

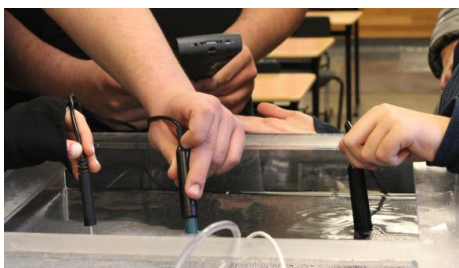


National Oceanic and  
Atmospheric Administration

U.S. Department of Commerce

# NOAA Education Accomplishments Summary

FISCAL YEAR 2016



ADVANCING NOAA'S MISSION THROUGH EDUCATION

## ON THE COVER

**Top left:** Visitors to the Exploratorium in San Francisco, California examine marine life collected from NOAA's pCO<sub>2</sub> buoy. Credit: Lisa Strong/Exploratorium.

**Top right:** Alexandria Barkman, Hollings Intern with NOAA Sanctuaries at Papahānaumokuākea Marine National Monument. Credit: Office of National Marine Sanctuaries.

**Middle left:** NOAA Corps LTJG Joseph Phillips releases an ozone sonde that is attached to a helium balloon. The instrument will rise 18 miles into the atmosphere to measure the thickness of ozone. Credit: Chet Waggoner/NOAA.

**Bottom left:** Students visiting a lab through the NOAA-funded Ecosystem Pen Pals program use probes to measure water chemistry. Credit: EarthEcho International.

**Bottom right:** Teachers learn about the connections between streams and rivers through a hands-on teacher workshop called Rivers to Reef. Credit: Gail Krueger/NOAA Gray's Reef National Marine Sanctuary.

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## LETTER FROM THE DIRECTOR //

### **Partners and friends of NOAA Education:**

On behalf of the NOAA Education community, I'm pleased to present our 2016 Annual Accomplishments Report. Education has an important role to play in advancing NOAA's mission of science, service, and stewardship — and this report shows how we make it happen.

I am proud of what we have accomplished this year. We set ambitious targets, challenging ourselves to deliver core programming and find ways to assess, innovate, and improve on the way we do our work. We are becoming a learning community, striving to advance our programs and performance. I can confidently say that we have made tangible steps toward achieving our strategic plan.

Throughout this report, you will see examples of how education efforts connect NOAA's assets — our people as well as our ships, labs, aircraft, buoys, data, satellites and other tools — with the public we serve. We continue our efforts to diversify our audiences and improve collaboration. These strides would not have been possible without the help of our friends and partners. 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 charged with engaging society to make informed social, economic, and environmental decisions through an understanding of Earth sciences. To achieve this, members of society should understand scientific processes, consider uncertainty, and reason about the ways that human and natural systems interact. Therefore, it is not enough for NOAA to research the ocean and atmosphere; NOAA must also educate so that individuals can use that information to support healthy ecosystems, resilient communities, and robust economies.



Teacher at Sea Rosalind Echols poses with a salmon sculpted out of marine debris in Kodiak, Alaska. (Courtesy of Rosalind Echols)

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. We educate audiences from preschoolers through postgraduates and provide learning opportunities outside of the classroom for people of all ages.

Despite the challenges of geographic distribution and scope, we have worked to build a community of educators within NOAA. The [NOAA Education Council](#), composed of representatives from NOAA education programs, provides a forum for coordinating efforts and developing new ideas. The Council leads the [NOAA Education community](#), which includes NOAA staff, partners, and friends who support education.

In 2015, the NOAA Education community released an update to the [NOAA Education Strategic Plan](#), which takes us through the year 2035. 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 shared focus across a wide range of educational activities.

The NOAA Education Council developed a two-year [implementation plan](#), through fiscal year 2017, which documents concrete steps toward our goals and objectives. We designed the plan to include actions that we undertake to expand and improve our current set of



Fifth grade students in Bayfield, Wisconsin, learn to operate an ROV with Amie Egstad from the Wisconsin Department of Natural Resources. This Lake Superior-focused activity is part of ongoing meaningful watershed education experiences provided by the Bay Watershed Education and Training (B-WET) funded Rivers2Lake education program. (Toben Lafrancois/Bad River Watershed Association)

programs and responsibilities. As a result, it is a document that encourages us to reach outside of our day-to-day operations, driving increased collaboration and challenging us to make progress in measurable ways.

Demonstrating progress toward our Strategic and Implementation Plans helps us ensure accountability and transparency. This report highlights some of our successes in fiscal year 2016; however, it is not a comprehensive catalog of our activities. Education Council members submitted updates on Implementation Plan actions, most of which will continue through fiscal year 2017. Members also provided qualitative data on programs and activities that made notable progress toward our Strategic Plan.

This report itself also constitutes progress, as we continue to improve our communication and outreach. We hope you enjoy reading about our progress and we welcome feedback from our community.



Students from McKinley Technology Middle School in Washington, D.C. learn about fish species of the Potomac River while participating in an instructional boat trip offered by the Chesapeake Bay Foundation and NOAA Fisheries. (Laura Oremland/NOAA)

## INTRODUCTION

# NOAA Education by the numbers

Before we dive into the goals, let us consider the reach of NOAA's education programs:

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

Nearly **450 institutions** increased their educational capacity through NOAA-funded interpretive and educational centers, exhibits, or programs.



Todd Stailey/Tennessee Aquarium



Jennifer Stock/Office of National Marine Sanctuaries

Over **2.6 million youth and adults** participated in NOAA supported informal education programs.

Over **40 million people** visited NOAA Education websites that support a broad spectrum of educational activities and provide critical information to the nation.

