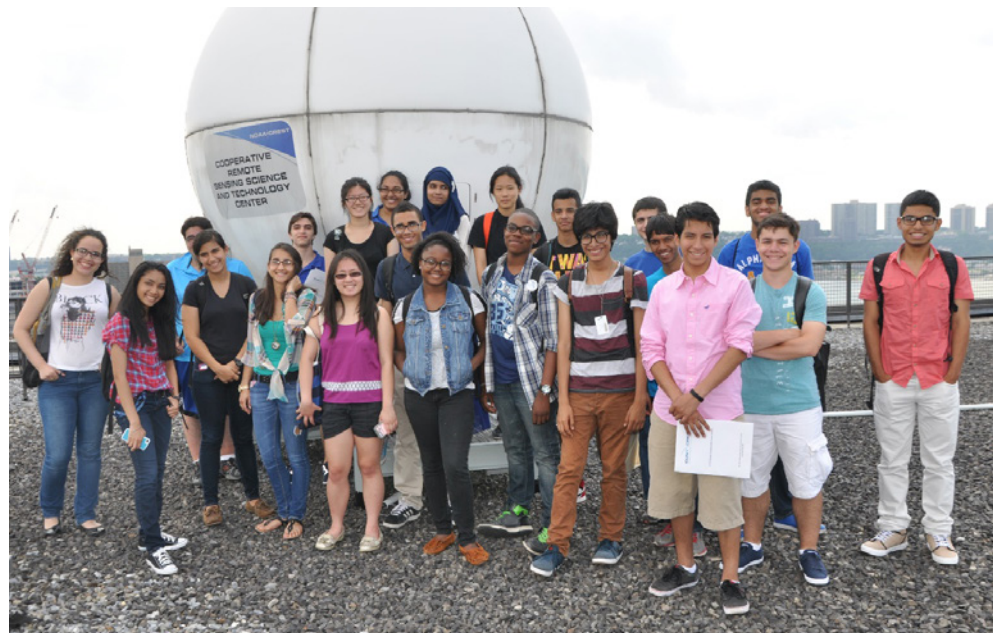
National Environmental Satellite, Data, and Information Service
Office of Education

PARTNERS

City University of New York
Cooperative Remote Sensing Science and Technology (CREST)
New York City Department of English Language Learners and Student Support

NOAA-CREST supports English language learners

To meet the needs of society, we need the best and the brightest from all backgrounds working in STEM fields. Demographers project that by 2030, English language learners will account for approximately 40% of the entire school-aged population in the United States. NOAA's Cooperative Remote Sensing and Technology Center (NOAA-CREST) at the City University of New York is working with 16 New York City school teachers and the Department of English Language Learners and Student Support to develop a strategy to engage the K-12 community in NOAA-related science and missions.



NOAA-CREST

The 2015 NOAA-CREST outreach program.

The initiative is creating a unique STEM project as part of an after-school program using NOAA's educational resources and assets to inform and empower the teachers with the right inquiry-based learning tools to engage students and get them interested in STEM disciplines and careers. The informal approach of this initiative is designed to engage English as second language students who are underrepresented STEM fields. The teachers involved in this initiative have commented that their students are creative thinkers with an interest in math and science. All they need, the educators say, is the right opportunity.

GOAL 4: Future Workforce

NOAA COLLABORATORS

Office of Education

PARTNERS

California State University, Los Angeles

Creighton University

Delaware State University

Florida A&M University

Hampton University

Howard University

Jackson State University

Lehman College

National Science Foundation

New York City College of Technology

Oregon State University

Savannah State University

Texas A&M University, Corpus Christi

The City College of the City University of New York

University of Albany, State University of New York

University of Maryland, Baltimore County

University of Maryland, College Park

University of Maryland Eastern Shore

University of Maryland, Institute of Marine Environmental Technology

University of Miami

University of Puerto Rico, Mayaguez

University of Texas, Brownsville

University of Texas, El Paso

Geosciences Bridge program students gain the skills they will need to succeed in college.

Geosciences Bridge Program helps students bridge from high school to college while exploring NOAA science

The Geosciences Bridge Program was developed to prepare students, particularly from underrepresented groups, to pursue undergraduate degrees in NOAA mission sciences. During summer 2015, 18 soon-to-be college freshmen participated in the third year of the NOAA and National Science Foundation-funded program at the University of Maryland Eastern Shore, the lead institution of the NOAA Living Marine Resources Cooperative Science Center (CSC). Students took trigonometry, algebra, or calculus over the summer, based on a mathematics placement exam. Quantitative skills are vital to the sciences, thus getting an early start on college-level math helps set students up for success in their major. In addition, students enrolled in a natural sciences seminar and received training in Geographic Information Systems. The students stayed in dorms and were provided a stipend during the six-week program.



