



National Oceanic and  
Atmospheric Administration  
U.S. Department of Commerce



# NOAA Education Accomplishments Report

ADVANCING NOAA'S MISSION THROUGH EDUCATION



FISCAL YEAR 2017

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## LETTER FROM THE DIRECTOR

### Partners and friends of NOAA Education,

On behalf of the NOAA Education community, I am pleased to present our 2017 Accomplishments Report. This report highlights the important role that NOAA educators played in meeting NOAA's mission of science, service, and stewardship this year.

This past year brought Earth science into the spotlight. An especially active hurricane season in the Atlantic fueled powerful storms, including Harvey, Irma, and Maria, which devastated many communities in the Gulf of Mexico, Atlantic, and Caribbean. Deadly wildfires in California destroyed thousands of homes and businesses. Drought, flooding, and tornadoes also inflicted heavy damage. NOAA plays a major role in helping our nation prepare for and respond to these environmental hazards, and our sympathies go out to those affected.

Events like these are turning points in people's lives. When I ask our scholarship recipients why they chose to study Earth science, many cite storms of the past—notably, Hurricanes Andrew, Katrina, and Sandy. It is a reminder that, out of tragic disasters, come young people ready to rise to a challenge. This is a testament to the innovation and tenacity of our country. We are proud of NOAA's role in educating the next generation of scientists, engineers, and experts who will help us prepare for these storms in the years to come.

Looking to the future, it's clear that educating the public about Earth science is essential. Whether we're preparing for disasters or managing coastal habitats, public engagement is key. Fortunately, NOAA's tools for studying Earth are now more capable than ever. GOES-16, our new Geostationary Operational Environmental Satellite, became our eyes in the sky, complementing NOAA's existing array of earth observing satellites and allowing us to see our planet in near real-time and stunning detail. NOAA probed the deep ocean with robotic vehicles, beaming data and videos live to researchers, students, and the public. We continued to take the pulse of the planet through a vast network of sensors on land, air, and sea. In this report, you will see examples of how education connects NOAA's assets—our people as well as our ships, labs, aircraft, buoys, data, satellites, and other tools—with the public we serve.

In 2017, we continued to improve our programs and reach diverse audiences. These strides would not have been possible without the help of our friends and partners. It is a true pleasure to work alongside such innovative organizations, talented students, and passionate educators. Thank you for the work that you do.

Sincerely,



Louisa Koch  
Director of NOAA Education



## INTRODUCTION

# Advancing NOAA's mission through education

The [National Oceanic and Atmospheric Administration](#) (NOAA) is a scientific agency that observes and predicts conditions in our ocean and atmosphere. From daily weather forecasts to long-term climate monitoring and fisheries management to marine commerce, NOAA provides communities and decision makers with the reliable information they need when they need it.



Education is an important extension of NOAA's role in environmental research, forecasting, management, and protection. The complex task of improving economic and social well-being through Earth science would not be possible without an engaged public. It is not enough for NOAA to study the ocean and atmosphere; we must also educate so individuals can use our information to support healthy ecosystems, resilient communities, and robust economies.

NOAA takes an "all hands on deck" approach to education. Our educators and partners work in different offices, programs, states, and countries, covering topics that span from the surface of the sun to the depths of the ocean. And while NOAA educators are our front line in reaching the public, we also rely on our scientists who volunteer their time to share their expertise and passion for their work. NOAA education takes place both inside and outside the classroom, reaching people of all ages.

We have continued to build a community of educators within NOAA. The core of this community is the [NOAA Education Council](#), composed of representatives from education programs throughout the agency. It is our forum for coordinating efforts and developing new ideas. The Council provides leadership to the NOAA Education community, which includes the staff, partners, and friends who support education.

Students from Meridian Elementary School look for phytoplankton on a microscope projection as part of Great Lakes Education Program on Lake Erie with Michigan Sea Grant. (Justin Selden, Michigan State University)

# INTRODUCTION

In 2015, the NOAA Education Council released an updated [Education Strategic Plan](#). In this guiding document, we outlined five goals and supporting objectives that help us advance NOAA's mission through education. These ambitious goals give the NOAA Education community a shared focus across a wide range of educational activities.



## Update on the 2016-2017 NOAA Education Implementation Plan

The NOAA Education Council developed a two-year [implementation plan](#) in fiscal year (FY) 2016, which documented the steps NOAA educators would take to expand and improve NOAA's current set of education programs. The implementation plan outlined 29 ambitious actions that were above and beyond business-as-usual. These actions included the efforts of individual programs as well as collaborative working groups involving educators from across NOAA. NOAA programs completed 28 out of the 29 actions (a 96% success rate). The action that was not completed will continue in FY 2018.

A student from Scott Collegiate Middle School uses a refractometer to measure water salinity during a kayak adventure near the Coastal Heritage Preserve in Galveston, Texas, with Artist Boat. This project was funded by the Gulf of Mexico Bay Watershed Education and Training program. (Artist Boat)

## How to read the goal chapters

This report is divided into chapters based on the five goals in our strategic plan. Each goal chapter includes three sections, described below. This report highlights many of our successes in FY 2017; however, it is not a comprehensive catalog of our activities. To learn more about NOAA Education, visit [NOAA.gov/education](https://www.noaa.gov/education).

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### OVERVIEW

We introduce each goal in our strategic plan and explain how it supports our overall vision for NOAA Education.

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### GOAL HIGHLIGHTS

We provide quick snapshots of some of the progress we have made. In the sidebar, we indicate the objective in our strategic plan that each highlight supports.

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### FEATURED STORIES

We share in-depth stories about efforts that resulted in societal, environmental, or economic impacts.

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# NOAA Education by the numbers

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**58 million people** visited informal education institutions hosting NOAA-supported exhibits or programs.

NOAA works with institutions to infuse NOAA science into exhibits and programs at science centers, zoos, aquariums, or other informal institutions. These institutions are our ambassadors, helping us reach many more people than we could alone.



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**450+ institutions** increased educational capacity through NOAA-funded centers, exhibits or programs.

NOAA partners with and funds educational and interpretive programs and exhibits at other organizations, including museums, science centers, after school programs, and nonprofits. By investing in these partners, we engage more people while building enduring relationships with organizations that share our mission.

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**2.5 million youth and adults** participated in NOAA-supported informal education programs.

Both directly and through partners, NOAA supports interactive informal educational programs. Children, families, adults, and communities participate in programs that enhance stewardship and understanding of the natural world. Working in the informal education setting, NOAA extends educational opportunities outside the classroom and promotes lifelong learning.



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**450,000+ P-12 students** participated in NOAA-supported formal education programs.

NOAA supports opportunities to work with students while they are at school, integrating NOAA science and resources into classrooms and the formal learning experience. Students therefore have the opportunity to learn about Earth science from the agency charged with understanding and predicting changes in climate, weather, ocean, and coasts.

## **25,000+ educators** participated in NOAA supported professional development programs.

NOAA supports and trains teachers and informal educators in Earth science and related topics. The state of the science is constantly changing as we discover more and develop new ways to gather environmental intelligence. Educator professional development programs provide direct conduits from NOAA experts to teachers and classrooms around the nation.



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## **44 million visits** were made to NOAA Education websites that support a broad spectrum of educational activities and provide critical information to the nation.

NOAA provides educational resources online. These resources include student opportunities, lesson plans, activities for children and families, and more.

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## **4,400+ postsecondary students** were trained in NOAA-related sciences through NOAA-funded higher education programs.

NOAA prepares undergraduate and graduate students for science, technology, engineering, and math (STEM) careers at NOAA and beyond. Students participate in research and career development opportunities, building skills and networks that will carry them into successful careers in Earth science, resource management, and other environmental fields.



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## **790+ postsecondary degrees** in NOAA-related disciplines were awarded to students NOAA supported in higher education programs.

NOAA's scholarship programs support and train students as they complete bachelor's, master's, doctoral, and law degrees in NOAA-related fields. These programs support the best and the brightest students from diverse backgrounds to foster the next generation of NOAA scientists, engineers, lawyers, resource managers, and other experts.

## 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.*



Kanesa Duncan Seraphin

## OVERVIEW //

NOAA's education programs provide opportunities for students and the public to learn about science and engage in our mission. In Goal 1, we lay the groundwork for an informed and scientifically literate society. We work with a wide array of educators and partners who collectively reach millions of people. We aim to inspire students and the public, help educators incorporate NOAA resources into their classrooms, and build enduring relationships with partners whose expertise complements our own.

## OBJECTIVES

- 1.1. Youth and adults from all backgrounds improve their understanding of NOAA-related sciences by participating in education and outreach opportunities.
- 1.2. Formal and informal educators integrate NOAA-related sciences into their curricula, practices, and programs.
- 1.3. Formal and informal education organizations integrate NOAA-related science content and collaborate with NOAA scientists on the development of exhibits, media, materials, and programs that support NOAA's mission.



## GOAL HIGHLIGHTS //

## Engaging students in hands-on, inquiry-based learning

Learning and doing science can be complex tasks. We keep learners engaged and spark curiosity by placing students' questions, ideas, and observations at the forefront of educational experiences.

- ▶ The 20th Annual [National Ocean Sciences Bowl](#) (NOSB), managed by The Consortium for Ocean Leadership, enriched science education through a nationally recognized academic competition that increased 1,960 high school students' knowledge of marine science. During FY 2017, more than 271 schools from 34 states participated. Students from Santa Monica High School in Los Angeles County, California won the final competition at Oregon State University. NOAA has provided core support for this effort and NOAA personnel have shared their scientific expertise and career experiences and volunteered at regional and national events. In addition, Sea Grant College Programs and Cooperative Institutes in 12 states hosted regional competitions. The NOSB addresses a nation-wide gap in environmental and Earth sciences in K–12 education by introducing high school students to and engaging them in ocean sciences, thus preparing them for careers in ocean science and other STEM disciplines.
- ▶ The [Bay Watershed Education and Training \(B-WET\)](#) program funded six grant competitions that supported 134 active grantees, including 43 new awards. As a result, B-WET connected 48,517 students and 2,507 teachers to quality STEM-based watershed education and professional development experiences.
- ▶ There are four elementary schools within ten miles of the [Elkhorn Slough National Estuarine Research Reserve](#) entrance gate, but until recently, most of the students had never visited this unique place. Between 2016 and 2017, a grant from the [Every Kid in a Park](#) initiative funded transportation to help students experience Elkhorn Slough. Additionally, the students received an Every Kid in a Park Pass, which provided fourth graders and their families one year of free admission to federal lands and waters around the country. Seven hundred students from six local schools and three school districts visited the Elkhorn Slough National Estuarine Research Reserve through Every Kid in a Park during the 2016–2017 school year.

## OBJECTIVE 1.1.

Youth and adults from all backgrounds improve their understanding of NOAA-related sciences by participating in education and outreach opportunities.



Students from Eastside High School in Florida compete in the National Ocean Sciences Bowl finals. (Katherine Pietrucha, Consortium for Ocean Leadership)

## GOAL HIGHLIGHTS //

- ▶ The Marine Art Contest and Traveling Exhibit from [Stellwagen Bank National Marine Sanctuary](#) in Massachusetts increased student understanding of local living coastal resources through a traveling art exhibit on the diversity of life in New England's ocean "backyard." Over the past few years, the contest has attracted 800-900 entries annually, primarily from Massachusetts, including ten other states and several foreign nations. The attention generated by the contest and exhibit has increased participation by teachers and students in marine studies and has inspired some high school art teachers to bring their students to aquariums for field trips. By promoting the understanding of marine living resources, the project plants the seeds of lifelong ocean stewardship.
- ▶ With over 145 institutions worldwide using NOAA's [Science On a Sphere®](#) (SOS), the platform provides unparalleled opportunities for global data visualization. However, teachers and students had not taken full advantage of this resource. To help close this gap, [NOAA's Office of Education](#) and [NOAA Research](#) launched a student contest for the 2017 Science On a Sphere Users Collaborative Network Workshop at the Detroit Zoo on April 25–27, 2017. The winners of the contest were Rachel Stukenborg and Kaitlin Tomlinson of James Madison University. Their project, "Energy Poverty-SOS: The overarching problem of energy poverty," exemplified the thoughtful and innovative approach NOAA sought to encourage through the contest.

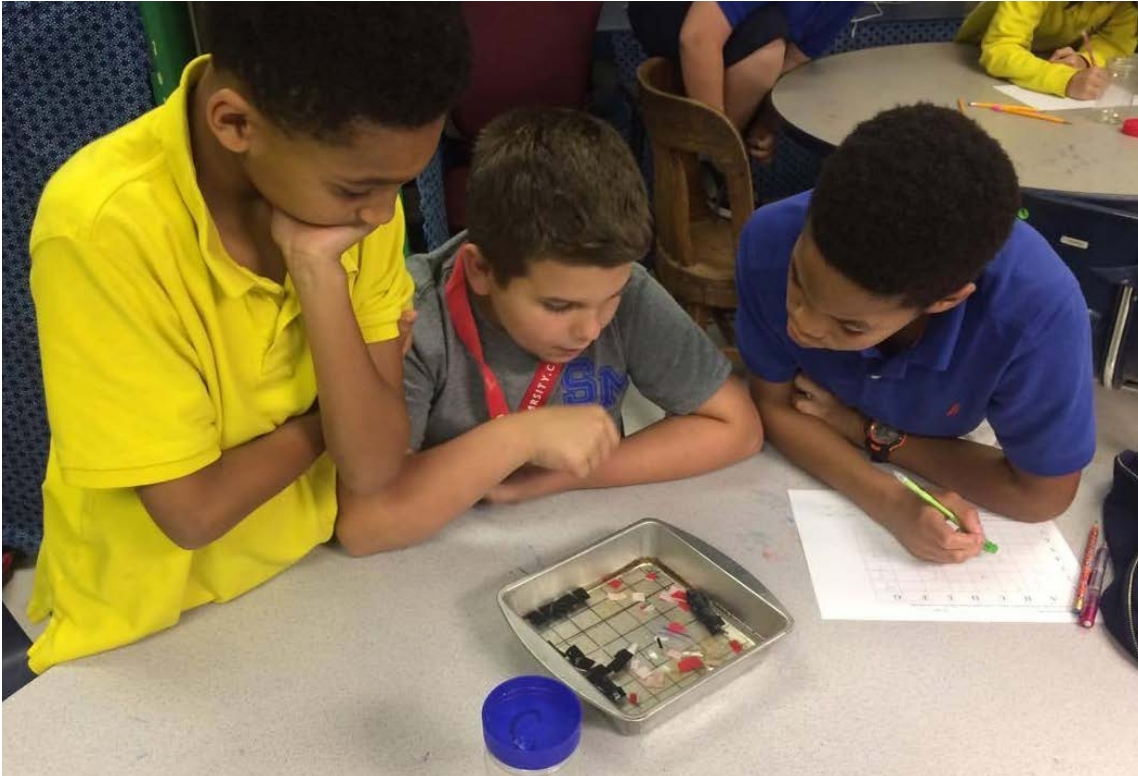


NOAA Education and the Detroit Zoo present Kaitlin Tomlinson and Rachel Stukenborg with the Science On a Sphere student contest award. (Detroit Zoo)

- ▶ The perspectives of both those who spend their lives fishing and those who research and manage ocean ecosystems are needed to fully comprehend the complex marine ecology, economy, and culture that surround our fisheries. Through the Fisherman in the Classroom program, education staff from California's [Greater Farallones National Marine Sanctuary](#) teamed up with local fishermen to deliver fisheries education. The teaching team brought salmon specimens from a hatchery, an industrial crab trap, fishing lures, hooks, and hands-on activities to the classroom. During FY 2017, the program served 899 middle and high school students.
- ▶ [NOAA Fisheries' Southeast Regional Office](#) helped marine science students in St. Petersburg, Florida, conduct oral history interviews with local commercial and recreational fishermen, charter captains, and fishing-support business owners. During the third

## GOAL HIGHLIGHTS //

year of a Voices from the Fisheries Partnership with Admiral Farragut Academy, eight interviews were completed by 24 students. Students gained a greater understanding of fishing history in the area, changes in the marine environment, and social science methods.