Over **440,000 preK-12 students** participated in NOAA supported formal education programs.

Over **23,000 educators** participated in NOAA supported professional development programs.



Jeff Dutrow/Apalachicola National Estuarine Research Reserve



Erik Davenport

Over **3,700 postsecondary students** were trained in NOAA-mission related sciences through NOAA-funded higher education programs.

Nearly **750 postsecondary degrees** in NOAA-related disciplines were awarded to students who were supported by NOAA in higher education programs.

These output measures were collected from the NOAA Education Council member programs as part of the fiscal year 2016 Unified Data Call.

## 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.*



Laura Oremland/NOAA

## OVERVIEW //

NOAA's education programs provide opportunities for students and the public to learn 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 audiences in the millions. 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.



## FEATURED STORY //

## Fourth Grade students engage with NOAA through Every Kid in a Park Initiative

**Eighty percent** of American families live in cities today, creating a disconnect with the natural world. Today's children spend more time on computers and smart phones than exploring nature. This disconnect from nature was the impetus for the White House's **Every Kid in a Park** program, which provides an opportunity for every fourth grade student across the country (approximately four million) to experience federal lands and waters first hand at no cost. This exposure at an early age helps create the next generation of outdoor stewards and users of our nation's lands and waters.

NOAA's **National Marine Sanctuary System** and **National Estuarine Research Reserve System** are part of our natural and cultural heritage. Several offices across NOAA came together to offer hands-on experiences for fourth grade students to introduce them to the vast places NOAA protects, including marine sanctuaries, research reserves, and a fisheries laboratory. The places NOAA manages are already free to visit but by working in partnership with foundations and friends groups such as the National Marine Sanctuaries Foundation and the National Park Foundation for financial support, schools were able to get transportation and even supplies covered for their field trips.

In total over 3,200 fourth grade students were able to experience NOAA programs during 51 events in just one year. Students were out on the water in national marine sanctuaries and national estuarine research reserves, toured labs, went to visitor centers, conducted water quality monitoring, built remotely-operated vehicles, and conducted beach cleanups — all while making connections to these special places NOAA manages.



Students learn about local marine organisms during an Every Kid in a Park visit to Cordell Bank National Marine Sanctuary. (Jennifer Stock/NOAA)

**“Thank you so much for letting Ottawa school come to Thunder Bay [National Marine Sanctuary]. I loved it. I learned so much about the Great Lakes... When I grow up I want to be just like you.”**

**- Every Kid in a Park participant**

Providing experiences like these to fourth grade students helps open the eyes of students who are just beginning to make connections to how the world around them works. As they move forward in their lives they will hopefully take with them an appreciation and understanding of the importance of our nation's public lands and waters. As Russell Callendar, Ph.D., assistant administrator for NOAA's National Ocean Service said, “We are proud to be part of the Every Kid in a Park initiative. NOAA's National Marine Sanctuaries and National Estuarine Research Reserves provide fourth graders and their families the chance to experience the sense of wonder that our ocean, coasts, and Great Lakes bring.”

## FEATURED STORY //

## Partners raise youth voices at COP21 through the Climate Education and Literacy Initiative

In December 2013, the White House Office of Science and Technology Policy launched the [Climate Education and Literacy Initiative](#) to connect American students and citizens with the best-available, science-based information about the challenges and opportunities of climate change. A series of federal and non-federal commitments were announced and numerous roundtable discussions held to discuss how best increase the nation's climate and energy literacy. As the partners considered the value of reaching youth directly, NOAA and the others realized that through collaboration they could have a greater collective impact.



Two students had the unique opportunity to represent the youth voice at the U.S. Center in the opening side event and an Association of Science-Technology Centers (ASTC) and Unverscience interactive video conference to engage young leaders around the world. (@ecoworksdetroit on Twitter)

Youth join forces to support climate action. (Courtesy of Connect4Climate)

The NOAA [Climate Program Office's](#) Communication and Education Program and a network of partners engaged youth worldwide around the historic 21st Conference of Parties (COP21) global climate talks in Paris and beyond. Federal agencies and external organizations in the United States committed to work to enhance youth engagement, forming the [#Youth4Climate – Road to COP21](#) campaign through coordinating youth and education efforts.

Prior to the Paris conference, The Wild Center, a nature museum, the Association of Science Technology Centers, CommEd, and others worked to promote a Youth Climate Summit model across the country, inspiring summits in Detroit, Vermont, Seattle, and Finland. The summits engaged students in climate literacy through dialogue and action planning.

The campaign used the hashtag [#Youth4Climate](#) to coordinate events, activities, and related educational efforts — many of which fulfill Climate Education and Literacy Initiative commitments — up to and during the climate negotiations at COP21 in Paris in December 2015. This initiative reached 33 million social media impressions during the conference, making it the largest youth focused social media presence at COP21. The [#Youth4Climate](#) partnership continues and focused again on the COP22 in Marrakesh, Morocco in November 2016.



## 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.*



Courtesy of Angela Huntemer-Sidrane

### OVERVIEW //

Promoting awareness of conservation issues and stewardship actions is an important way to share NOAA's mission with students and the public. Our education programs offer opportunities to participate in habitat restoration, everyday behaviors, and policy changes that help improve natural resource management. We are making progress by getting better at 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.