UNIVERSITY OF MARYLAND EASTERN SHORE

Through lectures and field trips, students gained hands-on experience in atmospheric science, environmental science and engineering, marine science, physical oceanography, and remote sensing. Faculty from all four of the NOAA CSCs taught the students in their areas of expertise. Students visited NOAA's Oxford Cooperative Lab and NASA's Wallops Island Flight Facility. During the summer, students also completed a research project and presented the results to their peers. In addition, the program focused on study skills, conflict resolution, and time management, all critical skills for college. Over 50 students have participated in the Geosciences Bridge Program since it began, with 42 matriculating at CSC institutions and the rest matriculating at other universities.

The NOAA Educational Partnership Program supports four CSCs based at Minority Serving Institutions, which include 22 academic partners. The CSCs graduated 71 students in FY15, including 37 bachelor's degrees, 14 master's degrees, and 20 PhDs. Since 2001, over 3,000 students have been trained through the Educational Partnership Program with Minority Serving Institutions, with over 75% from underrepresented groups.

GOAL 4: Future Workforce

NOAA COLLABORATORS

NOAA Fisheries

Alaska Fisheries Science Center

PARTNERS

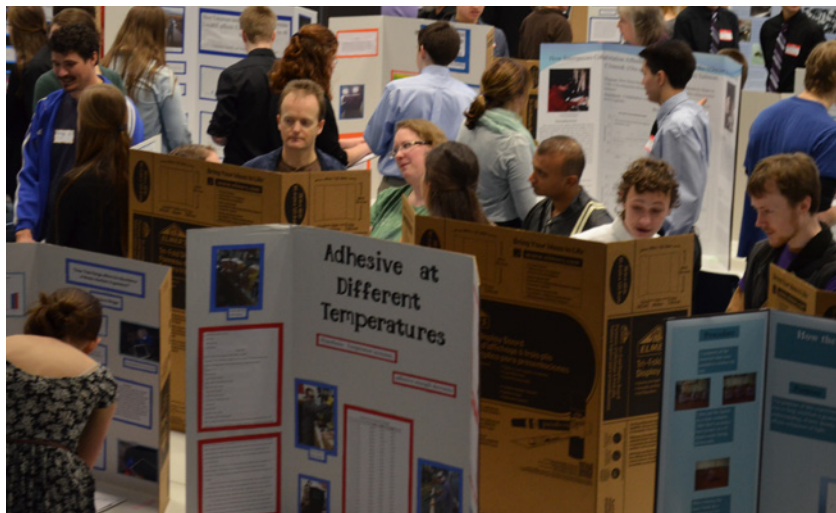
Juneau School District

Scientists and students talk about science fair projects at the Southeast Alaska Regional Science Fair in Juneau, AK.

Juneau students identify fish in an aquarium during Sea Week activities with NOAA Fisheries scientists. The Alaska Fisheries Science Center's Auke Bay Laboratory host all kindergarteners and sixth graders from the Juneau School District during Sea Week.

NOAA Fisheries in Juneau, AK provides a pipeline for students from kindergarten to college

Keeping students engaged in science is an important focus for Fisheries education programs. NOAA Fisheries staff in Juneau have created an effective pipeline for students to remain engaged in marine science from kindergarten to high school and beyond, through two main programs: Sea Week and the Southeast Alaska Regional Science Fair.



BONITA NELSON, NOAA

In 2015, NOAA Fisheries' Alaska Fisheries Science Center Auke Bay Laboratories hosted all kindergarteners and sixth graders in the Juneau School District, both Juneau middle schools, six private and charter schools, and 30 high school students from an Alaska State at-risk youth program (a total of 1200 students), as part of a larger Sea Week curriculum. Scientists engaged students with aquarium and touch-tank viewing, and hands-on activities for the older students focusing on current research, basic oceanography, and remotely operated vehicles.