- ▶ The [Marine Debris Program](#) supported marine debris educational programs at underserved schools in three coastal counties of Mississippi. Ship Island Excursions led this NOAA-funded effort to deliver marine debris classroom instruction, teacher professional development, and student field trips to participate in marine debris cleanups. Involving students in the debris issue on a local scale helps them relate to this problem in a broader sense. In FY 2017, 15 teacher professional development programs were conducted to provide educators with the tools necessary to explore this topic within their classroom, and almost 2,000 students participated in cleanup activities.
- ▶ [Kachemak Bay National Estuarine Research Reserve](#) (KBNERR) in Alaska hosted a three-week workshop on climate change. Fireweed Academy's third- through sixth-grade students collaborated with the Artists in the Schools program and KBNERR climate scientists to graph real data and illustrate concepts using silk paintings. The students' art was displayed publicly at the Alaska State Legislature in April. The project used an innovative approach, weaving together science, art, and education to enhance understanding of climate change and community resilience.
- ▶ [Mississippi-Alabama Sea Grant](#) implemented programs for P-12 students at its two environmental centers, [Dauphin Island Sea Lab](#) and the [Gulf Coast Research Laboratory](#). Over 16,000 students engaged in field experiences aboard boats, in salt marshes, at beaches, in forests, and in other coastal habitats. These experiences increased the students' understanding and appreciation of these habitats and organisms and developed STEM skills, including authentic methods of data collection and interpretation. Pre- and post-testing showed a statistically significant increase in students' content knowledge, averaging a 30% gain in understanding coastal and marine science.

Mississippi students participate in a marine debris classroom activity as part of Ship Island Excursions' educational program. (Hanna Miller, University of Southern Mississippi)

## GOAL HIGHLIGHTS //

- ▶ Through the [Long-term Monitoring Program and Experiential Training for Students \(LiMPETS\) program](#), over 5,000 students and educators became citizen scientists and monitor the coastal ecosystems of [Channel Islands](#), [Monterey Bay](#), and [Greater Farallones](#) national marine sanctuaries. In post-program surveys, 97% of participating teachers reported their students developed a deeper connection to the ocean through LiMPETS, and 84% stated they had gained confidence in teaching about the practice of science. One teacher explained, “My students are so excited about LiMPETS that they are trying to form a student LiMPETS Club to sample in months when good tides fall outside the school day. This is a program that makes high school students want to gather data on weekends. It’s hard for me to think of a higher praise for a citizen science program.” The LiMPETS network was also part of a [research study](#) published by Dr. Heidi Ballard.

**“My students are so excited about LiMPETS that they are trying to form a student LiMPETS Club to sample in months when good tides fall outside the school day. This is a program that makes high school students want to gather data on weekends. It’s hard for me to think of a higher praise for a citizen science program.”**

- Teacher participating in the LiMPETS program



Students prepare to launch a remotely operated vehicle they built in Greater Farallones National Marine Sanctuary. (Jenna Batchelder)

- ▶ Remotely Operated Vehicles (ROVs) are not only tools for research, monitoring, and exploration of the ocean and other Earth systems, they are also important tools for exposing students to technology. For over 15 years, [Gray’s Reef](#) and [Thunder Bay](#) national marine sanctuaries have offered regional ROV competitions that feed directly into the [Marine Advanced Technology Education \(MATE\)](#) Center’s international ROV competition. Staff have also conducted targeted outreach to Title 1 schools to ensure all students have access to this inspirational activity. This year for the first time, [Olympic Coast National Marine Sanctuary](#) also hosted a competition and an educator workshop to introduce aspects of the MATE model. Olympic Coast staff worked with tribal educators from Washington state to showcase techniques that combined indigenous learning systems and Western science in order to improve science education for students.

## GOAL HIGHLIGHTS //

## Extending NOAA's reach through virtual platforms

Social media, websites, and mobile devices are used now more than ever to share and gather information. NOAA educators ensure that resources are widely available online. As a result, NOAA education websites had 44 million visits this year.

- ▶ NOAA's [Office of National Marine Sanctuaries](#) and Office of [Ocean Exploration and Research](#) teamed up with the [Ocean Exploration Trust](#) to explore three national marine sanctuaries along the West Coast. The [Exploration Vessel \(E/V\) Nautilus](#) was equipped with two remotely operated vehicles to explore and characterize deep water environments in these underwater parks. Through the *Nautilus*'s telepresence technology, scientists and people from around the world participated and contributed in real-time to the success of the expedition. Over 4,460 youth and adults virtually explored America's underwater treasures through 147 live, ship-to-shore interactions with scientists and explorers. Ocean Exploration Trust had over 3.7 million social media impressions. In addition, NOAA was mentioned in approximately 2,463 news stories about E/V *Nautilus* that received an estimated 148 million impressions.
- ▶ [Gray's Reef National Marine Sanctuary](#) collaborated with [Georgia Public Broadcasting's \(GPB\)](#) education division to create a livestream, virtual dive using underwater footage of Gray's Reef. The piece featured the superintendent of Gray's Reef and a research scientist from the University of Georgia as experts. GPB reported that more than 45,000 people, mostly students, from as far away as Romania tuned in to see the "[Live Exploration to Gray's Reef.](#)" The education staff at GPB Education worked with Gray's Reef to integrate NOAA-related science content and collaborated with NOAA scientists to develop a program using livestreaming to support NOAA's mission.

## OBJECTIVE 1.1.

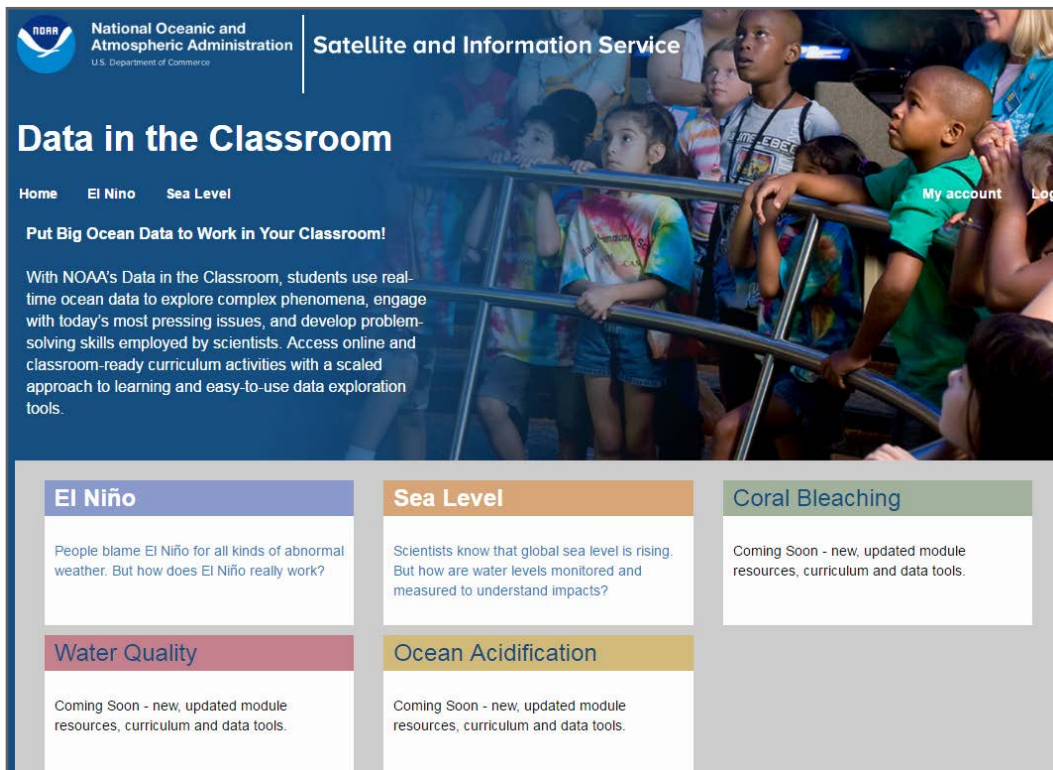
Youth and adults from all backgrounds improve their understanding of NOAA-related sciences by participating in education and outreach opportunities.



Claire Fackler (right) represented NOAA's Office of National Marine Sanctuaries on board the Exploration Vessel (E/V) *Nautilus* in collaboration with the Ocean Exploration Trust. The purpose of the expedition was to explore and characterize paleo shoreline features in and around the Channel Islands National Marine Sanctuary with the remotely operated vehicles, Argus and Hercules. (NOAA)

GOAL HIGHLIGHTS //

- ▶ NOAA [Climate Stewards Education Project](#) worked with federal agencies, non-governmental organizations, and academic partners to deliver 12 live distance learning opportunities to educators. Topics ranged from blue carbon to aquaculture and energy conservation to integrating climate change into social science and humanities education. Led by nationally recognized scientists, educators, and communicators, each opportunity worked to increase the scientific and pedagogic literacy of attendees in NOAA sciences. A virtual workshop, “The Dynamic Ocean,” which explored climate change impacts on the ocean and the communities that rely on it, was held in cooperation with the National Science Teachers Association. Evaluations showed 91% of all distance learning event attendees learned from their experiences, and 94% planned to use what they learned in their work over the next year, sharing the information and resources they received with over 60,000 colleagues, youth, and adults.
- ▶ NOAA’s [Climate Program Office](#) (CPO) strengthened the [Climate Literacy and Energy Awareness Network \(CLEAN\)](#) collection, rigorously reviewed collection of educational resources aligned with the Climate Literacy and the Energy Literacy frameworks to keep it high quality and relevant. CPO supported a partner gap analysis. The analysis revealed that, after 8 years of collecting resources and aligning them to “[three-dimensional learning](#)” science standards, the CLEAN collection is complete. CPO conducted a targeted outreach campaign focused on state science coordinators, large district coordinators, and regional and national education organizations for the 2017-2018 school year. To increase the usefulness of the CLEAN collection, CPO developed new, three-dimensional learning teacher guides to support use of the CLEAN collection as part of the campaign.



With NOAA’s Data in the Classroom, students use real-time ocean data to explore today’s most pressing environmental issues and develop problem-solving skills employed by scientists. (NOAA)

- ▶ [NOAA Satellite and Information Service](#) and [National Estuarine Research Reserve System](#) partnered to revise and improve NOAA’s Data in the Classroom modules. As of FY 2017, three modules have been revised and are now available online at <https://dataintheclassroom.noaa.gov/>. The website gives educators easy access to a sustainable platform for these resources. Since the launch of the new website, 4,595 unique visitors have participated in 7,516 Data in the Classroom web sessions. In addition, 45

## GOAL HIGHLIGHTS //

new educators have signed up for the Data in the Classroom newsletter, a 25% increase in subscribers since March 2017.

- ▶ The [National Ocean Service](#) improved the content on their education website. They added information about past stewardship projects, along with close-captioned archives of 15 webinars featuring climate scientists, educators, and communicators. These webinar archives have been viewed over 3,300 times since they were posted in January 2017. The National Ocean Service also added an extensive elementary through high school level learning progression focused on oysters, which was organized around the three dimensions of learning. New climate game offerings were also added to <https://games.noaa.gov>.
- ▶ [NOAA Fisheries' Alaska Fisheries Science Center](#) supported distance learning partnerships that connected remote Alaskan classrooms with current NOAA science. Through a partnership with AKTEACH (Alaskans Transforming Educational Access within Communities and Homes) and by using online conferencing tools like Google Hangouts, NOAA Fisheries scientists joined with classrooms in St. Paul, Eagle River, Kodiak, Anchorage, Danger Bay, and Larsen Bay to talk with students about NOAA research. Through these partners and virtual technology, NOAA Fisheries reached underserved classrooms and increased students' awareness of NOAA's research in Alaska.



A NOAA Teacher at Sea alumna builds a remotely operated vehicle during a regional Teacher at Sea Alumni workshop. (NOAA)

## GOAL HIGHLIGHTS //

## Training educators in NOAA science through active learning opportunities

Building students' critical thinking skills is one of the largest challenges educators face. Inquiry-based education gives educators the opportunity to meet learning standards while helping students understand the world around them. When teachers are well versed in NOAA science, they can pass that knowledge on to their students.

- ▶ The [Cooperative Institute for Meteorological Satellite Studies \(CIMSS\)](#) at the University of Wisconsin-Madison, a university partnership funded by NOAA, spearheaded a multi-year teacher development program that culminated in a two-day workshop at the GOES-R launch in November 2016. For three years, CIMSS worked with six middle and high school educators and numerous NOAA and NASA scientists and engineers to develop a suite of lesson plans for sixth- through 12th-grade students, which is available online. In total, 23 educators participated in the [GOES-R](#) Education Proving Ground professional development and witnessed the launch of the GOES-R (now called GOES-16) satellite.
- ▶ [Tijuana River National Estuarine Research Reserve](#) helped middle school teachers and students from the Roosevelt Middle School in San Diego, California, gain a deeper understanding about coastal environments. After participating in a 2016 Teachers on

**OBJECTIVE 1.2.**  
Formal and informal educators integrate NOAA-related sciences into their curricula, practices, and programs.