## FEATURED STORY //

## Mississippi students convince their community to permit permeable paving to protect their watershed

The Rotten Bayou Watershed encompasses 22,446 acres and lies in Harrison and Hancock counties in Mississippi. Rotten Bayou is a tributary of St. Louis Bay that has been identified as having impaired water quality. As a result, the State of Mississippi and partners worked to implement a Nutrient Reduction Strategy for Rotten Bayou Watershed. The Gulf Coast Community Design Studio, an outreach program of Mississippi State University's College of Architecture, funded through a [Gulf of Mexico Bay Watershed Education and Training \(B-WET\)](#) grant, designed an education program to support the reduction initiative. The fifth grade students of East Hancock Elementary School in Mississippi not only learned about the impact of development on the health of their local Rotten Bayou watershed and coastal ecosystem, but also took action.

Students learned that solid surface parking lots have the potential to increase the amount of polluted runoff that enters the watershed, which has a deleterious effect on the water quality and plants and animals living in the watershed. Through watershed experiments and hands on-learning activities, students gained an understanding of the value of healthy watersheds and learned about solutions, such as permeable paving, to decreasing harmful runoff. When students considered how this information could be used to improve their natural surroundings, they found that the community's laws did not allow for permits to be given to construct permeable paving systems, or parking lots. Permeable paving is made of sustainable materials that allow stormwater to move through the parking lot surface, filtering the pollutants out and reducing polluted runoff that enters the watershed, thereby improving water quality. In response, students provided presentations to the City Council documenting their watershed investigations and the proposed solutions to improving water quality and watershed health.



Staff from the Gulf Coast Community Design Studio, an outreach program of Mississippi State University's College of Architecture, show a map of the Rotten Bayou watershed as context for their meaningful watershed educational experience. (Barbara Ambrose/NOAA)



Following the presentation, posters summarizing the students' work remained on display in the City Hall for others to learn about the situation. As a result of the students' work, a zoning amendment to allow permeable paving systems in commercial parking areas in the community passed at a City Council meeting. This will allow future permeable parking areas to be constructed and may result in improved watershed health.

A middle school student participating in a meaningful watershed educational experience along the banks of the Rotten Bayou, Mississippi looks for invertebrates in his net sample. Invertebrates are an indication of water quality health. (Barbara Ambrose/NOAA)

## FEATURED STORY //

## Sapelo Island National Estuarine Research Reserve expands the Seeds to Shoreline program to Georgia

Georgia's salt marshes serve a valuable role in the coastal ecosystem by acting as a filter for upland and sea borne contaminants and as a buffer from storms. Saltmarshes generate millions of dollars for the local economy, both as a nursery for commercially and recreationally valuable fish and as a scenic draw for tourism. The [National Estuarine Research Reserves](#) in North Carolina, South Carolina, and Florida offer the Seeds to Shoreline program, in which students propagate *Spartina alterniflora* — the dominant plant species in the saltmarsh. The program provides a hands-on educational approach to saltmarsh stewardship and an understanding of the scientific method. In 2016, this successful program was expanded to Georgia's [Sapelo Island National Estuarine Research Reserve](#).

Middle school and high school students were permitted to harvest *Spartina* seeds from the salt marsh, germinate them in their schools, grow them out in greenhouses and plant the *Spartina* in marsh die-back areas, human disturbed areas, and living shoreline sites. Teachers from ten coastal middle and high schools were trained and given supplies to conduct this program. Students from these schools were allowed to harvest *Spartina* seeds from the marsh in the fall and store them in refrigerators throughout the winter. In the spring the students transplanted their germinated seeds into grow out containers. Students were given lectures and relevant scientific papers on *Spartina* and encouraged to stratify their storage and grow out procedures. In the spring, these students were taken to sites approved by the Georgia Department of Natural Resources and allowed to plant the seedlings into the marsh. These sites were then monitored by the students and growth data were collected.

A total of 226 students were engaged through this program. Successful plant propagation was highly variable during this pilot year, but all teachers and students who participated in this program rated it as very helpful in introducing science principles into the classroom and allowing students to stratify experimental treatments in a real world scenario. Robert Hodgen, a science teacher at Richmond Hill High School, commented, "In our standardized test driven culture, there are very few opportunities for students to participate in real-world scientific activities that are meaningful and that provide tangible benefits for the stakeholders in our community. Seeds to Shoreline provides students with opportunities to participate in activities that they might otherwise only read about or see in a video clip. Most students don't develop a passion for environmental stewardship through reading or through media clips alone. They develop passion through doing."

Students venture into the Sapelo Island National Estuarine Reserve through the Seeds to Shoreline program. (Sapelo Island National Estuarine Research Reserve)



**“Most students don’t develop a passion for environmental stewardship through reading or through media clips alone. They develop passion through doing.”**

**- Robert Hodgen,  
science teacher,  
Richmond Hill High  
School**

## FEATURED STORY //

## Climate Stewards bring stewardship projects to classrooms

NOAA's [Climate Stewards Education Project](#) was created to increase educators' understanding of climate science and to reach youth as the beginning of a long-term strategy to make communities more resilient to climate change impacts. Educators can participate in an online community that provides webinars with experts and educational resources. Recognizing that knowledge is best synthesized through real world problem solving, Climate Stewards also includes a stewardship project component funded through a competitive application process. Educators in the program learn climate science, communication strategies, and science teaching techniques as the basis for developing and implementing locally relevant stewardship projects with their students and communities.