Auke Bay Laboratories scientists are also heavily involved in the high school Science Fair, providing both organizational and mentoring support. Students often turn to Auke Bay Laboratories because they remember their Sea Week experiences from elementary school; in 2015, Auke Bay Laboratories scientists mentored 11 out of 58 science fair projects. Science Fair award winners go on to national and international science fair competitions later in the year, and Auke Bay Laboratories-mentored students regularly appear among top award winners. Successful students often go on to contracts or internships at NOAA or enter NOAA's Hollings Scholarship Program, and continue from there to graduate work or careers in science. For the 2015 fair, over 100 scientists evaluated 58 projects submitted by 73 students. Three Auke Bay Laboratories-mentored student projects won major awards at the fair and one continued on to a gold medal at the GENIUS Olympiad 2015.

Over the 40 years since the Sea Week program began, more than 25,000 Juneau students have been touched by NOAA science, with many going on to successful careers in science.



BONITA NELSON, NOAA

GOAL 4: Future Workforce

NOAA COLLABORATORS

Office of Education

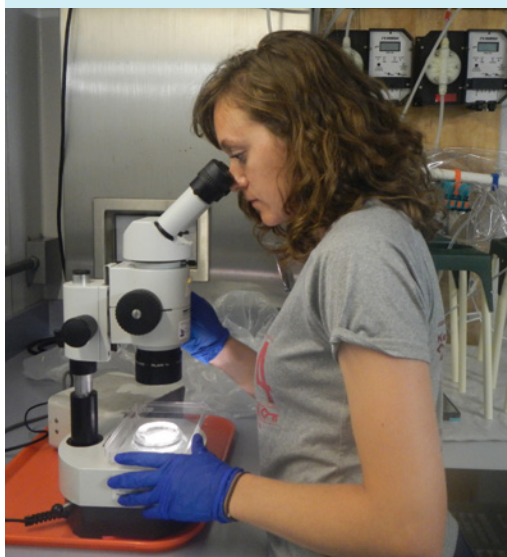
NOAA Fisheries

Office of Oceanic and Atmospheric Research



ANN THORNE

Hollings Scholar Jake Green talks with Dave Wineland, a Nobel Prize winning physicist from the National Institute of Standards and Technology. Dave Wineland gives a seminar on quantum physics for NOAA interns in Boulder, CO, every summer.



ASHLEY GORDON

Hollings Scholar Ashley Gordon conducts fisheries research during her summer internship at the James J. Howard Marine Sciences Laboratory in Sandy Hook, NJ.

NOAA labs provide research experience and mentorship to Hollings and EPP Undergraduate Scholars

A summer of research experience, career and graduate school advice, and establishing professional contacts helps students chart a course for success in science. The Ernest F. Hollings Scholarship and the Educational Partnership Program with Minority Serving Institutions (EPP/MSI) Undergraduate Scholarship provide tuition support and paid summer internships to outstanding students in NOAA mission fields. The internship includes hands-on research with a NOAA mentor. Many NOAA labs host Hollings and EPP scholars year after year, and students benefit from community support and expertise.



ANN THORNE

The James J. Howard Marine Sciences Lab at Sandy Hook, NJ, has been hosting scholars since 2008. Dr. Chris Chambers described them as predictably great students and has mentored projects with end products including presentations at NOAA Headquarters, senior research theses, and peer-reviewed publications. Typically, the students plan and conduct lab-based projects on young fish – the most vulnerable life stages – and study how environmental factors such as climate change and ocean acidification affect fish viability and condition. While in residence, scholars benefit from a weekly discussion group for interns that focuses on topics such as how to select a graduate school, what drives science, and how to apply for grants. The group hosts outside speakers and their lectures always end with an open question and answer session. Dr. Chambers has stayed in touch with many past scholars, and all four of the his 2014 mentees are now in graduate school in marine, biological, and environmental sciences.

The NOAA campus in Boulder, CO, has been hosting Hollings and EPP Scholars since 2005 and hosted a record of 15 scholars in FY 2015. Several scholars worked on renewable energy, while others conducted stratospheric and tropospheric ozone research or studied space weather. NOAA Boulder organizes a weekly seminar series, lab visits, and visits to local universities. Many scholars have gone to graduate school at Colorado State University and the University of Colorado, or worked with one of NOAA's Cooperative Institutes.

In FY15, NOAA provided internships to 106 Hollings and 18 EPP Undergraduate Scholars. In addition, the incoming FY15 scholars were selected and received orientation, including 150 Hollings and 11 EPP Undergraduate Scholars.

