



NEWSWAVE

NEWS FROM THE U.S. DEPARTMENT OF THE INTERIOR: OCEAN, GREAT LAKES AND COASTS

NEWSWAVE—Winner of NAGC's 2015 Blue Pencil Award

Summer 2016



Director, Abigail Ross Hopper, and Danish Ambassador, Lars Gert Lose, sign an MOU to recognize their countries' common interests in developing offshore wind as a clean and sustainable energy source at the Embassy of Denmark in the United States on May 4, 2016. Photo credit: Stephen Boutwell, BOEM

Sharing International Knowledge and Expertise About Wind Energy

By Connie Gillette (BOEM)

The United States and Denmark have signed a Memorandum of Understanding (MOU) to strengthen cooperation on offshore wind energy projects. Together on May 4, 2016, at the Embassy of Denmark in Washington, D.C., Danish Ambassador, Lars Gert Lose, and Bureau of Ocean Energy Management (BOEM) Director, Abigail Ross Hopper, signed an MOU to recognize their countries' common interests in developing offshore wind as a clean and sustainable energy source.

"This is an historic event for our respective countries as we work together to share knowledge, experiences, data and best practices relevant to offshore wind energy development," said Director Hopper.

See BOEM MOU page 3

State of the Birds Report 2016—Urgent Need for Conservation Action

By Samantha Spiece (DOI)

On May 18, 2016, the Trilateral Committee for Wildlife and Ecosystem Conservation and Management (Trilateral Committee) announced the release of the trilateral State of North America's Birds 2016 report. More than one-third of North American birds urgently need conservation action.

The report identified oceanic birds as the group of highest conservation concern, slightly over forest and subtropical birds. More than one-half of species from oceans and tropical forests are on the report's "Watch List" because of small and declining populations, small ranges and severe threats to their habitats.



An adult bald eagle cares for new chicks in the Channel Islands. Photo credit: NPS

The bald eagle's recovery in California is a spectacular conservation-through-management success story. In the mid-1950s, breeding pairs were eliminated in the Channel Islands because of hazardous substances like Polychlorinated biphenyls (PCBs) and the pesticide known as DDT. Funding provided through the Montrose Settlements Restoration Program supported the introduction of juvenile bald eagles back to the Channel Islands between 2002 and 2006.

In 2006, the first successful bald eagle nest was discovered on the Channel Islands in more than 50 years, and since that time, the recovering bald eagle population has continued to grow. The 2016 breeding season had a total of 17 pairs nested across five of the islands: one on Anacapa, six on Santa Cruz, two on Santa Rosa, seven on Santa Catalina, and one on San Clemente, CA.

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If you have any questions, comments or want to receive NEWSWAVE by email, contact: Ann Tihansky: tihansky@usgs.gov

For more information, contact:

Liza Johnson, Ocean, Great Lakes and Coasts Coordinator
Office of Policy Analysis,
1849 C Street, NW, Mail Stop 3530
Washington, D.C. 20240
Telephone: 202-208-1378
liza_m_johnson@ios.doi.gov



Illustration credit: Cole Goco



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These masked boobies on Tern Island are completely dependent on large predator fish of the ocean that drive smaller prey fish near the surface bringing them within the birds' underwater diving range. They are accompanied by a black-footed albatross, both common seabirds that nest within the Hawaiian Islands National Wildlife Refuge, part of Papahānāumokuākea Marine National Monument. Photo credit: Alex Wegmann, USFWS

NEWSWAVE is a quarterly newsletter from the Department of the Interior featuring ocean, Great Lakes, and coastal activities across the Bureaus.

Visit us online: <http://www.doi.gov/pmb/ocean/newswave>

Editor: Ann Tihansky (USGS)

Technical Editor: Rebekah Davis (USGS); **Layout:** Jeannette Foltz (USGS)

Contributors:

Samantha Spiece (DOI)
Erica Wales (DOI)
Janet Johnson (BLM)
Bob Wick (BLM)
Connie Gillette (BOEM)
Stephen Boutwell (BOEM)
Tiffany Gray (BSEE)
Ted Gostomski (NPS)
Elizabeth Rogers (NPS)
Alexandria Warneke (NPS)
Ed Bailey (USFWS)
Chris Darnell (USFWS)
David Eisenhauer (USFWS)
Annie Little (USFWS)
Meagan Racey (USFWS)
Debra Reynolds (USFWS)
Caleb Spiegel (USFWS)
Bill Thompson (USFWS)
Alex Wegmann (USFWS)
Linda Welch (USFWS)
Jeff Williams (USFWS)
Hannah Hamilton (USGS)
Andrea Miehl (USGS)