Bagging the bad guys – students remove invasive plants to prepare an area for planting native plants in Hawaii. (Courtesy of Angela Huntmer-Sidrane)

For example, in Hawaii, sea level rise and increased storm action from climate change will force animals and plants in coastal wetland habitats to move inland to survive. On the North Shore of Oahu, erosion and invasive plants make habitat inhospitable and are threatening nesting sites for migratory birds like the Laysan albatross. Elementary educator Angela Huntmer-Sidrane received funding from the Climate Stewards Education Project for two school years to restore habitat on Kahuku Point. During the project, 45 third graders removed 110 square meters of invasive plants, planted 800 grass starters, and 500 native plants — including endangered species grown from seed specifically for the project. They also removed 110 kilos (243 pounds) of trash and marine debris. The second year of the project will target 600 square meters of habitat, involving past and current third graders, 100 fourth graders, and 200 10th and 12th grade students from local high schools. By the end of the year, each student will have spent at least 12 hours restoring Kahuku Point.

Since the program began, over 400 educators have joined the NOAA Climate Stewards stewardship community and engaged thousands of students and community members in their stewardship projects. In 2016, 21 educators received stewardship project funding from Climate Stewards, reaching nearly 5,500 students to mitigate or adapt to climate change.

## 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.*



### OVERVIEW //

NOAA is committed to building a nation that is resilient to environmental hazards. Our agency provides sound environmental science to help guide choices that protect lives and property and support a strong economy. Public awareness is a crucial aspect of national safety and preparedness. Resilience to environmental hazards also depends upon coordination. Therefore, NOAA's education programs cultivate relationships with many partner organizations that help connect NOAA's science to actions that keep communities safe.

### 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.

## FEATURED STORY //

## Environmental Literacy Grantee offers free “PreparAthon” to help build resilience through education

Resilience is an issue of great concern for the state of Virginia. According to NOAA’s State of the Coast, 82 percent of Virginia’s shores are at “high” or “very high” risk for vulnerability to sea level rise, placing Virginia’s coasts just behind those of North Carolina and Florida. Climate change and resulting changes to weather patterns put the entire state at risk for damage caused by more frequent incidents of high winds, tidal flooding, rainfall flooding, severe storms, and drought. NOAA’s new resilience education grants help Virginia’s communities and others around our nation build the environmental literacy necessary for resilience to extreme weather events and environmental changes. The Science Museum of Virginia, one of the eleven [Environmental Literacy Grant](#) award recipients from the 2015–2016 cohort, held its first major public event as part of its “Learn, Prepare, Act — Resilient Citizens Make Resilient Communities” grant-funded project. The “PreparAthon” was offered in August 2016 and had a tremendous response from the community.

Nearly 3,000 attendees, many first-time museum visitors, took advantage of this free event and learned about Virginia’s particular vulnerabilities to climate-related threats from severe storms, flooding, and rising seas and how they can prepare for them. Disaster preparedness workshops and preparedness kits were provided to 200 families and later, additional kits were provided to those on a wait list. Workshops providing the knowledge and materials to build rain barrels were sold out. Attendees filled the seats of the theater to listen to NOAA’s Bill Sammler from the local weather forecast office, and local broadcast meteorologist, Andrew Freiden, who discussed the weather hazards facing Virginia and what actions to take when one is forecast. NOAA’s Science On a Sphere® was used as a platform to present global datasets on climate change and changes occurring in the ocean, such as sea level rise. Emergency managers from 29 local, state, and federal organizations were on site with equipment and vehicles providing opportunities for the public to talk with local firefighters, city planners, and non-profit organizations involved in preparedness and resilience.

Because this free event reached a large number of people, many of whom do not typically visit the museum, additional “PreparAthon” events will be offered annually during the 3-year grant project, which involves a range of offerings by the science museum, all reinforcing the message of why resilience is important to Virginians. This event exemplifies the similar efforts to build resilience through education that are underway in projects throughout the nation supported by NOAA’s [Environmental Literacy Program](#). Since the program began offering grants for resilience, the response has been the largest in the program’s 10-year history. In 2016, 170 applications, requesting more than \$77 million, were submitted from 40 states, the District of Columbia, and 3 U.S. Territories. The magnitude of this response highlights the need to build a long-term foundation for resilience through education.

The Science Museum of Virginia’s Preparathon featured local NBC broadcast meteorologist, Andrew Freiden, who engaged the audience by testing their knowledge of local weather hazards. (Chris Rand/Science Museum of Virginia)



The Science Museum of Virginia’s Preparathon engaged attendees with hands-on activities such as this “Challenge lab” in which families tested water filtration methods. (Chris Rand/Science Museum of Virginia)



## FEATURED STORY //

## USC Sea Grant engages citizen scientists to track urban tides

Sea level rise in Southern California is expected to match global projections with an increase of 5–24 inches by 2050. Evidence of these new risks can be visualized through images of current flooding and erosion due to winter storms and high tides. This information enables community leaders and local governments to set priorities as they plan strategies that will help the region adapt to the future impacts of sea level rise. Water levels can be determined from photos, and in this way images also provide critical information for scientists to help ground truth and calibrate scientific models used to project future sea level rise and identify vulnerable locations along the coast. These models are critical tools communities use to aid in adaptation planning.

To help fill this need for data, [University of Southern California \(USC\) Sea Grant](#) launched the Urban Tides Community Science Initiative in 2015. Urban Tides is a community based science effort to photo-document current tidal lines, beach erosion, and coastal flooding in Southern California. USC Sea Grant built partnerships with more than 25 non-formal education centers, scientists, schools, nonprofit organizations, and local municipalities in Southern California to engage communities in this effort. Urban Tides engages citizen scientists across the region to submit photos from local beaches and wetlands. Urban Tides is also a unique way to engage communities in meaningful science, increase ocean and climate literacy, and effectively invite more voices into the discussion of how we can adapt to rising seas.