GOAL 4: Future Workforce

NOAA COLLABORATORS

Delaware Sea Grant

PARTNERS

University of Delaware, College of Earth, Ocean, and Environment

Delaware Sea Grant marine education specialist, Chris Petrone, leads students on an exploration of wind energy, using University of Delaware's two-megawatt wind turbine as the backdrop.

Delaware Sea Grant provides marine science, robotics, and wind energy outreach to underrepresented audiences

Delaware Sea Grant provided marine science, underwater robotics, wind energy, and careers outreach to 256 elementary and high school students, many of whom are considered underrepresented audiences. These programs were high-quality, content-rich, high-touch programs – hosted at both the University of Delaware Hugh R. Sharp Campus in Lewes, DE, and in classrooms throughout the region.

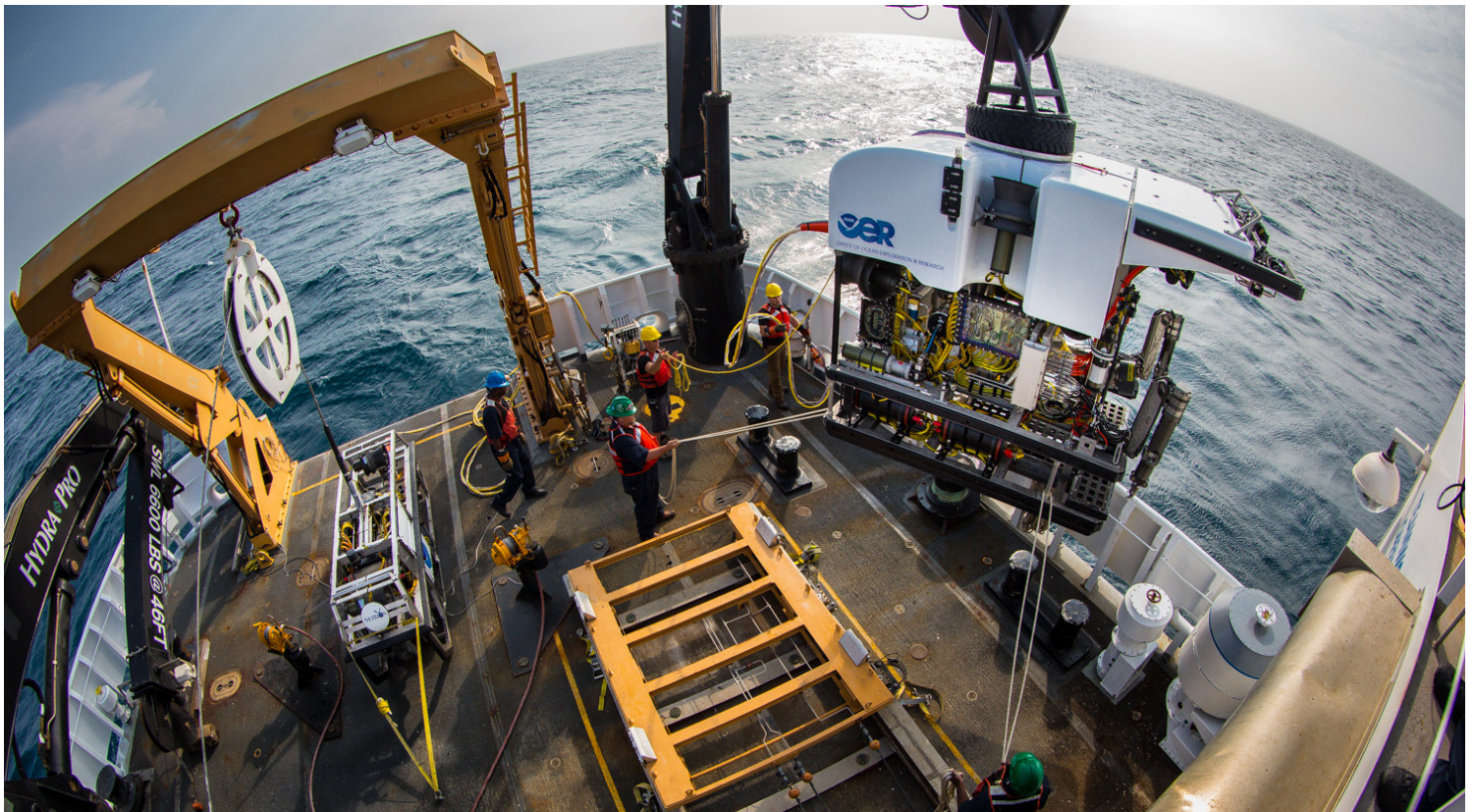


UNIVERSITY OF DELAWARE / DELAWARE SEA GRANT

Delaware Sea Grant planned and implemented programs that included behind-the-scenes tours of University of Delaware's Robotic Discovery Laboratories, Global Visualization Laboratory, and a 146-foot research vessel. Students interacted with the technologies that University of Delaware scientists use to study our world ocean: underwater gliders and other autonomous underwater vehicles; remotely operated vehicles; aerial drones; acoustic telemetry; and satellites.