Josh Miller (USGS)
Barry Rosen (USGS)
Michael Ready (Cabrillo National Monument Artist-in-Residence)
Jason Rogalski (Cabrillo National Monument Artist-in-Residence)
U.S. Environmental Protection Agency
Burger Boat Company
Environmental Law Institute (ELI)
Dan Roby (Oregon State University)
San Diego Refugee Tutoring Program (SDRT)
Esther Kennedy (Sitka Tribe of Alaska)
Chris Whitehead (Sitka Tribe of Alaska)
Dr. Charles Flagg (Stony Brook University)
Bethany Goodrich (Sustainable Southeast Partnership)
Cole Goco (Illustrator)
Keenan Adams (Photographer)
Jim Fenton (Photographer)
Gregory Gard (Photographer)
Lynn Schmid (Photographer)
Kai Schumann (Photographer)

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"This MOU represents an exciting milestone toward a achieving a clean energy future," said Ambassador Lose. "Denmark has been using offshore wind power as an energy resource for 25 years and I am delighted that we—by sharing our knowledge and experience—can help promote renewable energy in the world's largest economy."

The agreement will help promote the sharing of knowledge, best practices and policy initiatives; the identification and discussion of financial and risk management challenges; as well as the sharing of best practices, regulatory approaches and scientific models with regard to protecting the environment.

The MOU outlined the following topics as high priority areas for cooperation:

- Promoting information sharing, best practices and policy initiatives to support development and regulation of offshore wind energy resources.
- Working to identify and discuss challenges associated with financing

and risk management for offshore wind energy facilities.

- Identifying opportunities for the sharing of best practices, regulatory approaches and scientific models with regard to protection of the environment, including, but not limited to, the effects of offshore wind energy facilities on marine mammals, migratory birds and cultural resources.
- Facilitating technical knowledge transfer related to electrical interconnection and grid integration of electricity generated from offshore wind energy facilities.
- Knowledge sharing on a wide range of offshore wind energy issues, including supply chain, offtake, grid integration/interconnection, system planning to optimize offshore wind energy deployment, data on the benefits of offshore wind energy and strategies for achieving cost reductions.

Read the original press release: <http://www.boem.gov/note05132016/>

Read the MOU: <http://www.boem.gov/BOEM-Denmark-MOU/>



BOEM Director, Abigail Ross Hopper (fourth from left), along with members of her staff and representatives from the Danish Government toured offshore wind projects in Denmark. Photo credit: BOEM

State of the Birds continued from page 1

The trilateral State of North America's Birds 2016 report is available here: http://www.stateofthebirds.org/2016/wp-content/uploads/2016/05/SotB_16-04-26-ENGLISH-BEST.pdf

The North American Bird Conservation Initiative (NABCI) has recognized that the conservation model used by the North American wetlands and waterfowl conservation community works. The success of this habitat conservation model has helped support consistently rising populations of waterfowl by creating synergies between continental policy and funding (North American Wetlands Conservation Act), coordinated science across species' ranges (North American Waterfowl Management Plan), and the delivery of habitat conservation on the ground by local groups (regional conservation partnerships called Joint Ventures). Nonprofit conservation groups played a pivotal role in this model by harnessing the energy of waterfowl enthusiasts, funneling their philanthropy and their constituent voices toward directed policy objectives and fueling conservation mechanisms through matching funds.

At the recent Trilateral Committee meeting, Annie Little, U.S. Fish and Wildlife Service (USFWS) biologist with the National Resource Damage Assessment and Restoration program, highlighted an ongoing bilateral partnership aimed at restoring seabirds on seven islands off the coast of Baja California, Mexico. This collaboration consists of partners from Grupo de Ecología y Conservación de Islas (GECI), Montrose Settlements and S.S. Jacob Luckenbach Trustee Councils, National Audubon Society, Cornell Lab of Ornithology, Friends of the Mexican Fund for the Conservation of Nature and National Fish and Wildlife Foundation. This five-year project is

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State of the Birds continued from page 3

targeting restoration of nine seabird species through social attraction, disturbance reduction, protection of nesting habitat, nonnative vegetation removal, deployment of nest boxes, education and outreach, prevention of invasive species and monitoring. See related story, page 6.