USC Sea Grant has developed Urban Tides from the concept stage to implementation. The initiative has designated a series of beach and wetland locations where scientists need data. To make the data collection process efficient and reliable, Urban Tides established photo-taking protocols and developed a mobile app and database that lets users upload images, GPS location, and other observations with just a few clicks. USC Sea Grant has led seven beach walks and trainings bringing together scientists, community members and government leaders. So far, the program has engaged more than 100 citizen scientists, gathered more than 300 photo records, and effectively increased data gathering capacity for several researchers in the region. Visualizing risks through images of current flooding and erosion helps community members and local governments to set priorities as they plan strategies that will help the region adapt to the future impacts of sea level rise.

Urban Tides is a community-based science effort launched in 2015 to document current tidal lines, beach erosion, and coastal flooding. (USC Sea Grant)

## FEATURED STORY //

## Hurricane awareness tour reaches new audiences

Hurricanes threaten the U.S. coast every year, but decades may pass before a tropical storm makes landfall in any given region. To help maintain awareness of this persistent yet widespread hazard, NOAA's [National Weather Service](#) and the [U.S. Air Force](#) conduct the annual Hurricane Awareness Tour, an outreach event that has been 30 years in the making. The tour allows Weather Forecast Offices to engage with local partners, including emergency managers, airports, schools, and media. This year, the Hurricane Awareness Tour reached new audiences by adding an inland stop and webinar to their annual event.

Each of the five stops along this year's Hurricane Awareness Tour hosted hundreds of school children. Frank Revitte, Weather Forecast Office New Orleans Warning Coordination Meteorologist, summed it up: "It would be hard to beat a field trip for the targeted school aged group where they can not only tour hurricane hunter aircraft and related displays, but also have the opportunity to talk and interact with the on-board personnel who fly and navigate the planes and vessels; and of course the opportunity to interact with local NWS and National Hurricane Center meteorologists."

For the first time, the Hurricane Awareness Tour made an inland stop in San Antonio, Texas to highlight the inland threats from tropical storms. Inland flooding continues to play a significant role in fatalities and dangers associated with landfalling tropical weather systems; even if a storm is not classified as a hurricane, it can still produce copious amounts of rain. Residents along the Southeast U.S. Coast do not necessarily realize the risks they face from an inland tropical storm. During this stop, the San Antonio Weather Forecast Office partnered with FLASH (Federal Alliance for Safer Homes) to help push the #HurricaneStrong message.

For students not located along the coast or at one of the Hurricane Awareness Tour stops, the National Hurricane Center partnered with the University of Rhode Island to offer a live webinar for school kids across the country. The webinar was conducted from the Galveston, Texas stop since this was the location of the deadliest U.S. hurricane, which occurred in 1900. More than 500 classes and 9,000 students participated.

Students attend the 2016 Hurricane Awareness Tour, where they got to meet with National Weather Service personnel and tour Hurricane Hunter aircraft. (Frank Revitte/NOAA)

On the recent Hurricane Awareness Tour, several stops drew tens of thousands of residents in locations that have not experienced a landfalling hurricane in recent years. The Hurricane Awareness Tour provided an opportunity to learn about hazards, meet emergency managers, and gather information from local National Weather Service personnel. Events like these help to educate the public and enhance awareness of the mission and operations of NOAA with respect to hurricane forecasting and warning operations.



## GOAL 4

# Future Workforce

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



National Weather Service

### OVERVIEW //

Building and supporting a diverse and skilled future STEM workforce is critical to NOAA's mission. NOAA relies on a sustainable workforce pipeline that ranges from introducing young students to NOAA careers to transitional programs that prepare graduates to be successful in the workforce. Stories in this section exemplify how NOAA programs are inspiring and cultivating the next generation of scientists that resembles 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.

## FEATURED STORY //

## Latino high school students receive training for green careers

The Pájaro Valley region in California faces many challenges, including high local poverty rates and low academic achievement. As a result, many local high school graduates would be entering low-paying service sector or farm worker jobs. However, the local green job market is growing and will need more workers. To address both this need and opportunity, the newly created Green Careers Institute, funded by a grant from the [California Bay Watershed Education and Training \(B-WET\)](#) program, works primarily with Latino teens from low-income families in the Pájaro Valley to provide training in environmental careers.

The goal of the Green Careers Institute is for teens to be exposed to a wide range of green careers, to become stewards of the environment, to understand the impact of climate change and other environmental challenges facing the community, to learn skills in green careers, and to develop networks with local green career professionals. Twelve teens participated in a four-week, paid, intensive summer job training program. They shadowed and assisted professionals in the day-to-day operations of a wide range of green careers: water quality management, marine and wetland conservation, sustainable agriculture, and restoration ecology.

Pre- and post-internship surveys showed that at the end of the program 90% of the students were able to list and describe five green careers, 75% were able to name three or more facts they learned about the different green careers they experienced throughout the month, 100% spent more time in nature, and 90% said they think about the environment in their daily personal decision making. The vast majority of interns felt the program changed their lives in exposing them to many previously unknown careers and university study paths.



“This program changed my life”, said Gonzalo, one of the interns who went through the Green Careers program and graduated high school. Gonzalo was hired shortly after the program ended at the Lonely Mountain Farm, where he is surrounded by a supportive team who are encouraging him to choose college and a career path. A second intern, Evelyn, is now working as an environmental mentor to younger students and is planning on becoming an environmental educator. Evelyn’s post survey said “This program had a great impact on my life because I got to learn and see many things. It also helped me to view animals and plants different because in the end it all matters.”