Audiences included students from Caesar Rodney High School in Camden, DE and after-school program participants from Philadelphia's Independence Seaport Museum who hail from inner city Philadelphia, PA, and Camden, NJ. Wind energy programs focused on the University of Delaware's two-megawatt wind turbine – how it works and what it means for energy sustainability. Audiences included first and fifth graders from several Delaware cities.

Students received a unique experience, seeing highly technical components of Delaware Sea Grant and the University of Delaware's research assets. These experiences helped build an excitement for science and an awareness of the career opportunities that await students in the fields of marine science and alternative energy. Several high schools students participating in the underwater technology programs expressed a sincere interest in University of Delaware's undergraduate and graduate programs. Delaware Sea Grant has a longstanding history of providing in-depth coastal and environmental education programs to K-12 students throughout the Mid-Atlantic region. Through these and other education programs, Delaware Sea Grant reaches thousands of school-age children annually.



NOAA OKEANOS EXPLORER

Goal 5: Organizational Excellence

NOAA functions in a unified manner to support, plan, and deliver effective educational programs and partnerships that advance NOAA's mission.

NOAA Education is committed to using resources efficiently and effectively. Due to the magnitude of the challenges facing the nation that NOAA works to address, NOAA Education efforts must be coordinated, monitored, and continually improved. The stories in this section are examples of NOAA Education programs that have made effective use of partnerships and collaboration to reach a broad audience and advance the agency's mission. The NOAA Education community promotes efficiency and organizational excellence by facilitating cross-agency work, providing forums for discussion, increasing capacity for NOAA educators, sharing best practices, and tracking and monitoring progress and outcomes. The goal of organizational excellence is critical to the success and advancement of the other Education goals.

GOAL 5: Organizational Excellence

NOAA COLLABORATORS

NOAA Teacher at Sea Program

NOAA Fisheries

Office of Legislative and Intergovernmental Affairs

Office of Marine and Aviation Operations

PARTNERS

U.S. Senator Jeanne Shaheen
(New Hampshire)

NOAA's Teacher at Sea Program, along with NOAA Chief Scientist Dr. Rick Spinrad and U.S. Senator Jeanne Shaheen (not pictured), presented seven outstanding Teacher at Sea alumni with the NOAA Teacher at Sea Excellence in Science Education Award at a Capitol Hill event in 2015.

Senator Jeanne Shaheen partnered with NOAA's Teacher at Sea Program to host an event celebrating the program's 25th anniversary and honoring 10 outstanding alumni.

NOAA Teacher at Sea Program celebrates 25 years with Capitol Hill award ceremony

In 2015, NOAA's Teacher at Sea Program celebrated its 25th year of supporting NOAA's mission by connecting teachers to ocean stewardship through extraordinary at-sea research experiences. This successful milestone highlights the ongoing value of the program to the public, congressional leaders, and NOAA leadership.



NOAA TEACHER AT SEA PROGRAM

The Teacher at Sea Program partnered with United States Senator Jeanne Shaheen (New Hampshire) to host an event on Capitol Hill celebrating the program's anniversary and honoring 10 outstanding alumni with the NOAA Teacher at Sea Program Excellence in Science Education Award. Long after their research cruises ended, these teachers continue to be enthusiastic about ocean science and share the importance of being lifelong learners with their students.

On July 15, 2015 in the Dirksen Senate Office Building, 7 of the 10 teachers received their awards in person. NOAA Chief Scientist Dr. Rick Spinrad gave opening remarks and thanked the teachers for being champions of science and the ocean. Senator Shaheen, a former classroom teacher, lauded the Teacher at Sea Program's ability to excite students about science while supporting NOAA's important work. "If we're going to produce the workforce that we need in the future - the scientists, and engineers, and mathematicians, and the people who have the technology degrees that we need—then we've got to get [students] excited," explained Senator Shaheen. "And what better way to have that reservoir of knowledge and information than the Teacher at Sea Program? I am not only a big admirer of all of you who are teachers, for your dedication, but I'm also a big admirer of NOAA and of the wonderful work that NOAA does to let us know what's going on with the oceans."