## GOAL HIGHLIGHTS //

the Estuary Workshop, one of the teachers taught 330 seventh-grade students about estuaries for six weeks, which culminated in a project based on issues covered in the [Estuaries 101](#) curriculum. Roosevelt Middle School now plans to use the Estuaries 101 curriculum in the 2017-2018 school year and has scheduled a field trip to the reserve.

- ▶ The [B-WET program](#) funded professional development on providing “Meaningful Watershed Educational Experiences” (MWEEs) to 2,507 teachers in seven regions. Evaluation data show that 78% of teachers who responded intend to implement MWEEs independently without support from a professional development provider. In addition, 83% of teachers who responded to a follow-up survey indicated that they have conducted MWEE activities with their students.
- ▶ [NOAA Fisheries Chesapeake Bay Office](#), along with educators from NOAA’s Climate Stewards Program and NOAA Fisheries’ Sustainable Fisheries Office in Maryland, led a teacher professional development program called “Estuarine Literacy for Elementary Educators.” This program supported elementary science educators as they strive to implement Next Generation Science Standards and include estuarine science at the elementary level. By providing environmental literacy implementation guidance, NOAA Fisheries is enabling elementary educators to integrate NOAA science into their curricula, practices, and programs, increasing knowledge and understanding of NOAA science.



Educators at the 2017 Hawaii Environmental Education Alliance workshop gather to discuss hands-on professional development opportunities for educators and resources for students. This workshop was supported by the NOAA Climate Stewards Education Project. (Liz Foote)

- ▶ [NOAA Satellite and Information Service](#) (NESDIS) and National Weather Service (NWS) continued to make satellite and space resources available to educators. NESDIS and NWS supported the Satellite and Education Conference that is held each year at California State University, Los Angeles. At the conference, satellite experts trained 200 educators on using NOAA science and satellite data in the classroom.
- ▶ Ocean acidification can be a daunting topic to cover in the classroom, but for Washington state’s coastal communities, it already affects the health of the ecosystems they depend on for their livelihoods. In collaboration with Pacific Education Institute, [Olympic Coast National Marine Sanctuary](#) hosted a three-day workshop, “Engineering Solutions for a Changing Environment.” This workshop allowed local teachers of



## GOAL HIGHLIGHTS //

grades four through six to better understand ocean acidification and how to integrate it into their curricula. Reaching nearly 600 students each year, these teachers have a huge impact on Olympic Coast communities.

- ▶ The [Teacher at Sea Program](#) used pre- and post-cruise surveys to track how teachers use NOAA resources. Prior to their research cruises, teachers were likely to teach NOAA topics and use NOAA resources; however, post-cruise data show that 100% of teachers intend to integrate their experience at sea into their work within the next year. Teachers plan to use research experiences to demonstrate how scientists collect data in the field, incorporate NOAA research survey results and data into math lessons, teach students about NOAA careers, and use NOAA data and websites during hydrography units.
- ▶ For 25 years, NOAA's [Office of Education](#) has connected to educators at the [National Science Teachers Association](#) conference. In 2017, NOAA staff and partners joined over 10,000 educators at the conference in Los Angeles, California. Teachers with NOAA training, such as Teacher at Sea alumni and Climate Stewards educators, helped staff the booth. They spoke with other educators, sharing their experiences and strategies for teaching with NOAA's resources. Seventeen NOAA staff participated in eight share-a-thons or demonstrations and nine presentations. Approximately 680 conference-goers attended the 17 events, with an overall average attendance of 40 for each of the NOAA presentations. By connecting science teachers with NOAA resources and experts, more educators will incorporate Earth science resources into their classrooms.
- ▶ The [NOAA Climate Stewards Education Project](#) engaged over 500 educators at workshops in Alaska, Connecticut, and Hawaii. Focusing on climate change impacts to local communities, and underserved and indigenous populations, educators participated in hands-on STEM education professional development activities. Evaluations showed that participants demonstrated an increase in climate change knowledge with significant improvement in identifying how climate is regulated by complex interactions among components of the Earth, and how human activities are impacting the climate system. Participants reported they will share what they learned with over 10,000 colleagues, youth, and adults over the course of the coming year.
- ▶ The Office of [Ocean Exploration and Research](#) (OER) condensed the two [NOAA Ship Okeanos Explorer](#) educator professional development workshops, "Why Do We Explore?" and "How Do We Explore?" into a single, seven-hour offering with the new title, "Exploring the Deep Ocean with NOAA." In FY 2017, this professional development program and its associated lessons were updated with the latest findings and insights from the past three years of the NOAA Campaign to Address Pacific monument Science, Technology, and Ocean Needs (CAPSTONE) in the Pacific Ocean. Content now focuses on ocean exploration generally, including NOAA Ship *Okeanos Explorer* and other ocean exploration vessels.



A Teacher at Sea alumnus looks through a shark jaw during a teacher workshop. (NOAA Teacher at Sea Alumni Association)

## GOAL HIGHLIGHTS //

## Increased coordination and integration of NOAA assets for better engagement

Over 450 partner institutions use NOAA resources to engage and educate the public. Working with these partners involves ongoing dialog so we can learn about their needs, keep them abreast of advances in science, and help them make the most of NOAA's resources.

► **NOAA Research** and the **Office of Education** continued to support a partnership with the Exploratorium, an innovative science museum in California. The Exploratorium is located at a pier in San Francisco Bay, which provides a dock for NOAA ships when they call to port. NOAA and the Exploratorium developed explanatory materials (videos, diagrams, pictures, and text) to connect the public to NOAA's research vessels. NOAA also helped identify candidates for the Scientist in Residence program, where NOAA social and physical scientists use the museum as a living lab to engage visitors and communicate science. These efforts allow the one million people who visit the Exploratorium annually to learn about NOAA's research vessels, technology, and science.

► For over 15 years, the Office of **Ocean Exploration and Research** (OER) has partnered with the National Marine Sanctuary Foundation (NMSF) to provide professional development workshops for educators at aquariums and science centers. Currently, there are 14 "Education Alliance Partners." Most of these partners are located on the coasts, but OER and NMSF worked to expand to inland locations. One recent addition to the Education Alliance Partnership is the Loveland Living Planet Aquarium in Utah. The Albuquerque Biopark in New Mexico and the Great Lakes Aquarium in Minnesota have hosted multiple workshops, and Texas State Aquarium is extending their Alliance Partner workshops to a number of inland locations within the state. Under a new grant in FY 2018-2019, NMSF and NOAA will continue to establish new inland Education Alliance Partners.

► NOAA's **Environmental Literacy Program** (ELP) supported 25 grantees and issued three new awards to support community resilience through environmental education. As a result, ELP supported formal and informal educational programs and exhibits at 102 institutions that were visited by roughly 46 million people. ELP grants funded professional development programs for over 3,000 educators. ELP supported educational programs to increase people's awareness and knowledge of Earth system sciences and better prepare them to make informed environmental decisions. Funds allowed institutions to work with NOAA and integrate NOAA-related sciences into their exhibits and programs.

**OBJECTIVE 1.3.**  
Formal and informal education organizations integrate NOAA-related science content and collaborate with NOAA scientists on the development of exhibits, media, materials, and programs that support NOAA's mission.



Precious corals, like this species of *Hemicorallium*, were common during 2017 exploration of Carondelet Reef within the Phoenix Islands Protected Area on NOAA Ship *Okeanos Explorer*. (NOAA Office of Ocean Exploration and Research)

## FEATURED STORY //

## NOAA supports STEM in afterschool at 21st Century Community Learning Centers around the country

The Waterbury Public Schools District is one of the 30 lowest performing districts in Connecticut, and 72.5% of their students qualify for the free or reduced price lunch program. This summer, 75 Waterbury students from grades three to five and their teachers discovered watershed science and explored nearby Long Island Sound and Candlewood Lake with EdAdvance, an education provider that worked with the schools to present “WoW! The Wonders of Watersheds.” Academic enrichment activities like WOW that complement regular academic programs are a great asset for students in underserved schools. Thanks to a NOAA and Department of Education out-of-school pilot program, these students and over 1,500 others across the country had access to high-quality, watershed-focused STEM education in 2017.

Out-of-school programs encourage student interest in learning and engage students who might not otherwise have the opportunity to participate in STEM activities. The [U.S. Department of Education’s 21st Century Community Learning Centers](#) (21st CCLC) program is the largest out-of-school program in the nation, serving over 1.5 million students—particularly those who attend high-poverty and low-performing schools—in all 50 states. In 2017, the U.S. Department of Education invited NOAA to join a federal initiative to support STEM activities at these 21st CCLC sites. As a result, NOAA and the [National Marine Sanctuary Foundation](#) developed a [pilot grant](#) program to provide 21st CCLC sites with authentic STEM experiences using components of NOAA’s [Bay Watershed Education and Training \(B-WET\)](#) Meaningful Watershed Educational Experiences (MWEEs).

MWEEs are locally relevant, authentic experiential activities that include learning both outdoors and in the classroom, and they aim to increase the environmental literacy of all participants. Through this new collaboration, experienced B-WET MWEE providers worked with 21st CCLC sites to provide academic enrichment experiences to students and capacity-building to educators. NOAA resources were used to increase participants’ understanding and stewardship of watersheds and related ecosystems. By following the MWEE framework, STEM education was contextualized, emphasizing connections with students’ lives, choices, and communities.

In early 2017, the NOAA/21st CCLC pilot grant program awarded \$500,000 to 17 pilot projects, impacting 37 sites in 15 states and all seven B-WET regions. Over 1,600 youth and 184 21st CCLC educators and staff explored and investigated their local watersheds during out-of-school time. The evaluation indicated that projects excelled at making activities relevant to students’ lives and improved students’ understanding and awareness of the local watershed. Pilot grantees also forged strong collaborations with local 21st CCLC sites, establishing relationships that have the potential to be sustained beyond the pilot program funding.



Students from the Mountaineer Boys and Girls Club in West Virginia work with Friends of Deckers Creek to plant a raised wildflower garden at the Boys and Girls Club site. Students learned about native pollinators and habitat creation for local species as part of a 2017 NOAA-21st CCLC Watershed STEM Education Partnership Grant. (Friends of Deckers Creek)

## FEATURED STORY //

## Alumni workshops bring teachers together, building on NOAA's Teacher at Sea experience

NOAA's [Teacher at Sea](#) (TAS) Program provides a unique at-sea research experience for teachers, who often describe the opportunity as “transformational.” The program encourages teachers to engage with the TAS Alumni Association and connect with each other via regional workshops. Because research reveals a positive correlation between student achievement and teacher knowledge of science content and pedagogy, the Teacher at Sea Program structures these workshops to expand the teachers' science knowledge, introduce them to local NOAA resources and research, and solidify bonds between educators.

In FY 2017, the TAS Alumni Association collaborated with NOAA laboratory staff in the Pacific Northwest and Gulf of Mexico to host alumni workshops. Workshops included NOAA facility tours, presentations by scientists, hands-on educational activities, and lesson plan exchanges.

All of the participants of both workshops found them so useful that they planned to incorporate content, activities, and experiences from the workshop into their curricula, with some doing so the very next week.

Eighteen alumni from six Pacific Northwest states convened at NOAA's Western Regional Center in Seattle, Washington, in November 2016. Scientists from the Alaska and Northwest Fisheries Science Centers, the Pacific Marine Environmental Lab, and the local Weather Forecast Office gave presentations. Research topics included estimating marine mammal populations, mitigating polluted stormwater runoff, collecting environmental data through buoys and autonomous sail drones, and forecasting local weather and water conditions. The teachers also built miniature, underwater remotely operated vehicles.

“I found it very valuable to reconnect with my experience in TAS and all I learned from it,” wrote one Seattle workshop participant, “I'm excited to redesign my lessons and share them more thoroughly with the students and the community.”

Seventeen alumni from nine Gulf Coast and Southeast states then met at NOAA's Southeast Fisheries Science Center Laboratory in Pascagoula, Mississippi, in May 2017. Local NOAA scientists taught the teachers about sea turtle, groundfish, and larval fish studies, and a shark biologist led the teachers in hands-on shark dissections. On the second day, the teachers participated in a trawling demonstration aboard NOAA Research Vessel *Caretta* and went ashore to clean up a nearby barrier island.

Along with hands-on experience and learning directly from scientists just as they did at sea, Pascagoula workshop participants stated that “meeting the other teachers and NOAA personnel was most beneficial” and that “this type of networking is very valuable and somewhat rare for teachers.” By connecting with fellow alumni and staying engaged in scientific research, these educators are better able to pass that knowledge on to their students long after they return from sea.



NOAA Teacher at Sea alumni came together in Pascagoula, Mississippi, (upper) and Seattle, Washington, (lower) to learn about scientific research in the region, expand their STEM education network, and enhance their at-sea experience. (Teacher at Sea Alumni Association)

## FEATURED STORY //

## Educators in the Pacific connect new discoveries, traditional culture, and the deep ocean

It's not every day that a research vessel visits a remote island in the middle of the Pacific Ocean. Whenever the [NOAA Ship \*Okeanos Explorer\*](#) arrives in such a place, the team connects educators to the research taking place in their own deepwater backyards. From July 2015 through September 2017, NOAA's [Office of Ocean Exploration and Research](#) (OER) and partners conducted multiple ocean exploration expeditions in the Central and Western Pacific Ocean aboard the *Okeanos Explorer* as part of the three-year Campaign to Address Pacific monument Science, Technology, and Ocean Needs (CAPSTONE). Expeditions targeted marine national monuments and national marine sanctuaries. These unique places contain some of the last pristine marine ecosystems on the planet and harbor numerous protected species, undiscovered shipwrecks, and cultural landscapes sacred to the indigenous peoples of the Pacific.