Gonzalo, one of the graduated interns, works on Lonely Mountain Farm, a job he secured after the Green Careers program ended. (Watsonville Wetlands Watch)

Geneva, a Green Careers intern, takes water quality measurements to assess the health of Watsonville slough. (Watsonville Wetlands Watch)

## FEATURED STORY //

## Finding NEMO in Washington, D.C.

### NOAA and partners work together to inspire the next generation of ocean scientists in the nation's capital

The demographic makeup of the United States is changing, but minorities continue to be underrepresented in sciences — including the ocean sciences. Helping to bridge this gap, a small NOAA program called **NEMO** (NOAA Enrichment in Marine Sciences and Oceanography) brings together NOAA scientists, teachers, and local partners to provide students in Washington, D.C.'s diverse, inner-city public schools (DCPS) with mentors and unique opportunities to learn about the ocean sciences.

The program began as a one-year effort in 2007 to help DCPS field its first-ever team in the [National Ocean Sciences Bowl Program](#), a national academic competition for high school students in the ocean sciences. Nearly 10 years later, NEMO has reached several hundred students from 10 DCPS schools, and 18 DCPS teams have participated in the National Ocean Sciences Bowl.

NEMO consists of after-school activity sessions led by teachers and field trips coordinated by NOAA and its partners. In fiscal year 2016, students from McKinley Technology Middle School participated in several programs as part of NEMO, including a boat trip to study the Potomac River ecosystem with the Chesapeake Bay Foundation, squid dissections with the National Aquarium in Baltimore, Maryland, building miniature buoys with the NOAA Chesapeake Bay Program Office, and explorations of the Smithsonian Ocean Hall along with a tour of the NOAA Fisheries National Systematics Laboratory.

Participating students have also brushed elbows with leaders in the ocean science community, discussing ocean health and fisheries with NOAA Fisheries Chief Science Advisor Dr. Richard Merrick, touring the U.S. Naval Observatory with former Oceanographer and Navigator of the Navy, Rear Admiral David Gove, and meeting with Dr. Don Walsh, who co-piloted the only manned descent to the deepest part of the ocean, Challenger Deep.

The program depends on close partnerships with teachers, local organizations, scientists who serve as mentors, and NOAA staff. Program evaluation data show students experience many “firsts” through NEMO, such as being on a boat or studying physiology through dissection. NEMO also sparked students’ interest to further explore marine science, college studies, and STEM careers.

Zaire Garrett, one of NEMO's first participants from 2007, recently graduated with a degree in landscape architecture from the University of Rhode Island, and reflected on his NEMO experience. “If they [students] haven’t decided on a career, [NEMO] opens up a lot of ideas for what you might want to do in your life and is a really great start.”



Students from McKinley Technology Middle School take water samples from the Potomac River to assess river health while participating in an instructional boat trip offered by the Chesapeake Bay Foundation and NOAA Fisheries. (Laura Oremland/NOAA)

## FEATURED STORY //

## National Weather Service leverages the Pathways Internship Program to expand NOAA's workforce

The [National Weather Service](#) (NWS) is dedicated to building a Weather-Ready Nation by providing accurate and timely weather forecasts and warnings. NWS meteorologists must be able to quickly analyze weather data and provide critical information that can help save lives and property during extreme weather events. The NWS has over 600 vacancies and the number of jobs in atmospheric sciences is anticipated grow by at least ten percent between 2012–2022. As society becomes more vulnerable to extreme weather events, we need to cultivate a workforce pipeline that is highly capable of carrying out the NWS's role in protecting lives and property. The NWS is taking steps to address this need by providing transitional training opportunities that can lead directly to employment.

**“Entry-level positions within the field of meteorology are very competitive, and the National Weather Service was a dream career for me in college. The Pathways program gave me the experience necessary to achieve my short-term career goals.”**

- Connor Dennhardt, NWS El Paso, University of Nebraska

The Pathways Internship Program was created to provide opportunities for students and recent graduates to gain valuable work experience. In 2015, the NWS created and filled over 60 Pathways Internship positions. These students were placed in Weather Forecast Offices (WFOs) across the nation and will be eligible for federal employee conversion at the end of the internship. As interns, these students worked side-by-side with forecast meteorologists and gained real-world skills. Connor Dennhardt, a 2015 Pathways Intern, was able to become certified in upper-air observations and aided senior forecasters in monitoring weather in real time. Lauren Visin, also a 2015 Pathways Intern, was able to gain valuable experience in local terrain and hydrology, flash flood warning and response, and river flood warning and response during a major flooding event in Greenville, South Carolina.

**“Pathways ... allowed me to learn NWS policies and procedures, local meteorology, and operational responsibilities before converting to an Intern position, which I believe has given me an advantage in being able to independently perform Intern responsibilities.”**

- Lauren Visin, WFO Greenville-Spartanburg, Florida State University

In 2016, the NWS converted 22 of the 2015 Pathways Interns to Meteorologist Interns. A Meteorologist Intern is a permanent, career ladder position in the NWS. The 22 interns are working in WFOs across the country. Tatiana Gonzalez, a former Pathways Intern, worked at the Meteorological Development Laboratory where she played a critical role in improving the forecast efficiency of the Probabilistic Storm Surge model. Tatiana, now a federal employee for the NWS, explains, “Without the help of this program I would had never realized how much I enjoy working with models. But more importantly, I would had never been able to expand my network and have a job offer as soon as I defended my dissertation.” Now in the program's second year, the NWS currently has 25 Pathways Interns on board and is planning to bring on more fiscal year 2017.