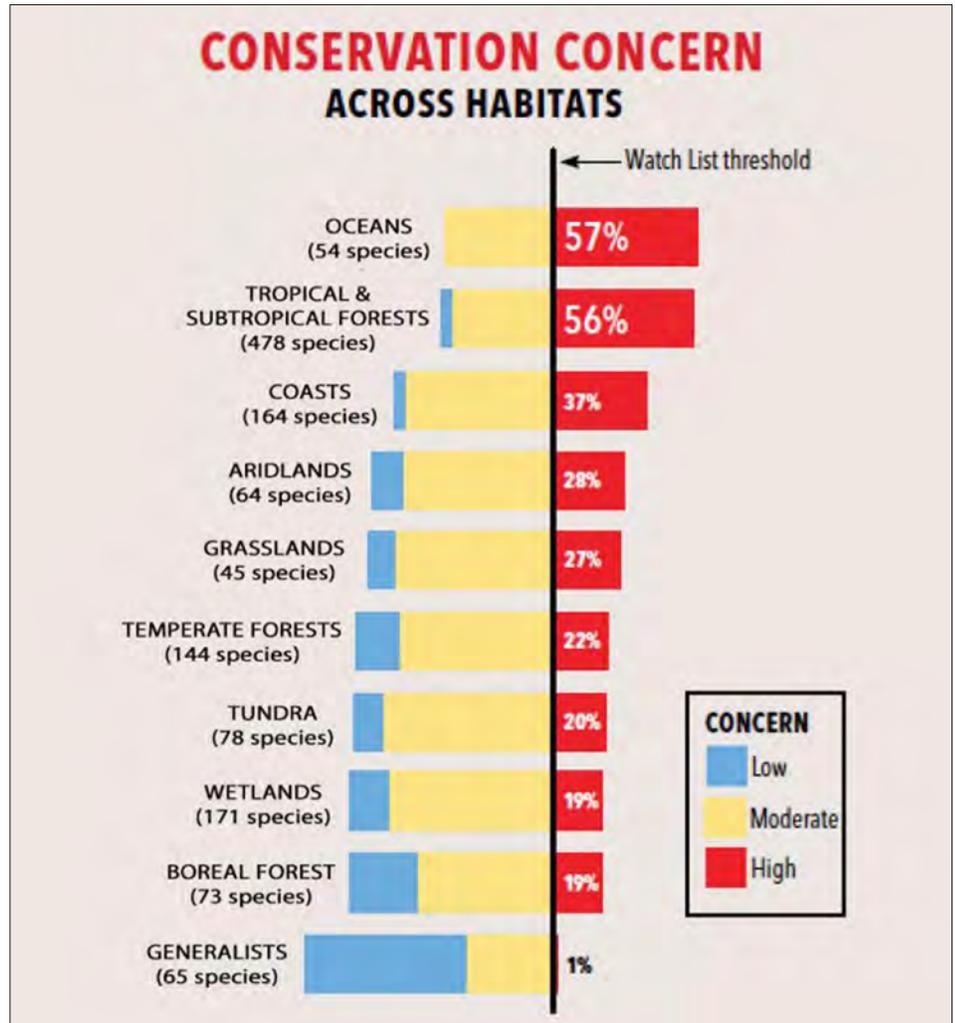
The successful work of Little (USFWS), trustees and partners with restoring bird on islands was highlighted several times at the Trilateral Committee meeting, particularly in light of the sobering news for oceanic birds in the State of the Birds Report.

This bilateral seabird restoration project is part of an overall collaborative effort in North America to conserve and restore island ecosystems. In 2014, a Letter of Intent (LOI) was signed between Canada, the United States, and Mexico. The purpose of the LOI is to promote collaboration on the conservation and restoration of island ecosystems and their adjacent coastal and marine environments. This includes islands in the Pacific, Atlantic and Arctic Oceans, Gulf of California, Gulf of Mexico and Caribbean Sea.