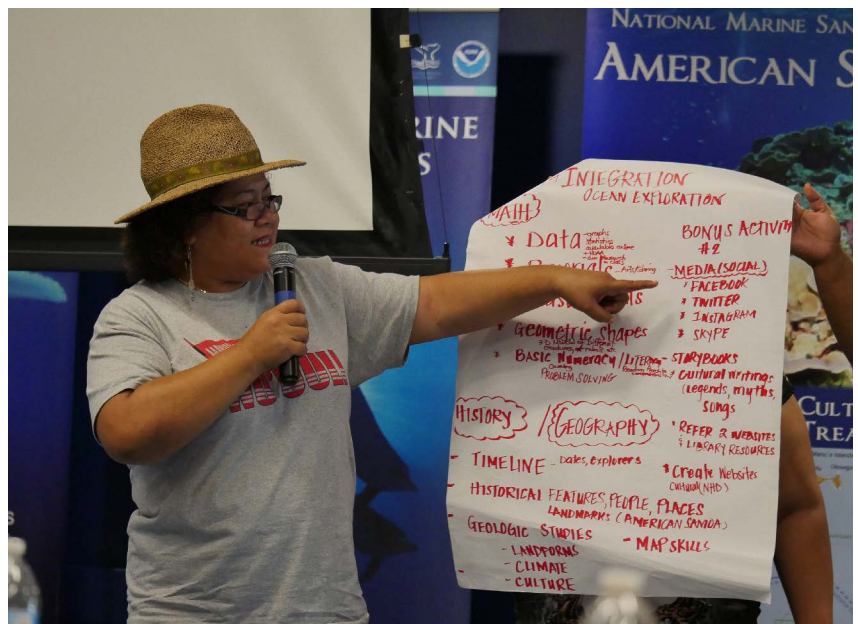
CAPSTONE was also an important opportunity to share ocean exploration results with Pacific Islanders. In April 2017, the *Okeanos Explorer* docked at Pago Pago, American Samoa, after expeditions focused on the National Marine Sanctuary of American Samoa and surrounding waters. Working closely with partners in the National Marine Sanctuary System, OER hosted events to share exploration results with the local community. These events included a professional development workshop and special tours of the ship for educators. OER provided educators with new lessons based on recent exploration results and other teaching resources tailored to American Samoa. The workshop was hosted by the National Marine Sanctuary of American Samoa at the Tauese P.F. Sunia Ocean Center in Pago Pago.

Forty-five public and private school educators from American Samoa participated in an exercise designed to teach their students creative communications skills to share ocean exploration discoveries with their village elders. Educators built short presentations that shared discoveries from the 2017 American Samoa Expedition, wrote stories and songs, and created new games to highlight recent findings and the excitement of exploring the deep ocean in the Central Pacific.

The participants also incorporated the importance of communicating Samoans' unique relationship with the sea based on the living tradition of *Fa'a Samoa* (the Samoan way). By maintaining the vibrant traditions, values, and legends that connect the Samoan people to the land and sea, the local community plays an integral role in protecting and preserving natural and cultural resources.

These activities expose educators in remote locations to NOAA and ocean exploration, increase their appreciation and understanding of the deep water ecosystems of their region, and help them share authentic, current ocean science with their students, creating a bridge between sacred traditions and modern ocean exploration.

**“Thank you! This is by far the best activity/professional development. This will really help me in my Earth Science and Biology [instruction].”**  
- Workshop participant



An educator presents during a communication lesson in a 2017 professional development workshop at the Tauese P.F. Sunia Ocean Center in American Samoa. (Emily Narrow, Global Foundation for Ocean Exploration)

## FEATURED STORY //

## Students become ‘Estuary Explorers’ at the Elkhorn Slough National Estuarine Research Reserve

Elkhorn Elementary School in California serves a predominantly low-income, Hispanic community that resides within the Elkhorn Slough watershed. In 2014, the [Elkhorn Slough National Estuarine Research Reserve](#) received a [Bay Watershed Education and Training \(B-WET\)](#) grant to create the Estuary Explorers Club, an after-school program in partnership with Elkhorn Elementary School. This program provides a unique opportunity for local students to experience the Elkhorn Slough reserve.

The Estuary Explorers Club is a one-day-a-week after-school program that engages 80 to 100 second- through fifth-grade students in watershed-focused activities. In September, these local school children arrive at the gates of the Elkhorn Slough reserve ready to explore. This program immerses children in the environment through field-walks, hands-on activities, and direct interactions with scientists.

Over the past three years, the Explorers have conducted field studies and collected data through activities that take them into the field with reserve researchers and stewardship staff. Lessons addressed natural resource priorities in Elkhorn Slough: water quality and invasive species, marine and coastal habitat protection, coastal resilience, and climate change. Students gained skills working with water quality tools like the Secchi disk and salinity refractometers as they examined the Slough using the same tools NOAA scientists use.

The Explorers adopted two restoration sites that they visited several times throughout the year for weeding and planting. They learned about the value of restoring native plants to an area and saw the bounty of their work as the sites expanded. “I love dirt! I use[d] to be afraid, but now I want to roll in it!” said one participant.

At the end of each year, Estuary Explorers worked in teams to create posters that address the connections between the watershed, the estuarine ecosystem, and their own lives. Estuary Explorers presented their projects at an evening event for family and friends. Parents were enthusiastic about the program. One parent commented, “She loves being an Estuary Explorer and coming to the reserve, she can’t talk enough about it!”

The true success of this program was watching the students return each year excited to take on the role of mentor. Students who participated in the first year of the program as second graders were fifth graders in 2017. They developed into passionate stewards for the reserve and confidently shared lessons they learned with younger students.

The long-term goal of the Elkhorn Slough education team is to provide ongoing estuarine education experiences for children to enrich their lives and ultimately benefit the health of the Elkhorn Slough and the surrounding coastal ecosystems. This is one of the many education efforts underway across the country that engage students and communities in the [National Estuarine Research Reserve System](#).

Estuary Explorers conduct field work at the Elkhorn Slough National Estuarine Research Reserve. (Virginia Guhin, Elkhorn Slough National Estuarine Research Reserve)



## GOAL 2

# Conservation & 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.*



Claire Fackler, Office of National Marine Sanctuaries

### OVERVIEW //

Promoting awareness of conservation and stewardship is an important way to share NOAA's mission with students and the public. Our programs enable people to participate in habitat monitoring and restoration, everyday behaviors, and policy changes that help improve natural resource management. We are making progress by understanding how our education portfolio supports stewardship and by encouraging educators and institutions to integrate stewardship actions into their educational projects.

### OBJECTIVES

- 2.1. Youth and adults from all backgrounds are knowledgeable about conservation and stewardship practices and skilled in applying them to address local, regional, national, and global issues related to NOAA's mission.
- 2.2. Formal and informal educators integrate NOAA-related conservation and stewardship concepts and activities into their curricula, practices, and programs.
- 2.3. Formal and informal education organizations establish guidance and provide support toward increasing participation of education audiences in conservation and stewardship activities related to NOAA's mission.

## GOAL HIGHLIGHTS //

## Engaging youth in environmental stewardship

NOAA Education strives to provide content and opportunities that help change practices, beyond passively providing information. It is important to engage youth, especially those from underserved and underrepresented groups, in understanding how humans impact the environment. Here are some examples of how students were able to learn about and take action toward a healthy environment.

- ▶ NOAA Fisheries led an art mural and school outreach project focusing on steelhead biology, ecology, and recovery. [NOAA Fisheries' West Coast Regional Office](#) worked with city officials, the art council, and a local muralist to engage fifth-grade students in completing a large mural of a steelhead and its watershed on a public building in Long Beach, California. To follow up, NOAA Fisheries staff visited fifth-grade classrooms and guided students through field observations along the San Gabriel River to connect with steelhead biology, ecology, recovery, and habitat, and to understand the importance of habitat restoration and human impacts. Through this art and science program, NOAA Fisheries increased students' knowledge about steelhead conservation and stewardship practices, in addition to exploring the influences of human activity on the steelhead's ecosystem.
- ▶ The [Marine Debris Program](#) supported a Marine Debris Creative Advocacy Competition, led by Bow Seat Awareness Programs. The program encouraged middle and high school students to be stewards of the ocean by addressing marine debris in their hometowns. The contest tasked students with using their creative talents to raise awareness and carry out real-world projects in response to marine debris issues in their community. Four winners were announced, with three honorable mentions and notable submissions. One winner remarked, "There is no better feeling than to feel passionate about something and then go out and do something about it." (MDP)

### OBJECTIVE 2.1.

Youth and adults from all backgrounds are knowledgeable about conservation and stewardship practices and skilled in applying them to address local, regional, national, and global issues related to NOAA's mission.

Students from Irvine, California, pose with "Maurice the Marine Debris Whale," an interactive sculpture created to educate the public about marine debris impacts on marine wildlife. (Bow Seat)





## GOAL HIGHLIGHTS //

- ▶ [Padilla Bay National Estuarine Research Reserve](#) in Washington helped create and sustain the annual Youth Earth Summit (YES). The YES conference generated student-led environmental stewardship projects. Each year, 80 to 100 high school students and their advisors participate. Projects include the installation of photovoltaic solar panels on school buildings, waste audits, community campaigns addressing pet waste, and the installation of a “hydration station” that counts plastic bottles saved as students fill their own water bottles. Participation in YES has inspired students to volunteer for restoration projects, such as riparian plantings and salmon surveys.



Elementary school students from an Ocean Guardian School in Santa Barbara, California, participate in a kayaking adventure. (Claire Fackler, Office of National Marine Sanctuaries)

- ▶ The [Climate Stewards Education Project](#) opened their application season on November 1, 2016, a month earlier than in previous years, and accepted more applicants with a wider range of projects. The 32 educators from 15 states who were accepted into the program received professional development and support through a peer mentoring network to develop new projects. These ranged from removing invasive plants and restoring native vegetation in Hawaii, starting an electronics recycling center in rural Michigan, planting a Three-Sisters garden, and holding Native American storytelling events to teach sustainable gardening and water conservation. While this group of educators developed stewardship projects for the 2018 academic year, 23 educators from 14 states and the U.S. Virgin Islands carried out projects during the 2017 academic year, engaging over 2,100 students.
- ▶ An [Ocean Guardian School](#) makes a commitment to protect and conserve its local watershed, the world’s ocean, and special ocean areas, like national marine sanctuaries. In FY 2017, 6,689 students at 35 schools with 258 community partners participated in the Ocean Guardian Schools program. The Ocean Guardian School program isn’t just valuable to the ocean; it’s valuable to parents, too. A recent socioeconomic study coordinated by the [Office of National Marine Sanctuaries](#) looked at the objective and perceived value of Ocean Guardian Schools, which is offered at no cost to parents. The study surveyed California parents whose children participated in Ocean Guardian School activities. Of the 270 responses, 90% were supportive of their child’s participation. A large majority of parents reported that their child had an increased sense of responsibility toward the environment and an increased understanding of their interactions with the environment. The study also showed that the students who participated in the projects are now talking to others about the actions others can take to improve the environment.

## GOAL HIGHLIGHTS //

## Expanding stewardship and conservation through virtual platforms

Given the magnitude of the environmental challenges we are facing, NOAA's education programs make the most of online programs to get people involved. As the highlights below demonstrate, virtual communication about stewardship and marine resource management helps us reach a wide array of audiences that are geographically distributed.

- ▶ The International Union for Conservation of Nature held their World Conservation Congress for the first time in the United States in Honolulu, Hawaii. Approximately 15,000 visitors, residents, and attendees from over 160 countries learned about NOAA and the work we do in the Pacific. NOAA's [Science On a Sphere](#)<sup>®</sup> (SOS) was a marquee exhibit at the U.S. Pavilion. The [Office for Coastal Management](#) coordinated with other NOAA offices to staff 24 presentations. From spectacular animations showing the global impact of tsunamis to 360-degree underwater footage of rarely seen coral reef ecosystems, visitors marveled at the stunning visual experience afforded by SOS. Approximately 1,500 people attended the talks in person, and an additional 30,000 people viewed the eight Facebook Livestreams conducted by the Office of National Marine Sanctuaries, the first pilot of Facebook Live within NOAA.
- ▶ [NOAA Fisheries](#) completed an inventory of 142 of their educational materials on endangered species. Five fisheries science centers and five regional offices assessed gaps, materials that need updating, and which materials to transfer to the new NOAA Fisheries website. Three offices are developing new materials on endangered species that were not covered in the initial inventory.
- ▶ [NOAA Fisheries](#) connected classrooms with a new crowdsourcing platform, [Steller Watch](#), which recruits members of the public to view photographs of endangered Steller sea lions in the western Aleutian Islands of Alaska. This platform allows the public to contribute to research by NOAA Fisheries Alaska Fisheries Science Center on the life history and movements of these animals. The innovative project sparked the imagination of teachers, some of whom visited the site daily to count sea lions. Steller Watch provides information on current research and conservation efforts on the endangered population of Steller sea lions.

## OBJECTIVE 2.1.

Youth and adults from all backgrounds are knowledgeable about conservation and stewardship practices and skilled in applying them to address local, regional, national, and global issues related to NOAA's mission.

NOAA's Science On a Sphere on display at the International Union for the Conservation of Nature World Conservation Congress in Hawaii. (NOAA Office for Coastal Management)



## GOAL HIGHLIGHTS //

## Building capacity for stewardship and conservation

NOAA works to protect ocean and coastal ecosystems and cultivate environmental stewardship. Partnerships are critical to achieving this ambitious task. In 2017, our agency connected our partners to best practices, new advancements, and lessons learned so that they can effectively integrate NOAA's conservation and stewardship resources into their programming.

- ▶ The [B-WET program](#) completed a national evaluation in FY 2017. Based on these results, 72% of teachers reported participating in a stewardship activity as part of their professional development and 82% engaged their students in stewardship behaviors. Also, 74% of grantees engaged their students in more than one stewardship behavior. This information helps the B-WET program understand how the educators they serve integrate NOAA-related conservation and stewardship concepts and activities into their curricula, practices, and programs so that NOAA can better support these activities.

▼ **OBJECTIVE 2.2.**  
Formal and informal educators integrate NOAA-related conservation and stewardship concepts and activities into their curricula, practices, and programs.



- ▶ NOAA's [Marine Debris Program](#) and [Office of National Marine Sanctuaries](#) partnered to develop a marine debris toolkit that focuses on involving K-12 students in assessing marine debris in their own communities. The free kit uses curricula, resources, and the Marine Debris Monitoring and Assessment Project protocols and database to introduce teachers and students to the topic of marine debris, engage them in hands-on assessments of debris, and provides opportunities for the students to educate the public.