Connor Dennhardt, a 2015 NWS Pathways Intern, poses in front of the Weather Forecast Office in El Paso, Texas. (National Weather Service)



Lauren Visin was a 2015 Pathways Intern in the Greenville-Spartanburg Weather Forecast Office in South Carolina. (National Weather Service)

## FEATURED STORY //

## Four Educational Partnership Program alumni selected as Knauss Marine Policy Fellows

NOAA's higher education programs have bolstered efforts to conduct collaborative outreach to help students, particularly those from underrepresented groups, successfully navigate the pipeline into NOAA and STEM careers. In fiscal year 2016, four [Educational Partnership Program with Minority Serving Institutions](#) (EPP/MSI) alumni were selected as [Sea Grant Knauss Marine Policy Fellows](#). The Knauss Marine Policy Fellowship is a unique opportunity for highly qualified graduate students interested in marine, coastal, and Great Lakes policy to spend a year in Washington, D.C., working at an executive agency or on Capitol Hill. The selection of these students recognizes their outstanding academic and research achievements, as well as the strong support and resources provided by the EPP/MSI institutions. As Knauss Fellows, these students are currently applying their scientific expertise to inform policy decisions affecting the nation's natural resources.

Last year, Efeturi Oghenekaro completed her doctorate at the University of Maryland Eastern Shore, the lead institution of the NOAA Living Marine Resources Cooperative Science Center (LMRCSC). She studied the mesozooplankton dynamics of Maryland coastal bays. Efeturi is currently a Knauss Fellow in the Office of International Affairs for NOAA Research. Efeturi said this fellowship will be instrumental in helping her gain a working knowledge of how environmental policies are written and implemented at the highest levels of government.

Symone Johnson is currently working on her master's degree at Delaware State University, part of the NOAA Environmental Cooperative Science Center. She is developing a conservation plan for sand tiger sharks in Delaware Bay. Symone was also an EPP/MSI Undergraduate Scholar while earning her bachelor's degree in Marine and Environmental Science at Hampton University. Her fellowship placement is in the NOAA Office of Education.

Larry Redd, Jr., earned his master's degree at Hampton University, part of the NOAA LMRCSC, where he completed a research project with implications for sustainable aquaculture. "It means quite a lot to be selected for the Knauss Fellowship," said Redd, Jr., "the Marine Science field lacks diversity. Hopefully I can be an example to other students that if you put in the work and trust yourself that you can make an impact." Larry was placed with NOAA Fisheries in the Highly Migratory Species Division.

As an undergraduate student, Jhoset Burgos-Rodriguez participated in a Research Experience for Undergraduates Program at the University of Maryland Eastern Shore through NOAA LMRCSC. Jhoset is currently finishing his law degree at the University of Puerto Rico. Through his Knauss Fellowship and law degree, Jhoset aspires to be an effective link between science and the policy-making process and dedicate his career to public service. Jhoset is currently a Fellow in the Department of Interior Office of Insular Affairs.



Educational Partnership Program alumni (left to right) Jhoset Burgos-Rodriguez, Larry Redd, Jr., Efeturi Oghenekaro, and Symone Johnson were supported by NOAA in their graduate or undergraduate careers. They returned to NOAA as Knauss Marine Policy Fellows, taking an important step down the NOAA career pipeline. (Brooke Carney/Sea Grant)

**“Hopefully I can be an example to other students that if you put in the work and trust yourself that you can make an impact.”**  
- Larry Redd, Jr., 2016 Knauss Marine Policy Fellow

## GOAL 5

# Organizational Excellence

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



NOAA

## OVERVIEW //

The NOAA Education Community is dedicated to continually improving our efforts to reach the goals set out in our strategic plan. The goal of organizational excellence drives us to enhance performance, provide the best service and resources to the public, and create avenues for the NOAA Education community to showcase their work. By integrating partnerships, evaluation, and professional development, we are able to uphold our commitment to provide quality education opportunities and expand our reach.

## 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.



## FEATURED STORY //

## Teacher at Sea alumni find creative ways to keep bringing the sea home to students

### Alumni Association maintains connection to NOAA and amplifies program benefits

NOAA's [Teacher at Sea Program](#) provides unique hands-on ocean research experiences for educators, and many participants have described their experiences as life-changing. However, the true demonstration of the program's value comes in the months and years after teachers sail with NOAA, as they work to find creative ways to share what they've gained with their students, schools, local communities, and the general public.



The Teacher at Sea Program's Alumni Association exists to track and support these outreach efforts, thereby amplifying the program's benefits. In fiscal year 2016, alumni participated in 35 events tied to their experiences at sea, including presentations, workshops, conferences, field trips, and other outreach opportunities. A total of 62 alumni volunteered or gave presentations about their experience at 8 local, regional, and national conferences. Other program alumni collaborated with as many as 30 NOAA scientists via field trips and classroom visits. These collective efforts reached thousands of students and members of the community.

Teacher at Sea Sue Zupko poses with the shipment containing the drifter buoy her class adopted in 2014. (Courtesy of Sue Zupko)

One standout example of this continued Teacher at Sea alumni-NOAA partnership comes from Huntsville, Alabama. Teacher Sue Zupko, inspired by her at-sea experiences in 2011 and 2014, launched an annual ocean-themed festival for students and families at her school. On April 15, 2016, Ms. Zupko hosted the second annual Seven Seas Celebration at Weatherly Heights Elementary. More than 200 students and parents attended the marine science and math activity night. Participants made nautical flags, weighed and measured fish that they created, followed the drifter buoy that was launched during Ms. Zupko's 2014 research cruise, and played ocean-themed games. Students collected Pokémon-inspired marine life cards at each station.