The islands of North America are recognized for their exceptionally high levels of biodiversity. Unfortunately, biodiversity on islands is declining at an alarming rate; approximately 80 percent of known species extinctions occurred on islands. Islands are vulnerable to threats such as climate change, invasive species, human disturbance, habitat loss, marine pollution and unsustainable practices.

The Trilateral Island Initiative is focusing efforts on invasive species, biosecurity, restoration, local communities and climate change.

For more information on the Trilateral Island Initiative and LOI, please visit: http://trilat.org/index.php?option=com_content&view=article&id=1568&Itemid=209



The analysis of all 1,154 bird species in Canada, the United States, and Mexico identified 432 species that meet the criteria for the State of North America's Birds "Watch List." Species were assigned to one breeding habitat, except for oceans and coasts (where species were also included if they occurred anytime during the year) and wetlands (where species were included in both wetlands and their terrestrial breeding habitat). Species that commonly occur in many different habitat types were classified as generalists. Image credit: State of North America's Birds 2016 report.

What Can You Do?

The decisions we make in our everyday lives can make a difference for birds.

As birders: Birding can be more than a hobby. It can be an act that contributes meaningful data for conservation. We can make our bird sightings work for science by logging lists into citizen-science databases, such as eBird: <http://ebird.org/>

As citizens: We can elect representatives who recognize that healthy environments are good for birds, people and the economy, and support the foundational concepts of science-based legislation and conservation.

As consumers: Each grocery trip is an opportunity to support bird habitat in the tropics (bird-friendly coffee), grasslands (grass-fed beef), the boreal forest (certified sustainable paper products), reduce plastic use for seabirds (plastic bags, straws) and at sea (certified sustainable seafood).

Read more from the State of North America's Birds 2016 report: <http://www.stateofthebirds.org/>

Offshore Technology Challenge for High School Students

By Tiffany Gray (BSEE)

In March 2016, a team of eight students from West Side High School in Houston, TX, emerged victorious from the first High School Offshore and Technology Stars Challenge, which was co-hosted by the Bureau of Safety and Environmental Enforcement (BSEE) and Ocean Energy Safety Institute (OESI) at the University of Houston. Other participating schools included Energy Institute High School, Charles H. Milby High School and Young Women's Preparatory Academy.

The event hosted 120 local high school students to push innovative technology and promote careers in science and engineering. During the challenge, the students collaborated within their teams to design and build an energy harvesting circuit based on National Aeronautics and Space Administration (NASA)-developed piezoelectric technology that generates an electrical charge when it vibrates or bends. The circuits are used to charge battery packs for remote control helicopters. The idea is that some of these designs could inform projects that could be scaled

up to harvest ocean energy as clean power for offshore oil facilities. The students used the circuits to charge the batteries of remote-controlled helicopters and flew them back and forth across the University of Houston's TDECU Stadium football field to simulate travel to and from an offshore platform. Each team accumulated points for course completion and the distance their helicopters flew in an eight-minute period.

“Experts have projected that there will be a workforce need of one million

additional science, math and engineering graduates by 2022,” said BSEE Director, Brian Salerno, as he welcomed the young competitors to the Technology Challenge, “This is very exciting for you as you get ready to graduate—the U.S. needs you to help meet the needs of our nation.”

Read more: <http://www.bsee.gov/BSEE-Newsroom/Press-Releases/2016/Top-Prize-at-Offshore-Technology-Challenge-Awarded-to-West-Side-High-School-Students/>



The victorious West Side High School from Houston, TX, poses with their prize money from the first High School Offshore and Technology Stars Challenge. Photo credit: Tiffany Gray, BSEE



A student team concentrates on their work. Photo credit: Tiffany Gray, BSEE



The teams prepare to fly their helicopters through the competition course. Photo credit: Tiffany Gray, BSEE

Connecting Landscapes for Shorebird Survival—The Atlantic Flyway Shorebird Initiative

By Debra Reynolds (USFWS)

Every year Atlantic Flyway shorebirds breed on the Canadian Arctic tundra and spend winter along the eastern shores of South America. These long-distance journeys include stopping at a number of critical migratory sites along the east coast of the United States so the birds can eat and rest. Along the way, these shorebirds face many threats, and several of these migratory species face serious population declines. Hunting, predators, human disturbance, habitat loss and change, and climate change threaten these birds' survival. These threats have become more diverse and widespread in recent decades and pose serious conservation challenges. Although the threats may vary, each migratory stopover site plays a critical role in shorebird survival. *See related story, page 1.*