Marine debris threatens wildlife in places like Papahānaumokuākea Marine National Monument. (Ryan Tabata, NOAA)

## GOAL HIGHLIGHTS //



Workshop participants conduct water quality testing on the coast of Louisiana through a project funded by the Gulf of Mexico Bay Watershed Education and Training program. (Dinah Maygarden)

- ▶ [NOAA Fisheries' Chesapeake Bay Office](#) and partners developed and released “The Educator’s Guide to Designing and Implementing the Meaningful Watershed Educational Experience (MWEE).” This guide will support the environmental literacy goal in the Chesapeake Bay Agreement. By providing a common framework for implementing MWEEs, formal and informal educators will be able to more effectively integrate MWEEs into their curricula, practices and programs, making these programs more available to youth and adults in the Chesapeake Bay region.
- ▶ The [Ocean Guardian School](#) program, coordinated by the [Office of National Marine Sanctuaries](#), funded 35 schools, 12 of which were Title I schools from underserved and underrepresented areas. In addition, the program is working to include entire school districts in underserved communities to become Ocean Guardian School districts in California. By encouraging and funding Ocean Guardian School projects that serve predominantly underserved and underrepresented students, a more diverse population of youth will be more knowledgeable about stewardship practices and more likely to apply them to environmental issues they face.
- ▶ The Ocean Project completed work on their [Innovative Solution Grants-Plus \(ISG+\)](#) program. NOAA’s [Office of Education](#) made a 6-year investment in this program, which enabled aquariums and zoos to test new ways to engage their visitors in ocean conservation and stewardship. Over that time, the ISG+ program provided 18 zoos, aquariums, and botanical gardens with financial resources, technical expertise, and strategic guidance. The program began with an emphasis on finding effective ways to encourage individual conservation actions and ended with a realization about the importance of community partnerships to achieve success and sustainability. The lessons learned from these grants were shared with peers in the Ocean Project’s network of 2,000 zoos, aquariums, and museums.
- ▶ The [B-WET program](#) analyzed their portfolio of funded projects to learn how grantees implement stewardship projects. B-WET has been increasing emphasis on the stewardship components of projects. As a result, applications to B-WET competitions in FY 2017 showed an increase in the percent of applications that include a high quality stewardship component, from 60% of applications received in FY 2016 to 86% in FY 2017.

▼ OBJECTIVE 2.3.  
Formal and informal education organizations establish guidance and provide support toward increasing participation of education audiences in conservation and stewardship activities related to NOAA’s mission.

## FEATURED STORY //

## Stewardship grants help Florida students take action in their community and improve test scores

Rising sea levels and weather-driven storm surge threaten to inundate low-lying coastal communities and ecosystems. This is becoming increasingly problematic for people, property, and the economy. In Florida, unusually high tides and moderate to heavy rains routinely cause coastal flooding, costly disruptions to communities, and public health and water quality challenges. Teacher Chris Simoniello took action with local St. Petersburg K-12 students through a stewardship project funded by the [NOAA Climate Stewards Education Project](#).

Through NOAA Climate Stewards, educators can apply to join the stewardship community and receive funding to support activities that mitigate or adapt to the impacts of climate change. With funding during the 2016–2017 school year, Chris Simoniello led 60 students from Title I schools in 29 hands-on science lessons. Topics included natural and human contributions to global climate change, the role of coastal wetlands in the sequestration of carbon, and assessing vulnerability to inundation by looking at a variety of flood maps and models. The students developed plans for adaptation to rising sea levels and emergency preparedness plans for severe weather. They also learned about a variety of career options during their lessons, including biogeochemist, meteorologist, wetland ecologist, floodplain manager, and water quality manager. Partners included the University of South Florida, Weedon Island Preserve, Tampa Bay Watch, the City of St. Petersburg, Tampa Bay Estuary Program, and the Gulf of Mexico Coastal Ocean Observing System.

While learning the science behind global warming, sea level rise, and storm surge, the students put their knowledge into action. By changing their behaviors related to transportation, food choices, home energy use, and waste management, they reduced the amount of carbon they released into the atmosphere by 0.8 tons. The students also restored habitat at Bay Vista Park in St. Petersburg, Florida, planting 1,350 plugs of *Spartina* in wetlands, within an area of 2,293 square feet. These marsh grasses will sequester up to 35.77 tons of carbon dioxide annually.

In addition to restoring their local environment, the students gained science knowledge. These improvements were measured by pre- and post-testing, which demonstrated increases in knowledge and understanding ranging from 16% to 88%, respectively. In addition, state test scores of the students in the project exceeded the district and state averages, with 74% of the participants passing, whereas the school had a passing rate of less than 50% in the previous two years.

Over the past six years, the NOAA Climate Stewards funded over 125 educators to implement stewardship projects with their audiences. The program reaches well over a thousand teachers annually with professional development opportunities, such as monthly webinars as well as face-to-face and virtual conferences. In FY 2018, the NOAA Climate Stewards Education Project changed its name to the NOAA Planet Stewards Education Project. This change represents the expansion of the program's scope to include a wider range of NOAA topics related to understanding and protecting our environment, such as marine debris, natural resources, and severe weather events.



Students in the Lakewood High School Aquatic Management Systems and Environmental Technology career program help younger students at Bay Point Elementary School plant marsh grass in St. Petersburg, Florida. (Chris Simoniello)

## FEATURED STORY //

## Great Lakes elementary students recycle 68,000 plastic bags, win Pennsylvania Governor's Award

Single-use plastic bags are one of the most common items collected during freshwater and marine cleanups. During the 2016 International Coastal Cleanup, nearly a million plastic bags were collected. As plastic degrades, it affects wildlife health, impairs water quality, and affects shoreline aesthetics. With help from [Pennsylvania Sea Grant](#), students at Iroquois Elementary School in Erie, Pennsylvania, developed a recycling program that put a dent in the plastic bag problem and improved their Lake Erie community.

Iroquois Elementary strives to prepare students for a changing world and promotes responsible citizenship. Teachers encourage students to engage in projects that can affect change in their communities. Iroquois Elementary invited Pennsylvania Sea Grant to speak to students about marine debris and plastics in the environment and specifically, in Lake Erie. At the time, students were looking into environmental topics around which to develop a community-based project. Pennsylvania Sea Grant educators planted the seed, and after researching the consequences of plastic bags in the environment, students in fourth through sixth grade decided to embark on an outreach campaign to improve the recycling and reuse of plastic bags in their community. Pennsylvania Sea Grant supported their efforts by providing resources about plastics and water quality.

Students collected data on plastic bag use by observing and tallying customer use of reusable bags in a local grocery store. They also surveyed school district teachers to determine the percentage of teachers who recycle. Students discovered that the reason for the low rate of recycling plastic bags in their community was that, unlike other recyclables, plastic bags are not collected curbside; they must be taken to specific drop off locations, such as grocery stores.

The students launched a plastic bag recycling program at their school by installing recycling receptacles for plastic bags. The students hosted an assembly for the entire school to introduce the issue and created a competition between classrooms to recycle the most bags, with the winners receiving a pizza and ice cream party.

“The students leading this project made a strong effort to educate their peers and their community about the importance of plastic bag recycling,” said Sarah Skelton, teacher at Iroquois Elementary. “As they educated the students in the school, those students educated their families and neighbors, making this a community effort to recycle plastic bags.” In just two months, the entire school had recycled over 68,000 plastic bags, which were later converted into a park bench by the Trex Company, Inc. As a result, Iroquois Elementary students were awarded the Governor's Award for Environmental Excellence.

“One of the most inspiring aspects of this project is that it was initiated and implemented by a group of fourth- through sixth-grade students,” said Skelton. “They inspired change through education, created awareness, and became a part of the solution.”

**“As they educated the students in the school, those students educated their families and neighbors, making this a community effort to recycle plastic bags.”**  
- Sarah Skelton, Iroquois Elementary School teacher



Iroquois Elementary School students won the Pennsylvania Governor's Award for the recycling program they developed with help from Pennsylvania Sea Grant. (Sarah Skelton, Iroquois Elementary)

## FEATURED STORY //

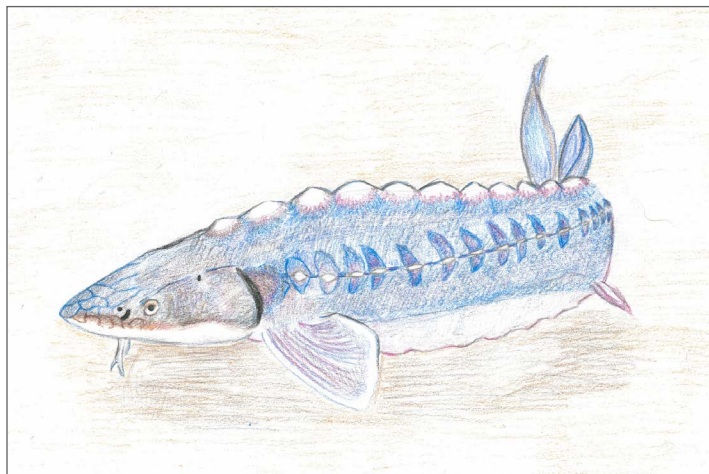
## NOAA Fisheries' Endangered Species Day Art Contest inspires students in its seventh Year

**NOAA Fisheries' Greater Atlantic Fisheries Office** (GARFO) coordinated its sixth annual Marine Endangered Species Art Contest in 2017. Endangered Species Day, always the third Friday in May, highlights plants and animals that face extinction, are endangered, or are at risk of becoming endangered. The annual celebration provides an opportunity for people to learn about endangered and threatened species and what we can do to help them.

GARFO's Marine Endangered Species Art Contest, initiated in 2012, raises awareness of protected marine species, including fish, marine mammals, and sea turtles in the Greater Atlantic area from Maine to Virginia, as well as awareness of the Endangered Species Act itself. Student submissions highlight one or more endangered or threatened, ocean-dwelling species in the Greater Atlantic area. The art projects increase awareness and understanding of these species and the role of NOAA Fisheries in their recovery.

What started as a local contest has expanded nationally and internationally, with an entry from Canada in 2016. In 2017, GARFO received 202 pieces of artwork from 13 schools, including those in the District of Columbia, New Jersey, Texas, and California, as well as one home-school submission. Since 2012, over 1,600 students have participated in the contest. NOAA Fisheries honored this year's winning students at an award ceremony on May 25, 2017, held at NOAA Fisheries' GARFO facilities in Gloucester, Massachusetts.

The contest has succeeded in raising and maintaining awareness about endangered species throughout the Greater Atlantic area. Submitted art is displayed for public viewing throughout the month of May in a gallery at GARFO, and the winning and honorable mention entries each year are featured in an online calendar. The winners' schools receive printed posters of their students' artwork, ensuring continued awareness of endangered species throughout the year. In addition, videos of the awards ceremony and artwork can



be seen on the GARFO website and Facebook page. One parent even asked for a photo of her child's submission so that she could surprise her daughter with a cake featuring the artwork! Continued participation in GARFO's Marine Endangered Species Art Contest will provide more opportunities for youth and adults to understand conservation policies and engage in stewardship actions.

NOAA Fisheries' Marine Endangered Species Art Contest winner, first grade: Turtle, by Maia U.



NOAA Fisheries' Marine Endangered Species Art Contest winner, ninth grade: Shortnose Sturgeon, by Isabel O.

## GOAL 3

# Safety & 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.*



Eric Workman

## OVERVIEW //

NOAA is committed to building a nation that is resilient to environmental hazards. Our agency provides sound environmental science to protect lives and support a strong economy. Hazards come in many forms; therefore, so do the ways we communicate about them. Public awareness is a crucial aspect of safety and preparedness, so education is an important component of any comprehensive resilience effort.

## OBJECTIVES

3.1. Youth and adults from all backgrounds are aware of, prepare for, and appropriately respond to environmental hazards that impact health, safety, and the economy in their communities.

3.2. Formal and informal educators use and produce education materials and programs that integrate and promote consistent science-based messaging on hazards, impacts, and societal challenges related to water, weather, and climate.

3.3. Formal and informal education institutions integrate water, weather, and climate hazard awareness, preparedness, and response information into curricula, exhibits, and programs that create learning opportunities for youth and adults.



## GOAL HIGHLIGHTS //

## Understanding environmental threats and building resilient communities

Our education programs for students and educator professional development opportunities help people understand the underlying science of NOAA's content and resources that keep communities safe from extreme weather and other environmental hazards.

- ▶ The [Bay Watershed Education and Training \(B-WET\)](#) program and the [National Estuarine Research Reserve System](#) supported a K-12 education project entitled "Meaningful Watershed Educational Experience for Resilience to Accelerated Sea Level Rise and Flooding Risk" at the University of Southern Mississippi's Gulf Coast Research Lab Marine Education Center. This project relies on tools typically used by adult decision makers to engage students in authentic problem-solving using real world data related to rising sea level near the Pascagoula River in Mississippi.
- ▶ [California Sea Grant](#), through a partnership with the California Coastal Conservancy, engaged over 650 children and adults in restoration and cleanup of San Diego's network of coastal canyons and seasonal streams. Almost 9,000 pounds of trash and over 13,000 pounds of invasive plants were removed from over 7.6 acres. Approximately 600 new native plants were planted. In total, the work saved the City of San Diego an estimated \$20,822 in clean up and revegetation costs. By clearing the canyons and streams, the local community took action to help improve preparedness and resilience to the threat of stormwater flooding, a hazard that can damage the health and safety of members of their community.

### ▼ OBJECTIVE 3.1

Youth and adults from all backgrounds are aware of, prepare for, and appropriately respond to environmental hazards that impact health, safety, and the economy in their communities.



Third place winners of the Resilience Meaningful Watershed Educational Experience Stewardship Summit present at the Gulf Coast Research Laboratory in Ocean Springs, Mississippi. Dominic Blankenship, Nic Steele, and Tommie Ashford are in Mr. Cooper Kimbrell's Marine Science class at Gautier High School. (Gulf Coast Research Laboratory, University of Southern Mississippi)

- ▶ The [National Weather Service](#) and the National Weather Association (NWA) combined resources to conduct a regional teachers' workshop during the NWA annual meeting in Norfolk, Virginia. An estimated 100 science teachers from Virginia, Maryland, Pennsylvania, North Carolina, and the District of Columbia participated. The agenda included presentations by NOAA scientists, commercial weather companies, and teachers. Ron Gird, National Weather Service Outreach Program Manager, was the keynote speaker kicking off the workshop. A free information and resource package was provided to all the participants, including the American Meteorological Society's text book on weather forecasting.

### ▼ OBJECTIVE 3.2

Formal and informal educators use and produce education materials and programs that integrate and promote consistent science-based messaging on hazards, impacts, and societal challenges related to water, weather, and climate.

## GOAL HIGHLIGHTS //

## Building capacity for weather safety and resilience

It is important to reach everyone who might be impacted by weather and other environmental hazards. To make the most of our resources, NOAA programs coordinate internally and with partners. By sharing lessons learned, developing guidance, and improving communication, we are able to engage stakeholders so they receive and share safety and preparedness information.