NOAA TEACHER AT SEA PROGRAM

GOAL 5: Organizational Excellence

NOAA COLLABORATORS

Climate Program Office
Chesapeake Biological Laboratory
National Ocean Service
Office of Education

PARTNERS

Alliance for Climate Education
American Meteorological Society
Aquarium of the Pacific
Association of Science-Technology Centers
Chicago Botanic Garden
Climate Central
Climate Generation: A Will Steger Legacy
Climate Interactive
Climate Leadership Engagement Opportunities (CLEO) Institute
Climate Literacy and Energy Awareness Network (CLEAN)
Cooperative Institute for Research in Environmental Sciences and the University of Colorado, Boulder
Department of Energy
Earth Day Network
Green Schools Alliance
Los Angeles Unified School District
Maryland and Delaware Climate Change Education Assessment and Research (MADE-CLEAR) Program
Museum of Science in Miami
NASA
National Aquarium
National Environmental Education Foundation
National Park Service
National Wildlife Federation
New England Aquarium
Philadelphia Zoo
Public Broadcasting Service

Lifting America's game in climate education, literacy, and training

The White House Office of Science and Technology Policy launched a new Climate Education and Literacy Initiative with the U.S. Global Change Research Program in December 2014. This initiative brought together NOAA and a suite of federal and non-federal partners to help connect American students and citizens with the best-available, science-based information about climate change.



Students and teachers Act on Climate at the White House during the August 2015 Back-to-School Climate Education event.

The initiative is working with leaders across sectors to ensure a climate-smart citizenry and a next-generation American workforce of city planners, community leaders, engineers, and entrepreneurs who understand the urgent climate change challenge and are equipped with the knowledge, skills, and training to seek and implement solutions.

Through these partnerships NOAA's Climate Program Office strives to facilitate a formal education system that produces climate literate citizens by engaging participation from education policymakers, academic and informal education institutions, professional associations, and teachers.

These institutions pledged exciting new commitments by federal agencies and outside groups and convened key leaders in the education community from government, academia, philanthropies, non-governmental organizations, and the private sector to find ways to enhance climate education in the United States. As a result, the Climate Education and Literacy Initiative has raised the importance of climate education and has gathered a new set of partners committed to ensuring society has more citizens who understand the climate system and know how to apply that knowledge in their careers and in their engagement as active members of their communities.

Seattle Aquarium
Second Nature
TERC
The Ocean Project
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

U.S. Forest Service
University of California, Irvine
USA National Phenology Network
WGBH Boston

GOAL 5: Organizational Excellence

NOAA COLLABORATORS

Office of Education
All NOAA Line Offices

PARTNERS

Citizen Science Association
Federal Community of Practice for Crowdsourcing and Citizen Science
White House Office of Science Technology Policy

NOAA's citizen science community advances tools to share project information and best practices to increase effectiveness

Citizen science can empower the American public to contribute to our understanding of the world around us while increasing environmental literacy. From surveying fish species to measuring precipitation, NOAA has a rich tradition of supporting citizen science. There are currently over 65 citizen science projects supported by resourceful individuals throughout the country.

NOAA Education is working to increase the effectiveness of these efforts. In 2013, the Office of Education surveyed individuals working on citizen initiatives throughout the Agency to determine areas of need. The survey found the following would be most useful: 1) mechanisms to compile and share best practices, 2) an improved ability to share resources, and 3) a searchable database of NOAA's citizen science projects. To help meet these needs, passionate NOAA employees from across the agency formed the NOAA Citizen Science Community of Practice.



PELIKA ANDRADE, UNIVERSITY OF HAWAII / HAWAII SEA GRANT

Students work on sea urchin studies with University of Hawai'i Sea Grant.

In 2015, the White House Office of Science Technology Policy worked to address similar needs at a government-wide level and issued a formal call for actions to encourage and support the appropriate use of citizen science and crowdsourcing at federal agencies. The NOAA Community worked with the Office of Science Technology Policy and other partners to create the Federal Crowdsourcing and Citizen Science Toolkit to aid in designing, carrying out, and managing such projects. NOAA also participated in the creation of the Database of Federal Crowdsourcing and Citizen Science Projects, which facilitates sharing information on government-supported projects.