Recent conservation gains show that we can reverse these population declines across the flyway; however, effective conservation will require an internationally coordinated and collaborative approach to identify and reduce threats throughout the



The Whimbrel (*Numenius phaeopus*) is a true long distance migrant, breeding in the Arctic and migrating to South America. The species experienced sharp declines beginning in the late 19th century because of hunting, habitat loss and other human pressures. Photo credit: Lynn Schmid

flyway. This approach must coordinate research, conservation and management efforts of many groups across multiple political boundaries.

The development of the Atlantic Flyway Shorebird Initiative identifies and addresses major threats and detailed steps needed to reverse steep shorebird declines. The Initiative culminated in a multi-year effort involving multiple partners along the entire Atlantic Flyway—from Alaska to Argentina—to address declines

in shorebirds and grew to embrace a full-lifecycle Atlantic Flyway Shorebird Conservation Business Plan that was published in February 2015. This document represents the full suite of strategies and actions needed to conserve 15 Atlantic Flyway shorebirds. By working together and heeding the call to action, there is hope for our shorebirds.

Read about the Initiative: <http://atlanticflywayshorebirds.org/>

The Atlantic Flyway

The Atlantic Flyway describes the path that migratory shorebirds follow as they cross thousands of miles each year from the Canadian Arctic tundra to the windswept beaches of Tierra del Fuego in the southern hemisphere. Shorebirds breeding in Alaska and Canada make this amazing journey to spend their nonbreeding period in South American or Caribbean countries.

Migratory birds know no boundaries. To make the Atlantic Flyway Shorebird Initiative truly hemispheric, engaging partners in the Caribbean and South America is imperative. Some partners include the American Bird Conservancy, Canadian Wildlife Service, and Caribbean Coastal Area Management Foundation.

Read more: <http://atlanticflywayshorebirds.org/>



Atlantic Marine Bird Cooperative—Bringing Partners Together to Support Seabirds

By Caleb Spiegel (USFWS)

Seabirds are key indicators of functional marine ecosystems. Worldwide, seabirds face greater threats from human-related activities than most other bird taxa, experiencing substantial declines during recent decades. In the northwest Atlantic (Canada to the Caribbean), primary threats include competition for food resources with fisheries, bycatch in fishing gear, displacement and mortality associated with offshore energy development, pollution and degradation of nesting habitat. The magnitude of these issues requires collaboration among many stakeholders across broad geographic areas and international boundaries.

Since it formed in 2005, the Atlantic Marine Bird Cooperative (AMBC) has brought together a diverse international partnership of agencies,

non-governmental organizations and academic institutions to identify, prioritize and better understand the most pressing conservation needs for marine birds in the Northwest (NW) Atlantic, and develop actions to address them. The AMBC is a World Seabird Union Member Organization that contributes regional knowledge to seabird work worldwide. Group accomplishments include the NW Atlantic Seabird Catalog, a comprehensive data repository of northwest Atlantic marine bird surveys since 1938; the Business Plan for Addressing and Reducing Bycatch in Atlantic Fisheries, leading to projects aimed at reducing bycatch mortality (with industry participation); and tracking, surveying and distribution modelling research that directly informs offshore energy development. *See related story, page 9.*

Upcoming Meeting

The group will meet September 21–22, 2016, in New Bern, NC, at the 40th Waterbird Society Conference.



The Great Shearwater (*Puffinus gravis*) is a pelagic seabird endemic to the Atlantic Basin. They breed on only a handful of islands off of southern South America. During the non-breeding season, Great Shearwaters disperse north to North Atlantic waters where they are commonly found off of the U.S. Atlantic coast. Though numerous, the limited breeding range of the species makes it vulnerable. Shearwaters often forage in flocks and commonly feed around fishing boats. Photo credit: Bill Thompson, USFWS

Conservationists, researchers and managers with an interest in NW Atlantic marine birds are invited to participate.