- ▶ The [Environmental Literacy Program](#) (ELP) supported 13 projects that use education as a tool for increasing community resilience to extreme weather events and other environmental hazards. Each project integrated resiliency information into their education programs. Furthermore, ELP conducted a webinar and in-person workshop for 60 participants to increase collaboration and build camaraderie among ELP resilience grantees. By sharing information and lessons learned through their projects, grantees can integrate best practices for resilience education projects and solutions to implementation challenges. The funded projects have increased 39 institutions' capacity to integrate community resilience topics into their education programs.
- ▶ The [National Weather Service](#) drafted a field resources guide and a "Best Practices Guide" to support personnel who do education and outreach in Weather Forecast Offices across the country. The National Weather Service conducted two needs assessments across 122 weather forecast offices: the publications survey received 91 responses, and the outreach survey received 85 responses. Based on the results of these surveys, the National Weather Service will develop resources that make it easier for staff to provide consistent and effective education and outreach at the local level.
- ▶ The [National Weather Service](#) strengthened the use of technology and partnerships to reach educational audiences about weather safety and preparedness. National Weather Service headquarters drafted best practices and guides to support field offices across the country. By sharing knowledge and skills across the large network of weather forecast offices, the National Weather Service builds capacity and increases the consistency of its messages. With this increased capacity, more youth and adults will better understand weather science and how to stay safe.
- ▶ Two national estuarine research reserves, [Waquoit Bay](#) in Massachusetts and [Jobos Bay](#) in Puerto Rico, increased their focus on resilience and developed programming that will help their communities stay safe from environmental hazards. One of them was successful in leveraging funding to complete a study to frame an approach to better serve vulnerable populations in their area. By helping reserve educators incorporate resilience education into their programming, more communities will have access to important, local safety information.
- ▶ The [National Weather Service](#) reached over 113 million Twitter users through the #SafePlaceSelfie campaign. The campaign prompted individuals to identify their safe location, to share their ideas with others, and to take a picture of themselves in a location safe from severe weather and other hazards. When more people can readily identify their "safe places" at work, home, school, and other locations, they will be more likely to successfully shelter there, if and when the need arises. The campaign was coordinated for all National Weather Service social media accounts. On its most popular day, the peak activity for this campaign reached over 4.6 million users who collectively saw the posts 30.5 million times.

### OBJECTIVE 3.3

Formal and informal education institutions integrate water, weather, and climate hazard awareness, preparedness, and response information into curricula, exhibits, and programs that create learning opportunities for youth and adults.

## FEATURED STORY //

## Phoenix-area residents learn the science behind resilience to extreme heat and drought

In the southwest United States, drought and heat are commonplace. However, the severity and frequency of both have been increasing, underscoring the need for communities to adapt to these conditions. But how will communities prepare for future extremes? With support from NOAA's [Environmental Literacy Program](#), Arizona State University has been raising awareness and finding solutions through public forums that put community members in the roles of decision makers.

NOAA's Environmental Literacy Program builds on NOAA's understanding of extreme weather and other environmental hazards and helps Arizona's communities and others around the nation build the environmental literacy necessary to become more resilient to the hazards that they face. Arizona State University's [Consortium for Science, Policy and Outcomes](#) (CSPO), one of the program's Environmental Literacy Grant award recipients, created "Science Center Public Forums" around four major environmental hazards: extreme heat, drought, extreme precipitation, and sea level rise. A recent public forum, hosted by the Arizona Science Center, brought a group of Phoenix-area residents together to discuss community resilience strategies to address some of these hazards.

Participants learned about the hazards by using NOAA's products focused on heat and drought. Then, they worked through a variety of scenarios and "role played" as different stakeholders in fictional towns to build understanding of different perspectives that should be considered for possible resilience strategies. "The goal is to create replicable capacities at science museums in cities across the U.S. to help citizens, planners and experts to openly discuss science-informed solutions," explained Mahmud Farooque, Associate Director at the CSPO.

Phoenix's diverse communities were represented by sixty participants, selected from over 300 applicants. At the event's conclusion, participants made recommendations for increasing community resilience to extreme heat and drought. These recommendations will be shared with state and local government officials and other stakeholders. During the forum, participants had the opportunity to hear about their city's resiliency from Mark Hartman, Phoenix's Chief Sustainability Officer, and to share with him their thoughts on Phoenix's plans.

The forum increased participants' understanding and interest in these issues. Pre- and post-forum surveys showed that the number of participants who strongly agreed with the statement, "it is important for my local community to develop and implement a resilience plan," increased from 42% to 84%. Similarly, the percentage of participants who reported that they knew "a lot about the climate-related hazards that could affect their local community" increased from 18% to 65%.

This event exemplifies efforts to build resilience through education that are underway in 13 projects throughout the nation, supported by NOAA's Environmental Literacy Program. To date, these projects have served more than 90 communities in 24 states.



Arizona State University, an Environmental Literacy Program grantee, engages Phoenix, Arizona, residents in a public forum exploring how communities might adapt to extreme heat and drought. (Arizona State University)

## FEATURED STORY //

# Severe weather meteorology simulation puts people in ‘The HotSeat’

## What’s it like to make high pressure warning decisions?

When the National Weather Service issues a tornado warning, people in homes and business may have only minutes to seek shelter. But what goes on behind the scenes during these life-and-death decisions? Now participants can find out for themselves in a simulated severe weather forecast scenario.

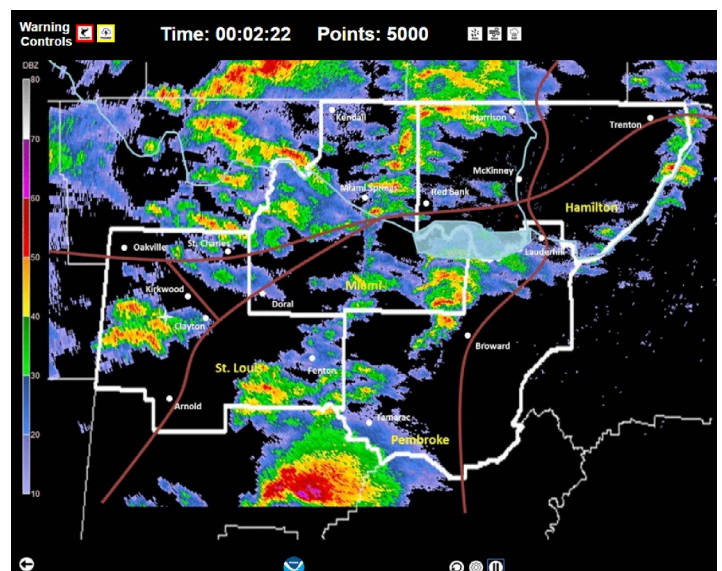
**HotSeat** is a science-based, personal computer simulator that gives the general public, educators, and students an appreciation of the meteorology of severe weather events and the decision-making processes that go into warnings at NOAA’s [National Weather Service](#) offices. The software was originally developed at the Weather Forecast Office in Peachtree City, Georgia, with continued development at NOAA’s National Severe Storms Laboratory. HotSeat uses archived Weather Surveillance Radar (WSR-88D) data, severe weather reports, and pictures of damage caused by actual storms in a displaced, real-time mode to capture the experience of issuing severe weather warnings in the National Weather Service. Upon completion of each event, the participant receives a score indicating his or her success in the simulation. Each simulation runs approximately 20 minutes.

The HotSeat simulator was first shared in 2006 at an American Meteorology Society WeatherFest in Atlanta, Georgia, and has been showcased at numerous other events across the United States. The National Severe Storms Laboratory made the program available online in 2017; since then, more than 1,800 visitors have tried it out. The use of the simulator in classroom settings can complement teachers’ weather units in science and may inspire future scientists. HotSeat can also be used to train emergency managers and other key officials. The National Weather Service hopes that HotSeat participants will become better users of severe weather warnings when they understand the process behind the forecast. Feedback from participants has been overwhelmingly positive. Many cannot believe how stressful the decision-making process is and how much information is presented in such a short period of time. All information has to be processed rapidly to make life-saving decisions!

WeatherFest participants test their skill at issuing severe weather warnings. (Lans Rothfusz, National Severe Storms Laboratory)



HotSeat uses archived Weather Surveillance Radar (WSR-88D) data to simulate a forecast scenario. (NOAA)



## FEATURED STORY //

## Weather-Ready Nation Ambassador Care Model strengthens education

Minnesota is known for harsh winters, filled with snow storms and below-zero temperatures. When the snow melts and the ground thaws, dangerous thunderstorms can bring flooding, hail, and tornadoes. As a result, [National Weather Service](#) (NWS) meteorologists in Minnesota's Twin Cities need all the help they can get in spreading the word about weather safety. To meet this need, the [Twin Cities Weather Forecast Office](#) (WFO) developed a creative way of connecting with their partners through the [Weather-Ready Nation Ambassadors](#) (WRN) initiative. Their approach has been so successful that it is now being replicated in forecast offices across the country.

The NWS works with partner organizations through the Weather-Ready Nation Ambassador initiative. Through this program, organizations like schools, community organizations, government agencies, hospitals, the media, and a wide variety of private businesses get resources from the NWS and play a role in keeping their communities safe. As its ambassador program flourished and expanded, the Twin Cities office saw a growing need to diversify communication and education strategies. Staff in the Twin Cities WFO conducted needs assessments and listened to their ambassadors. The Ambassador Care Model (ACM) emerged out of their desire to enhance WRN Ambassador communication and education, revolutionizing their ability to connect with new ambassadors and strengthen relationships with existing ones.

The ACM outlines how to interact with WRN Ambassadors and is a ground-breaking way to provide service in today's NWS. Instead of communicating about weather hazards on a case-by-case basis, the NWS Twin Cities office now works with WRN Ambassadors year-round to empower them to become champions of weather safety and weather preparedness information. The Twin Cities office opened the line of communication to all their ambassadors, listened to their questions about weather preparedness, and gave them the tools they needed to get their employees, students, or clients weather-ready. Using the tools in the ACM, the Twin Cities WFO provides tool to guide effective life and property decision making. This guidance integrates hazard education with preparation, communication, and real-time weather information.

After implementing their Ambassador Care Model, the Twin Cities office saw a sharp rise in ambassadors sharing NWS safety content on social media and websites. More organizations and private businesses began displaying weather safety posters in their buildings or sharing weather safety information in publications. WFO staff have also been invited to outreach events that the office was unaware of before establishing the ACM.

The Ambassador Care Model has now been distributed to every weather forecast office in the nation, allowing individual WFOs to build long-term relationships with their ambassadors and to provide richer and more integrated community education experiences. With nearly 6,500 ambassadors and over 2,800 new ambassadors enrolled over the last year, the initiative has grown significantly.



Instead of creating a traditional gift basket for their annual holiday auction, these second-graders decided to prepare a weather-ready kit. (Michael Lewis, National Weather Service)

## FEATURED STORY //

## Resilience planners and climate educators put their heads together to keep communities safe

Cities, counties, and states are leading local responses to climate change and extreme weather. The need to act is increasingly urgent; in 2017, the United States experienced [16 separate billion-dollar weather and climate disasters](#). Communities are on the front line in dealing with climate impacts, and this challenge allows them to innovate and experiment with sustainable and resilient living. Currently, 18 states are using resilience and adaptation plans to prepare their communities for future environmental conditions. Additionally, cities and regions all around the country are tackling the same issues at the local level. In 2017, NOAA participated in two meetings that brought educators together with leaders of communities that seek to meet climate goals.

The Climate Education and Opportunities Collective Impact Summit was held in September 2017 in Sundance, Utah. City and county leaders from across the country met with climate change education professionals, including NOAA's [Climate Program Office](#), to explore how education can help communities meet their climate and resilience goals. Representatives from cities that are already experiencing the impacts of a changing climate shared their needs. Climate educators helped connect them to existing resources and best practices gleaned from a decade of climate education initiatives. Together, participants brainstormed about next steps. The community leaders and colleagues from the climate education community explored results from federal and philanthropic initiatives and concluded that these initiatives are key to supporting their communities' climate actions through effective education.

These findings were echoed at a separate workshop that NOAA hosted in September 2017. NOAA's [Office of Education](#) held the [Environmental Literacy Program](#) Resilience Education Grantee Workshop at the Museum of Science in Boston, Massachusetts. These grantees are using education to support community resilience to extreme weather events and other environmental hazards. NOAA supported projects that integrated city- and state-level resilience plans into their education efforts and collaborated with organizations involved in implementing those plans. A panel of city and state planners explained why they need an informed community to support their efforts. With 13 grantees at various stages of implementing their projects and testing different approaches to demonstrating how education can support resilience goals, the workshop provided a venue to explore challenges, opportunities, and best practices for this emerging field. Grantees began to build a community of practice, sharing what they are learning, how they are working with their local city planners, and how they are integrating resilience and climate adaptation plans.

Both workshops paved the way for increased collaboration among NOAA's education partners and grantees to better support cities and states in their resilience efforts. NOAA will continue to foster relationships with and among its partners to strengthen the collaborators' and grantees' work on climate and resilience education. At these workshops, participants concluded that education partnerships can support climate actions in communities while also preparing the new workforce and equipping citizens, professionals, and other influential leaders with the scientific foundation necessary to make informed decisions.

City leaders and climate educators discuss how education can support communities' climate actions over the coming decades at the Climate Education and Opportunities Collective Impact Summit. (Frank Niepold, NOAA)



## GOAL 4

# Future Workforce

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



Tanya Rogers, National Science Foundation Graduate Research Internship Program

## OVERVIEW //

Building and supporting a diverse and skilled future STEM workforce is critical. NOAA relies on a sustainable workforce pipeline that ranges from introducing young students to NOAA careers to preparing graduate students to be successful in the workforce. Stories in this section demonstrate how NOAA programs are inspiring and cultivating the next generation of scientists that resemble our diverse nation.

## OBJECTIVES

- 4.1. Students, particularly from underrepresented groups, consider education and career pathways in disciplines that support NOAA's mission.
- 4.2. NOAA and partner institutions leverage federally funded assets to provide students, particularly those from underrepresented groups, with experiential learning, research, and scholarship opportunities.
- 4.3. Postsecondary students, particularly from underrepresented groups, pursue and complete degrees in disciplines critical to NOAA's mission.
- 4.4. Graduates completing NOAA-supported student opportunities continue education, enter the workforce, and advance in careers that support NOAA's mission.

## GOAL HIGHLIGHTS //

## Providing students with career development opportunities

By providing hands-on learning experiences for students at all levels, NOAA Education aims to inspire the next generation of scientists and experts. Many programs targeted underrepresented groups, including minorities, girls, and students in rural areas. The experiences described below serve as a starting point for engaging youth in planning for future career paths.