Participating in citizen science has a demonstrated educational value. The Community Collaborative Rain, Hail and Snow (CoCoRaHS) Network, a NOAA Environmental Literacy Grant recipient, found that participating students made gains in science skills and were more likely to aspire to a career in STEM. The White House recognized the

value of these activities and even installed a CoCoRaHS rain gauge in the First Lady's Kitchen Garden. NOAA's projects were also featured in a Mini Page edition focused on citizen science, which was awarded a gold star for Crowdsourcing apps by DigitalGov.

The NOAA Citizen Science Community of Practice not only succeeded in meeting its three goals of compiling best practices, sharing resources, and creating a database of citizen science projects, it also contributed to similar efforts on a government-wide scale.

GOAL 5: Organizational Excellence

NOAA COLLABORATORS

Office of Oceanic and Atmospheric Research

Office of Education

All NOAA Line Offices

PARTNERS

Exploratorium

Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator, Dr. Kathryn Sullivan gets “hands-on” with an interactive, dynamic visualization of San Francisco Bay at the Exploratorium.

NOAA extends agency-wide partnership with San Francisco’s Exploratorium through a second, 5-year agreement

NOAA engages strategic partners to increase its educational capacity and reach to the public. A long-term, agency-wide partnership with San Francisco’s Exploratorium has led to dramatic increases in coverage of NOAA science topics in the Exploratorium as they moved to their new facility at Piers 15/17, which provides docking facilities for NOAA vessels. In FY15, NOAA and the Exploratorium signed an agreement for the second phase of a 10-year partnership to continue to build a science-informed society together.



NOAA

This partnership allows NOAA to explore and deploy new methods of presenting the Agency’s work in a proven educational setting with unique facilities and capacities. The Exploratorium is also a leader in informal science education through its model for exhibits that involves a high degree of collaboration with scientists and artists, an emphasis on interactive demonstration of scientific phenomena, and research into how people learn using these exhibits.

Scientists from across NOAA helped exhibit developers and educators understand and interpret NOAA’s data, advised on instruments to install to collect environmental data, and presented their work to the public. NOAA’s research ships docked at the Exploratorium, allowing NOAA Corps to conduct tours of ships and on-board scientists to explain the ship’s scientific mission to visitors and Exploratorium employees. NOAA’s most advanced data visualizations have been incorporated onto the Exploratorium’s large, nine-screen media wall allowing experimentation to find which visualization approaches are most effective.

As a result of this extended partnership, new, pressing scientific topics are the focus of additional education products, such as ocean acidification and the rebuilding of the salmon fishery in the Pacific. Over one million visitors have had the opportunity to learn from these products and there have been approximately 650,000 visits to NOAA-related online exhibits in the past year.

NOAA Education Council Members

The NOAA Education Council members listed below represent and coordinate education programs across the agency. Council members selected the stories for this report to highlight the breadth of NOAA Education.

Council Chair

Louisa Koch

Council Vice Chair

Christos Michalopoulos

Bay Watershed Education and Training Program (B-WET)

Amy Clark, Bronwen Rice

National Environmental Data, Satellite, and Information Service

Nina Jackson, Dan Pisut

National Marine Fisheries Service (NMFS)

Kate Naughten, Lisa Hiruki-Raring

NOAA Teacher at Sea Program (NMFS)

Jennifer Hammond

National Ocean Service (NOS)

Peg Steffen, Bruce Moravchik

Office for Coastal Management (NOS)

Atziri Ibanez, Nancy Cofer-Shabica

Office of National Marine Sanctuaries (NOS)

Tracy Hajduk, Seaberry Nachbar

National Weather Service (NWS)

Ron Gird, Mary Fairbanks

Warning Coordination Meteorologists (NWS)

Faith Borden, Kerry Jones

Office of Oceanic and Atmospheric Research (OAR)

Rochelle Plutchak, Eric Hackathorn

Climate Program Office (OAR)

Frank Niepold

Ocean Exploration and Research (OAR)

Paula Keener, Susan Haynes

National Sea Grant College Program (OAR)

Julia Galkiewicz, Maia McGuire

Office of Education – Higher Education

Marlene Kaplan, Kristen Jabanoski

Office of Education – K-12 and Informal Education

Christos Michalopoulos, Sarah Schoedinger



NATUREBRIDGE

A student examines groundcover with NatureBridge, an environmental education program supported by a NOAA Environmental Literacy Grant.