For more information, contact Caleb Spiegel at: caleb_spiegel@fws.gov



The Piping Plover (*Charadrius melodus*) is along the Atlantic and Gulf coasts, as well as inland in the northern Great Plains. All populations are considered endangered or threatened, facing threats from human activities such as beach disturbance and habitat loss. Photo credit: Jim Fenton



The American Oystercatcher (*Haematopus palliatus*), seen here with a chick, has a brightly colored bill that is used to feed on bivalves (oysters, clams and mussels) as its name implies. The American Oystercatcher Business Plan has helped reverse declines in the species (https://www.manomet.org/sites/default/files/publications_and_tools/NFWF_AMOY_BusinessPlan.pdf). Photo credit: Gregory Gard



In North America, the Snowy Plover (*Charadrius nivosus*) is restricted to the Gulf and Pacific coasts of the United States and scattered inland localities from Saskatchewan to California and Texas. Plover nests, eggs and chicks are so well camouflaged that they are often crushed accidentally by people and vehicles. Photo credit: Lynn Schmid

Seabird Restoration Baja—Exciting Steps Toward Seabird Recovery

By Samatha Spiece (DOI), Annie Little (USFWS)



From 2013–2016, management and restoration of the Baja California Pacific Islands, Mexico, is advancing seabird restoration. This illustration highlights some of the documented milestones for the last four years of the project. These noteworthy events are a result of increased monitoring, use of social attraction and artificial nesting habitat and disturbance reduction. The sustained presence of Mexico's Grupo de Ecología y Conservación de Islas biologists on the islands has also created strong partnerships within the local island communities, which is also contributing to positive steps for many ocean and shorebird species. Image credit: DOI and Conservación de Islas

Observations of Dynamic Coastlines

By Elizabeth Rogers (NPS), Ann Tihansky (USGS) and Meagan Racey (USFWS)

On October 29, 2012, Hurricane Sandy created a breach within a Federally-designated wilderness at Fire Island National Seashore, a unit of the National Park System located off the south shore of Long Island, NY. Wilderness management directives have allowed for the breach to remain open while the National Park Service (NPS) proceeds with a Wilderness Breach Management Plan/Environmental Impact Statement to determine how best to manage the breach. The open breach has provided an extraordinary opportunity to evaluate the physical and ecological response of the barrier island and Great South Bay. This research will be used to inform breach management decisions at Fire Island and will help inform future breach management decisions within the mid-Atlantic region and elsewhere.

Although storm events and breaches are part of a barrier island's natural processes and breaches can provide ecological benefits, decisions about the breach must be balanced by concerns that an open breach may exacerbate flooding in communities across Long Island's south shore. Within 48 hours of the storm, the NPS began monitoring the wilderness breach shoreline position. The State University of New York at Stony Brook, USGS, NPS, U.S. Army Corps of Engineers (USACE), and other coastal experts continue to regularly monitor conditions of the breach (breach shoreline position, depth, and tidal exchange) and water levels and water quality in the Great South Bay.

This research is collecting and synthesizing information on how the Great South Bay initially responded to the wilderness breach (i.e., water quality, plankton) and how the ecosystem continues to evolve. Breach management

See Breach page 9



Royal Tern (*Thalasseus maximus*). Photo credit: Dan Roby, Oregon State University



Caspian Terns (*Hydroprogne caspia*). Photo credit: Dan Roby, Oregon State University



Cassin's Auklet (*Ptychoramphus aleuticus*). Photo credit: Dan Roby, Oregon State University



Brown Pelican (*Pelecanus occidentalis californicus*). Photo credit: Dan Roby, Oregon State University

Restoring Razorbills

Satellite Tagging to Document Important Foraging Areas

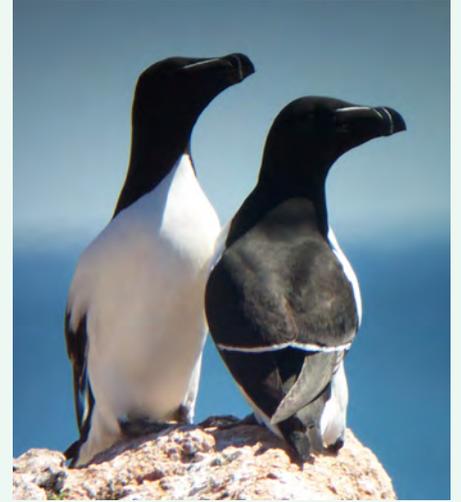
By Linda Welch (USFWS)

Conservation agencies have been working for decades to restore populations of seabirds to the coast of Maine. Although the restoration efforts were highly successful for more than 20 years, several species are now experiencing substantial declines. Razorbills are facing new challenges, including climate change, reduced productivity in the Gulf of Maine and potential development of offshore wind turbines. Biologists at the Maine Coastal Islands Refuge have been working to identify important seabird foraging areas and migratory pathways in order to be able to better protect the areas critical to the birds' survival.