- ▶ In partnership with Mahogany Youth Corporation, [Florida Sea Grant](#) enhanced the lives of urban youth through immersive environmental education focused on fishing and marine exploration. Together, they have taken more than 50 high school students out on fishing and camping trips into the Everglades and have had them assist with ongoing science projects, including sea sponge restoration in Biscayne Bay. By working with its partners, Florida Sea Grant provided underrepresented students with experiential learning and research opportunities.

▼ **OBJECTIVE 4.1**  
Students, particularly from underrepresented groups, consider education and career pathways in disciplines that support NOAA's mission.



A commercial fisherman teaches students about salmon fishing in Greater Farallones National Marine Sanctuary. (Vanessa Gayton)

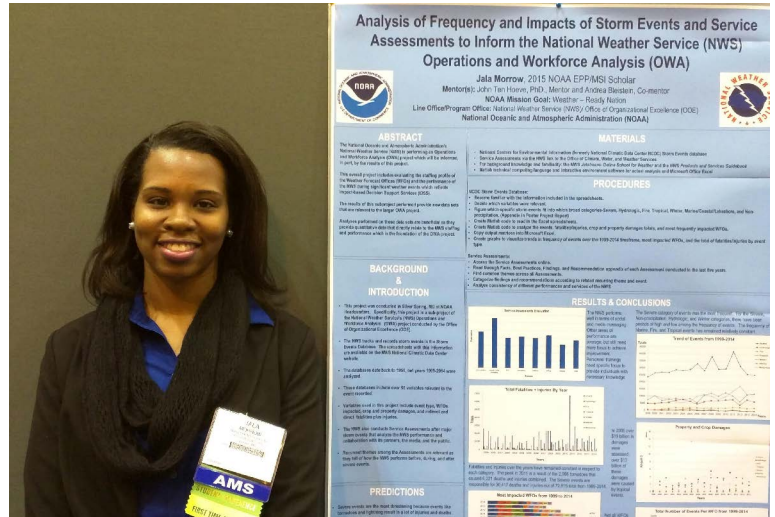
- ▶ [NOAA Fisheries](#) provided five-week high school internships, two-week marine science seminars, and undergraduate internships at its Woods Hole Science Aquarium in Woods Hole, Massachusetts. Summer interns learned about marine animals and their environments, aquarium operations, and careers in marine science and related fields, training to serve as assistant naturalists on public shore-side collecting walks, as well as meeting scientists and touring Woods Hole laboratories. Through this internship program, NOAA Fisheries promotes greater understanding of NOAA-related science, and exposes the Woods Hole Aquarium interns to career pathways in NOAA fields.

▼ **OBJECTIVE 4.2**  
NOAA and partner institutions leverage federally funded assets to provide students, particularly those from underrepresented groups, with experiential learning, research, and scholarship opportunities.



GOAL HIGHLIGHTS //

- ▶ Scientific conferences are excellent opportunities for undergraduate students to present their research, get feedback, learn from experts, and build their professional networks. As part of the [Hollings](#) and [Educational Partnership Program with Minority-Serving Institutions](#) undergraduate scholarship programs, NOAA scholars can apply for funding to present their research at up to two U.S. scientific conferences. This year, a record of 92 NOAA scholars took advantage of this opportunity to give an oral presentation or present a poster on research they conducted during their summer internships with NOAA.
- ▶ NOAA's [Satellite and Information Service](#) supported the international [M.Y.S.P.A.C.E. Program](#) (Multinational Youth Studying Practical Applications of Climatic Events) program. M.Y.S.P.A.C.E. provides opportunities for high school students to complete research projects on environmental issues with the help of NOAA and NASA personnel. Students from two new schools, Moorestown Friends School and Medford Memorial Middle School in New Jersey, participated this year alongside students from China, the United Kingdom, and the United States.



Jaia Morrow, 2015 Educational Partnership Program with Minority-Serving Institutions Undergraduate Scholar, presents her research at the American Meteorological Society conference in New Orleans, Louisiana. (John Baek, NOAA)

GOAL HIGHLIGHTS //

# Increasing diversity through targeted outreach and recruitment

NOAA has committed to increase diversity and inclusion efforts across the agency. Education is no exception. These stories show how our scholarship and career development programs have reached out to students from underrepresented groups.

- ▶ The [Hollings Scholarship Program](#) reached more students underrepresented in NOAA mission fields through targeted outreach. Over the past two years, Hollings used informational webinars, campus visits, and direct contact with key faculty to encourage students from underrepresented groups to apply. The number of diverse qualified applicants increased from 510 applicants in 2015 to 558 in 2017. This year, the Office of Education Scholarship Outreach Team visited seven institutions, five of which were Historically Black Colleges and Universities or Hispanic Serving Institutions.
- ▶ The [Dr. Nancy Foster Scholarship Program](#) targeted minority serving institutions, historically black colleges and universities, and top producers of bachelor's, master's, and doctoral degrees in the marine science and fisheries disciplines for black and Hispanic students to help diversify the applicant pool. A list of 52 institutions was developed in collaboration with recruitment resources from the Educational Partnership Program with Minority-Serving Institutions. Of the 52 institutions that were targeted, 15 had an increased number of applicants in 2017. Examples include an increase of 11 applicants from the University of Washington, 10 from the University of California Santa Barbara, and five from Florida State University. There were also two universities on the list that each had applicants for the first time in two years: the University of South Florida and the University of Alaska.

**OBJECTIVE 4.3**  
Postsecondary students, particularly from underrepresented groups, pursue and complete degrees in disciplines critical to NOAA's mission.

## GOAL HIGHLIGHTS //

## What's next? Understanding the workforce pipeline

Our programs aim to prepare the best and brightest students for future careers in NOAA-related fields. As students transition into the workforce, it is important that we not only continue to provide opportunities that help them develop the skills needed to be competitive, but also track their progression through their academic and workforce careers.

**OBJECTIVE 4.4.**  
Graduates completing NOAA-supported student opportunities continue education, enter the workforce, and advance in careers that support NOAA's mission.

- ▶ The [Educational Partnership Program with Minority-Serving Institutions](#) and the [Hollings Scholarship](#) program worked with an external evaluator, Insight Evaluations, to understand the long-term student impacts of each program. The evaluation surveyed 827 students who received one of the scholarships and 818 non-recipients. The evaluation revealed that the Hollings and Undergraduate Program Scholars are significantly more likely to publish their research, get an advanced degree, and indicate wanting to work at NOAA than did students who did not receive the scholarship. Based on the recommendations for improvement that came out of the evaluation, the Scholarship programs have revised pre- and post-program internship surveys for current scholars and updated the alumni trajectory data collection process.
- ▶ The [National Weather Service](#) (NWS) Warning Coordination Meteorologist network collected data on the number of students who volunteer in NWS field offices. An informal questionnaire was sent out to field personnel, and 52 out of 126 offices responded. All six NWS regions were represented, along with two national centers. During FY 2017, the NWS trained at least 16 high school students, 104 undergraduate students, 10 NOAA Hollings or Educational Partnership Program undergraduate scholars, three Pathways students, 29 graduate students, and one other student, for a total of 163 student volunteers. By gathering this information, the NWS will not only be able to better communicate its reach in training and exposing students to career opportunities, but it also will have more information to help support the weather forecast offices and national centers.

Summer volunteers and National Weather Service meteorologists visit the University of Alabama, Huntsville. (National Weather Service)



## FEATURED STORY //

## NOAA Boulder hosts Tribal Colleges and Universities Science Day

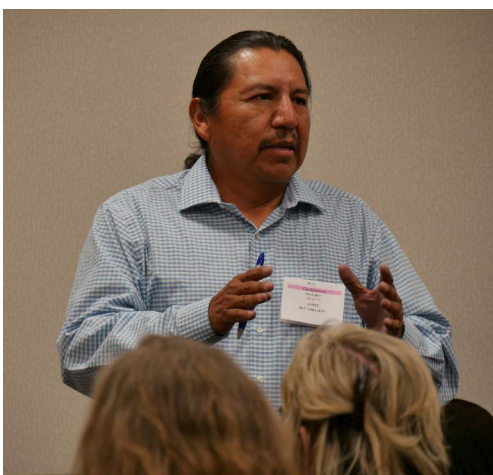
In the cultures and traditions of many indigenous peoples around the world, humans are deeply connected with nature. Because of this intimate relationship, Native groups are recognized as vital stewards of our environment. Tribal Colleges and Universities foster this indigenous knowledge and NOAA is embracing their role as valuable partners in environmental research and management. In addition to serving as a bridge between indigenous knowledge and NOAA science, Tribal Colleges and Universities are resources for achieving a diverse and talented workforce at NOAA.

On September 20, 2017, the [NOAA office in Boulder, Colorado](#), hosted a Tribal Colleges and Universities Science Day in coordination with the 40th American Indian Science and Engineering Society annual conference held in Denver. The event brought together students from six Tribal Colleges and Universities: Fond du Lac in Wisconsin, Haskell in Kansas, Leech Lake in Minnesota, Northwest Indian College in Washington, Nueta Hidatsa Sahnish in North Dakota, and Sinte Gleska in South Dakota.

Students toured the NOAA facility and met with senior scientists to learn about NOAA science relating to extreme weather and the impacts of wildfires on climate. They also learned about student opportunities at NOAA, such as the Educational Partnership Program with Minority-Serving Institutions and NOAA Hollings Scholarship. In turn, NOAA learned about issues that need to be considered when developing long-term plans for recruiting and retaining tribal college students in NOAA careers. The students' barriers include cultural issues, such as leaving their home and community for a 10-week internship, and concerns about how students from lower-income universities might measure up to other applicants.



The NOAA office in Boulder, Colorado hosted a Tribal Colleges and Universities Science Day in coordination with the 40th annual American Indian Science and Engineering Society conference. (NOAA)



Immediate feedback on the whole day was positive. Thayne Yazzie of the Northwest Indian College said, "Thank you so much for the wonderful opportunity to join in the NOAA Tribal Science Day! I had an absolute blast and look forward to future opportunities as well as integrating more students and tribal youth into your programs." Overall, NOAA hosts and their guests from Tribal Colleges and Universities alike came away with knowledge and connections as they joined forces to bring indigenous backgrounds and knowledge to bear on the environmental problems we all share.

James Rattling Leaf speaks at NOAA Tribal College and Universities Science Day in Boulder, Colorado. (NOAA)

## FEATURED STORY //

## NOAA scholars are making waves in the private sector

Over the past 12 years, the [NOAA Hollings](#) and [Educational Partnership Program with Minority-Serving Institutions](#) (EPP/MSI) undergraduate scholarships have supported over 1,300 students studying in STEM fields, social science, and education. The scholarships provide students with two years of financial support and valuable research experiences that may not otherwise be available at the undergraduate level. NOAA scholars spend 10 weeks in their summer internships gaining hands-on research and technological experience at NOAA labs and facilities. Nearly half of the alumni in the workforce are putting their skills to use in the private sector, working as environmental consultants, meteorologists, engineers, hydrologists, and more.

Many NOAA scholarship alumni are using their skills in the environmental consulting industry. Dr. Kersey Sturdivant, a 2005 EPP/MSI undergraduate scholarship alum and professor at Duke University in North Carolina, helped start a small business based on sediment profiling technology he worked on as a graduate student. His company, INSPIRE Environmental, performs rapid marine environmental assessments of the sea floor. He has worked with clients on off-shore wind and energy habitat assessments as well as monitoring the recovery of deep sea habitats after the Deepwater Horizon oil spill.

Kersey said that the mentorship he received during his NOAA scholarship experience was invaluable. Now he mentors students and advises that many science careers offer rewarding work, including opportunities in the private sector. In addition, scholarship alumni have built careers with environmental consulting firms such as AECOM, Closed Loop Advisors, and Environmental Resources Management.

Several NOAA scholarship alumni work as meteorologists in the private sector, including Abby Dyer, an on-air meteorologist for the local NBC/ABC affiliated television station in Missouri, KY3. As a 2009 Hollings Scholar, Abby created a program for Science On a Sphere® entitled, “Vog [smog or haze containing volcanic dust and gases] on the Island of Hawaii,” during her internship at the Imliloa Astronomy Center of Hawaii. She analyzed data from the Mauna Kea Observatory and local weather forecast office and created visuals to represent the data. In addition, she utilized her communication skills to write and record the script. The experience inspired her to pursue a broadcast career.

Today, Abby’s forecast reaches 42 counties in Missouri and Arkansas. Her job is to forecast the weather daily for her viewing area and effectively communicate watches and warnings issued by the region’s National Weather Service forecast offices. Abby mentors an intern every summer, and future meteorologists often shadow her on the job. She tells the students about the opportunities offered by NOAA undergraduate scholarships. Other NOAA scholarship alumni are putting their meteorology skills to work at companies including CNN International, Zurich, Weather Decision Technologies Inc., and Risk Management Solutions.

Both private and public sector organizations play critical roles in providing environmental information. NOAA undergraduate scholars develop transferable skills that set them up for success in any sector.

Dr. Kersey Sturdivant, an EPP/MSI alumnus, conducts an environmental assessment for the Block Island Wind Farm. (Kersey Sturdivant)



Hollings Scholarship alumna Abigail Dyer is a storm team meteorologist with NBC/ABC-affiliated television station KY3 in Missouri. (Abigail Dyer)

## FEATURED STORY //

## NOAA Satellite Conference launches careers for remote sensing experts

From detecting greenhouse gases to tracking harmful algal blooms and even monitoring natural resources, satellite technology allows NOAA to observe changes to Earth's surface and atmosphere. The National Research Council emphasized the importance of highly trained remote sensing technical staff for interpreting and translating these complex data for use by the public and private sectors. If the United States is to remain on the forefront of this technology, it is critical to train our next generation in remote sensing technology.

Conferences provide a unique opportunity for students, novice researchers, experts, and product developers to build relationships, present and learn about new ideas, and solve problems. However, there are a limited number of conferences that focus on remote sensing and even fewer that allow for specialized training for users at all levels on cutting-edge satellite data. The [2017 NOAA Satellite Conference](#) was able to fill this gap. The 2017 Conference focused on the theme, "A New Era of NOAA's Environmental Satellites." It was sponsored by NOAA's [Satellite and Information Service](#) and hosted by the NOAA [Center for Earth System Sciences and Remote Sensing Technologies \(CREST\)](#) at the City College of New York. In keeping with the theme, conference sessions focused on educating students and professionals about the capabilities of NOAA's new satellite systems that will launch or become operational in the near future, including the next-generation geostationary satellites known as the GOES series and JPSS-1, the first of NOAA's new polar-orbiters.