Acknowledgments



Alexandria Barkman, Hollings Intern with NOAA, snorkels at the Papahānaumokuākea Marine National Monument.

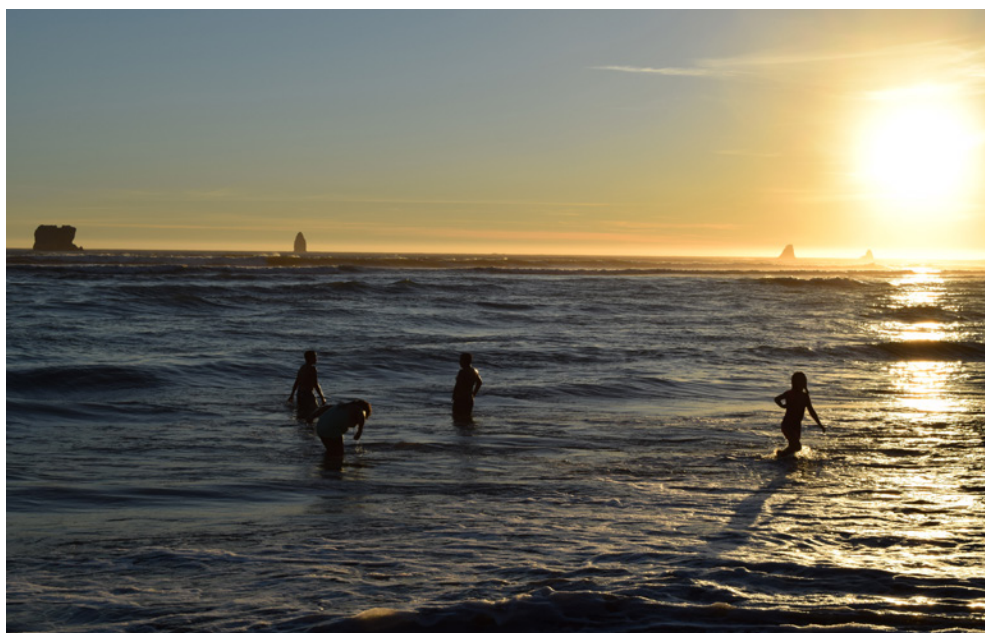
OFFICE OF NATIONAL MARINE SANCTUARIES

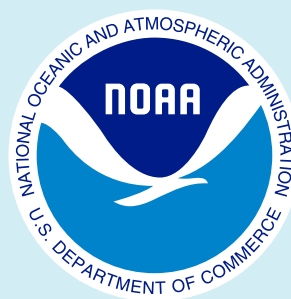
The NOAA Education community would like to thank the NOAA offices, programs, employees, partners, and grantees for their contribution to this report. Accomplishments were submitted on behalf of NOAA education programs by members of the NOAA Education Council. In addition, many members of the education community contributed significantly to writing these stories. We would like to extend a special thanks to the following people: Andrew Larkin, Ann Faulds, Ann Thorne, Bonita Nelson, Bree Turner, Carrie McDougall, Chris Chambers, Chris Petrone, Christina Package-Ward, Colleen Coogan, Deirdre Kimball, Emily Susko, Jacqueline Laverdure, Jeff Dutrow, Sarah Falkowski, Joan Muller, John Baek, John McLaughlin, Kālewa Correa, Katherine Cheney, Katy O'Connell, Kelly Drinnen, Kenneth Rainer, Kevin Schabow, Kirstin Wakefield, Krista Stegemann, Leon Geshwind, Lisa Nakamura, Maile Sullivan, Manning Taite, Margaret Mooney, Margaret Sedlecky, Molly Harrison, Monica Allard Cox, Onjalé Scott, Paula Arvedson, Peggy Foreman, Renee Wilson, Robert Hansen, Shakila Merchant, Stephanie Bennett, and all of the other NOAA staff and partners who worked to make these efforts happen. The document was edited by Marissa Jones and Patrick Drupp.

Image contributors

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 in the current educational programming of NOAA and its partners. Individual image credits are listed below each photo.

A quiet sunset moment for campers during their last night of Hoh Adventure Camp on the Washington Coast.





FOR MORE INFORMATION PLEASE VISIT [EDUCATION.NOAA.GOV](https://www.education.noaa.gov)

The NOAA Education Portal provides links to all the major education programs from across the agency. It serves as a gateway to educational resources, student opportunities, grant funding announcements, professional development activities, and more.