With support from the program, NOAA Corps Lieutenant (LT) Jonathan Heesch traveled to Huntsville for the event and taught students about the importance of ship safety. LT Heesch brought water survival suits for the students to try wearing, and they had fun racing to see who could don their suit the fastest. "Ultimately, through the process of having fun, the kids received an understanding of the dangers posed by being at sea and a solid exposure to the possibility of a career at sea," said LT Heesch.

By maintaining strong relationships with our program alumni, we are able to see the lasting benefits to the educators, their students, and their school communities.

NOAA Corps LT Jonathan Heesch stands with a Seven Seas Celebration participant wearing a water survival suit. LT Heesch traveled to the Huntsville, Alabama, event to teach students and parents about ship safety. (Sue Zupko)

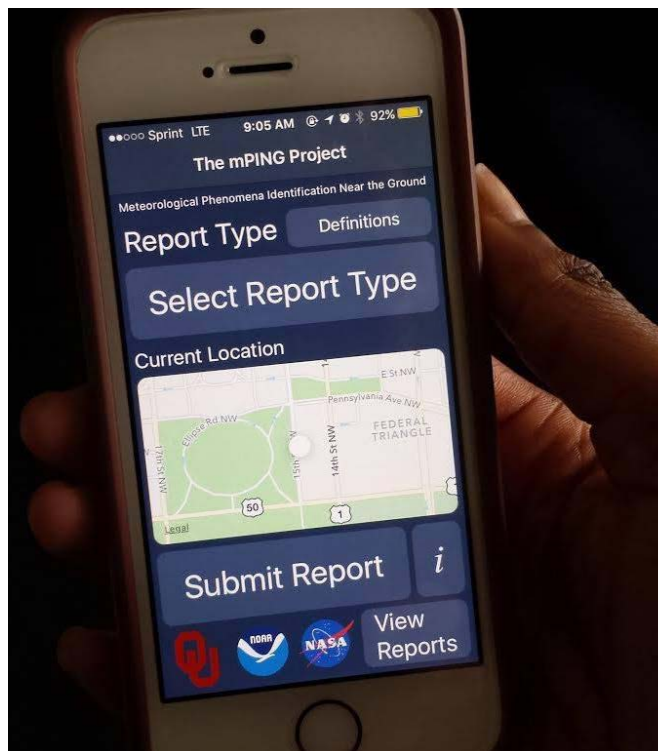


## FEATURED STORY //

## NOAA collaborates with White House and partners to advance citizen science and crowdsourcing

The rapidly growing field of citizen science offers opportunities for government to better partner with the public to address real-world challenges. John Holdren, Assistant to the President for Science and Technology, issued a memo entitled Addressing Societal and Scientific Challenges through Citizen Science and Crowdsourcing to detail a plan for taking advantage of these opportunities. Released on September 30th, 2015, the memo states that citizen science projects can provide hands-on STEM learning and increase STEM literacy, enhance scientific research, and address societal needs. It outlines principles federal agencies should apply to ensure future use of citizen science and crowdsourcing in a way that is appropriate and leads to greatest value and impact. It calls for improved coordination of and support for citizen science and crowdsourcing within and between agencies.

To address this call, NOAA worked through the Federal Community of Practice for Crowdsourcing and Citizen Science in partnership with the White House Office of Science and Technology Policy to assist with the creation and launch of [CitizenScience.Gov](http://CitizenScience.Gov). This government-wide website is designed to accelerate the use of crowdsourcing and citizen science across government agencies and aid in coordination of government-wide efforts. Launched in April 2016, it serves as a one-stop hub to access resources, including a toolkit for starting and supporting projects, a catalog of projects, the home for the federal community, and a blog that tells citizen science stories.



The NOAA National Severe Storms Laboratory is collecting citizen science weather reports through the Meteorological Phenomena Identification Near the Ground, “mPING,” app. This is one of the 40 projects NOAA contributed to the federal catalog of citizen science projects on CitizenScience.gov. (June Teisan/NOAA)

This work resulted in increased awareness of and interest in federal citizen science initiatives. [CitizenScience.Gov](http://CitizenScience.Gov) has had over 25,000 visits to date. Following the launch of the site, the recruitment rate for the [Federal Community of Practice for Crowdsourcing and Citizen Science](http://FederalCommunityofPracticeforCrowdsourcingandCitizenScience) more than doubled with the community growing to 322 members representing 60 federal organizations. NOAA submitted 40 of the 306 projects currently in the catalog. [CitSci.org](http://CitSci.org), the largest database of citizen science projects in the world, has partnered to expand the reach of the catalog. Ten posts telling the stories of NOAA projects made on to [CitizenScience.Gov's blog](http://CitizenScience.Gov'sblog). Many of these stories were also posted on [NOAA's Education and Outreach Facebook page](http://NOAA'sEducationandOutreachFacebookpage), where they had an average reach of over 2,000 people.

# ACKNOWLEDGMENTS

## NOAA Education Council

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

### Council Chair

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### Council Vice Chair

Christos Michalopoulos

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

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### National Marine Fisheries Service (NMFS)

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### Office of Education – K-12 and Informal Education

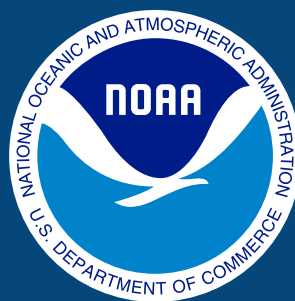
Christos Michalopoulos, Sarah Schoedinger

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## Image contributors

We would like to thank the many people who contributed images for this document. These images represent a sampling of the many activities, audiences, and settings in the current educational programming of NOAA and its partners.



[WWW.NOAA.GOV/EDUCATION](http://WWW.NOAA.GOV/EDUCATION)