More than 390 participants from 40 countries attended the conference, including 220 students and young professionals. The main conference was held from July 17-20, 2017, preceded by a two-day workshop with more than 90 participants. CREST, in partnership with other institutions across the nation, is funded by NOAA's [Educational Partnership Program with Minority-Serving Institutions](#) and focuses on recruiting and retaining students from underrepresented groups. At the conference, students showcased the results of their collaborative research projects through posters and oral presentations. Organizers held training sessions geared toward students and introductory users on GOES and JPSS. The organizers sponsored a career fair during the conference, where students were able to gain career insights and potential job leads. Students were also matched with NOAA employees to gain one-on-one experience through mock interviews.

The conference engaged students from [NOAA Cooperative Science Centers](#) and City University of New York campuses, a diverse population that includes significant number of students from underrepresented minority communities. This conference provided the students and faculty an out-of-the-classroom educational and professional experience. The use of SLI.do, a tool designed to foster audience interaction, and social media helped conference organizers gain valuable insights and feedback from the participants. Twenty-seven percent of participants found the conference "relevant" to their jobs and 59% found it "very relevant."



Students and young professionals network with renowned scientists and experts from across the globe at the NOAA Satellite Conference. (NOAA)

# Organizational Excellence

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



NOAA

## OVERVIEW //

NOAA has over 12,000 employees and a mission that spans from the surface of the sun to the ocean floor. Like other large organizations, we face the challenge of coordinating and communicating to help everyone stay on the same page. NOAA Education has made progress toward breaking down organizational silos, both within and across programs. The goal of organizational excellence drives us to enhance and measure performance to provide the best service to the public.

## OBJECTIVES

5.1. Leaders internal and external to NOAA recognize and support education investments as a way to achieve agency mandates, mission, and goals.

5.2. The NOAA Education community develops implementation plans and establishes agency education priorities informed by stakeholder needs and national initiatives.

5.3. NOAA educators and partners collaborate at local, regional, and national levels to coordinate efforts, build capacity, and better serve educational audiences.

5.4. NOAA and partner organizations use effective evaluation, performance monitoring, and evidence-based approaches in the design and management of educational programs, products, and services.

5.5. NOAA develops and supports a coordinated portfolio of products, programs, and partnerships that improves education opportunities in NOAA-related content areas for underserved audiences.

## GOAL HIGHLIGHTS //

## Advancing education and professional development for underserved groups

NOAA is committed to extending the reach of its education programs to underserved audiences and breaking down barriers that prevent individuals from underserved groups from advancing their careers. To do so, we rely on dedicated employees to lead the way. We also continue to develop best practices and strategies to engage diverse audiences successfully.

- ▶ The **Diversity and Professional Advancement Working Group** briefed the NOAA Deputy Under-Secretary for Operations and Assistant Administrators and their Deputies from each line office. As a result, each line office named at least one champion who will facilitate and support strategies to better prepare candidates for advancement, connect more effectively with other line offices, and encourage underrepresented groups to pursue leadership positions. These informational briefings garnered support and commitment for the working group's objectives throughout NOAA.

### ▼ OBJECTIVE 5.1

Leaders internal and external to NOAA recognize and support education investments as a way to achieve agency mandates, mission, and goals.



Middle schoolers experiment with changing bathymetry as NOAA's Pete Holmberg talks to them about how bathymetric charts are important to safe marine navigation during the 2017 NOAA Science Camp in Seattle, Washington. NOAA Science Camp, now in its 15th year, is a week-long camp introducing middle school students to earth and ocean sciences through hands-on activities. (Eric Strickler, NOAA)

- ▶ The Education Council **Underserved Audiences Working Group** conducted an inventory of education programs at NOAA that target underserved groups. The working group received survey responses from 44 programs and conducted nine case studies. The working group is currently developing a report to summarize their findings. This information helps articulate how education supports NOAA goals of diversity, inclusion, and reaching audiences from diverse backgrounds, and how these programs can be better supported in NOAA.

### ▼ OBJECTIVE 5.5

NOAA develops and supports a coordinated portfolio of products, programs, and partnerships that improves education opportunities in NOAA-related content areas for underserved audiences.

## GOAL HIGHLIGHTS //

## Increasing coordination and communication across NOAA

Networks provide opportunities for NOAA educators from across the country to work collaboratively on education activities for the greatest impact. Networks engage educators and partners to better communicate and promote NOAA science.

- ▶ The **Internal Professional Development Working Group** developed seven informational webinars to give an overview of NOAA Education. These webinars are easily accessible as a new resource collection on the NOAA Education website. The site was viewed 215 times, each video averaging 30 views, between February and October of 2017. This resource promotes better cross-agency coordination while demonstrating the connection between NOAA Education and the agency mission.
- ▶ The **NOAA Outreach Center** distributed materials and handled outreach requests from educators and the general public. Sharing these materials, along with tips and tricks for using them, encourages people to engage with NOAA. Outreach Center staff responded to 1,169 unique requests through August 2017. Of these, 31% were from formal and informal educators and 17% were from students and researchers. The rest were from NOAA staff and members of the public. NOAA Outreach also supported 11 program events and nine community events and open houses, and it assisted offices across NOAA and at other federal agencies in their efforts to engage with the public.

**OBJECTIVE 5.3.**  
NOAA educators and partners collaborate at local, regional, and national levels to coordinate efforts, build capacity, and better serve educational audiences.

A NOAA employee fields questions during the NOAA Open House in Silver Spring, Maryland. (NOAA)



- ▶ The **Diversity and Professional Advancement Working Group** increased membership from 17 members in 2014 to 36 members in 2017. The working group was initially formed to support federal scientists at NOAA. In FY 2017, the Diversity and Professional Advancement Working Group expanded their membership to include social



## GOAL HIGHLIGHTS //

scientists and clerical and administrative personnel. In addition, the working group developed and approved an official charter along with three supporting committees focusing on recruitment, retention, and advancement.

- ▶ While NOAA Education serves the entire nation, most education happens at state and local levels. The **Regional Collaboration Working Group** has coordinated three regional NOAA educator networks (Chesapeake Bay, Pacific Islands, and Alaska/Pacific Northwest). They identified regional priorities and are working to establish a new network in the Great Lakes. The working group created a self-assessment questionnaire, completed by each of the four pilot networks, and used the results of the questionnaire to document best practices, common strategies, and unique approaches in each network. By connecting NOAA educators and partners on the regional level, each can better meet the unique needs of the people they serve.

- ▶ **NOAA Fisheries** increased communication between Fisheries educators through the Fisheries Education Council, resulting in increased knowledge sharing, collaboration, and coordination. Fisheries educators come together for a consistent monthly engagement to share information about their programs. This meeting also provides the opportunity to update best practices, recruit new education and outreach staff, and coordinate internship opportunities. The council also has developed NOAA Fisheries Education and Opportunities web pages, which improves external communication and makes it easier for students to find programs.



Students participating in the Watsonville Area Teens Conserve Habitats (W.A.T.C.H.) Program try their hands at cast netting at the Elkhorn Slough National Estuarine Research Reserve in California. (California Department of Fish and Wildlife)

## GOAL HIGHLIGHTS //

## Using strategic planning and evaluation to assess progress

NOAA does not conduct random acts of education. Our programs are strategic, evidence-based, and designed to meet the needs of our stakeholders. Through planning and evaluation, we hold ourselves accountable to measure and report the progress we make.

- ▶ The **National Weather Service** refined its education operating plan. This guiding document was established and used in FY 2016. In FY 2017, the National Weather Service updated the plan and sought feedback from the NOAA Education community. An operating plan for FY 2018–2019 will be added to the document. Developing and improving the education operating plan has created greater cohesiveness and direction for the weather education and outreach portfolio.

▼ **OBJECTIVE 5.2.**  
The NOAA Education community develops implementation plans and establishes agency education priorities informed by stakeholder needs and national initiatives.

## GOAL HIGHLIGHTS //

- ▶ Twenty [Sea Grant](#) educators representing 15 state programs attended the annual Sea Grant Educators Network meeting. There, they began the process of updating the network's strategic plan. These efforts will allow Sea Grant educators to better allocate their own resources, coordinate cross-network efforts more efficiently, build capacity, and more effectively serve educational audiences.
- ▶ The [National Estuarine Research Reserve System](#) (NERRS) piloted a Teachers on the Estuary evaluation model with reserve staff across 28 sites to improve consistency and strengthen promotion of the program. The evaluation surveyed program outcomes and helped identify audiences and effective marketing messages. By creating a consistent evaluation tool and developing a standardized template to share metrics, results, and success stories, NERRS education coordinators will be better able to recruit teachers and communicate the success of the program.
- ▶ The [Teacher at Sea](#) (TAS) Program added pre- and post-season survey questions to track the use of NOAA resources by TAS participants. These surveys were implemented online in the TAS program training and database. TAS developed an additional alumni survey in order to collect data 10 months after the teacher returns from sea. The purpose of gathering this data is to find out how alumni use NOAA resources in their classroom or institution after they have returned from sea.
- ▶ The [TAS Program](#) conducted an external evaluation of the TAS Program and Alumni Association. The external evaluator used the "Most Significant Change Technique" to gain insights into the impact the at-sea research experiences and participation in alumni activities had in current and past teachers. TAS drew on the data to create a video of one of the teacher's stories that demonstrates significant change. The results from the external evaluation helped the program identify ways to support Teacher at Sea alumni to better integrate their ship-based research experiences into their curricula and teaching practice.
- ▶ The **Products, Programs, Development, and Delivery Working Group** (P2D2) developed an instructional resources review tool that can be used to determine how well NOAA and NOAA-partner resources fit [three-dimensional learning](#), which includes Next Generation Science Standards. P2D2, in partnership with the Internal Professional Development Working Group, completed a needs assessment with NOAA educators to determine the needs for three-dimensional learning training and offered an introductory webinar and two-day workshop. Through these activities, the NOAA Education community is better able to create products that meet the needs of educators.

▼ OBJECTIVE 5.4. NOAA and partner organizations use effective evaluation, performance monitoring, and evidence-based approaches in the design and management of educational programs, products, and services.



Sea Grant Educators convened at the National Marine Educators Association conference in Charleston, South Carolina. (Lisa Tossey, Delaware Sea Grant)

## FEATURED STORY //

## Promoting conservation and stewardship to diverse audiences through national marine sanctuaries

First-generation and low-income students are at major disadvantages when it comes to experiencing the outdoors and pursuing ocean conservation careers. The [NOAA Office of National Marine Sanctuaries](#) is working to make America's underwater treasures accessible to youth of all backgrounds. These learning opportunities encourage individuals and communities to be involved in stewardship behaviors and decisions that conserve, restore, and protect our underwater parks. They also prepare a diverse range of students for the workforce.

The [Ocean Guardian School Program](#) gives students from disadvantaged backgrounds opportunities to learn about the ocean, marine science careers, and stewardship. Starting in 2016, the program began targeting Title I schools to apply and receive funding by building capacity within the school community. Students learn new skills to implement a local stewardship project, giving them ownership of their community environment. This past school year, there were 35 Ocean Guardian Schools, 12 from low-income areas, reaching 6,689 students.

To reach other diverse communities, NOAA sanctuaries provided diversity and inclusion funding for new programs. Through this funding opportunity, more than 100 different activities targeted underserved audiences, reaching 2,942 K-12 students, teachers, and interested parties in [Monterey Bay](#), [Greater Farallones](#), [Channel Islands](#), and [Stellwagen Bank](#) National Marine Sanctuaries. In Stellwagen Bank National Marine Sanctuary, this funding supported a new program titled "Whale Ambassador—Every Kid in a Park." Stellwagen Bank education staff connected with a Title I school in Boston, Massachusetts, for a three-week program that included a visit by the sanctuary's life-size inflatable whale, a trip to the New England Aquarium, and whale watching in the sanctuary. Staff also collaborated with the Hispanic Access Foundation and worked with the Dominican community in Lawrence, Massachusetts, and a Title I school summer program to raise awareness about the ocean, whales, and NOAA careers, culminating in a whale watch during Latino Conservation Week. Greater Farallones National Marine Sanctuary staff focused on bringing Title I schools in the San Francisco Bay area hands-on ocean science experiences. The programs varied by age and taught topics ranging from good seashore manners to changing ocean chemistry.

In addition, many programs incorporate traditional knowledge. For instance, at the [Moku-papapa Discovery Center](#) located in Hilo, Hawaii, the Navigating Change Program, an education and environmental stewardship program that incorporates traditional knowledge with western science to inspire the next generation of conservation leaders, worked with almost 1,682 Native Hawaiian students.

At the graduate level, the [Dr. Nancy Foster Scholarship Program](#) built connections between underrepresented students and the ocean by recognizing outstanding scholarship and encouraging research, particularly by female and minority students. Recent changes to this scholarship program have helped ensure that underrepresented graduate students with the greatest financial need have a better chance of ranking higher in the application process.

Through these programs, sanctuaries are reaching new audiences and supporting communities from all backgrounds. In FY 2017, the National Marine Sanctuary System reached 22,903 underserved youth.



Fifth graders in San Francisco observe shorebirds and seabirds during their Seabird Scientist field trip to the Greater Farallones National Marine Sanctuary Visitor Center. (Justin Holl, Office of National Marine Sanctuaries)

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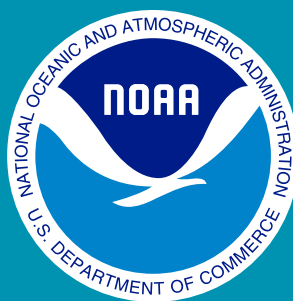
## On the cover

**Top left:** NOAA's Heather Ziel talks to middle schoolers about how NOAA scientists track marine mammals during the 2017 NOAA Science Camp in Seattle, Washington. (Jonathan McIntyre, NOAA Fisheries)

**Top right:** Children from the Hancock County Unit of the Boys and Girls Club conduct water quality testing on Magnolia Bayou, an important coastal stream that flows into the Bay of St. Louis in Mississippi. (Barbara Ambrose, Riverside Technology, Inc., NOAA National Centers for Environmental Information)

**Bottom left:** ReNEW Schaumburg and Sci Tech students dissect squid during a Gulf of Mexico Bay Watershed Education and Training grant-funded project. (Polly Burns)

**Bottom right:** Teacher at Sea participants go on a boat trip during a workshop. (NOAA Teacher at Sea Alumni Association)



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