In July, Refuge biologists tagged five razorbills breeding on Matinicus Rock with solar-powered satellite tags to document their foraging behavior.

Razorbills

Razorbills (*Alca torda*) are a stocky, crow-sized seabird, which reside in Arctic and subarctic marine waters from Maine to Northern Russia. As a member of the Auk (Alcidae) family they are closely related to puffins (*Fratercula* spp.), guillemots (*Cepphus* spp.) and murrelets (*Uria* spp.). Razorbills prefer the open ocean, only coming ashore during the breeding season to lay one egg in a rock burrow or crevice. The male razorbill will escort the chick to sea 18–20 days after it hatches, and they remain together for up to two months. Razorbills feed primarily on herring (*Clupea harengus*) and hake (*Rexea solandri*) and may dive more than 100 meters to catch these prey items.



Razorbills at Maine Coastal Island Refuge. Photo credit: USFWS

Tags track where the birds go to find food for their chicks and their migration routes after the breeding season is completed.

Razorbills are large seabirds in the Alcidae family, which live in the North Atlantic and breed along the

coast of Maine and Atlantic Canada. The Gulf of Maine is the southern limit of their breeding distribution. About 650 pairs of razorbills nest on six islands in Maine; four of these are refuge islands. *See related stories, pages 6–7.*

Breach continued from page 8

plans for Fire Island and Assateague Island National Seashores incorporating this collaborative research will enable the NPS and USACE, New York and Maryland to better respond to a breach event on these barrier islands. Fire Island National Seashore's Wilderness Breach Management Plan and Assateague Island National Seashore's General Management Plan are using the best available science to balance the geomorphological, ecological and socioeconomic impacts of breaching with the goal of maximizing ecosystem resilience and ensuring public health and safety.

<https://www.doi.gov/hurricanesandy>

Video:

<http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newyork/places-preserves/long-island-on-display-bellport.xml>



Aerial view of the open breach in Fire Island National Seashore's wilderness area. Read more about Fire Island: <http://coastal.er.usgs.gov/fire-island/research/sandy/sandy-breach.html>, <https://www.nps.gov/fiis/learn/nature/monitoring-the-breach-at-old-inlet.htm>, http://ny.water.usgs.gov/projects/hurr_sandy_2012/. Photo credit: Dr. Charles Flagg, Stony Brook University

Building Resilient Coasts

By David Eisenhauer (USFWS)

A collection of news and information from the USFWS Hurricane Sandy recovery and resilience program.

Discover the “New Jersey’s Hidden Coast” Video Series

You’ve heard of the Jersey Shore, but do you know about New Jersey’s other coastline?

The Delaware Bayshore is the focus of a new video series by the American Littoral Society and Conserve Wildlife. The series takes viewers to this “Hidden Coast” where the waves are gentle, the beaches expansive and the wildlife abundant.

Every two weeks a new episode airs that explores this extraordinary bay system—from horseshoe crabs and their relationship to the rufa red knot and other migratory birds, to living shorelines and oyster reefs, to the impact of Hurricane Sandy, which made landfall just 30 miles from the Hidden Coast.

In the aftermath of Hurricane Sandy, the USFWS has worked closely with partners like the American Littoral Society and Conserve Wildlife to strengthen and restore coastal areas such as the Delaware Bayshore to better withstand impacts of future storms.

Catch all the episodes by the American Littoral Society here: <http://www.littoralsociety.org/index.php/2-uncategorised/332-littoral-society-and-protect-wildlife-launch-video-series>

Living Shoreline at Fog Point, MD

Work is complete on a 21,000-foot living shoreline project at Fog Point on the Glenn L. Martin Refuge in Maryland’s Eastern Shore. The project will slow shoreline erosion, protecting



Aerial view of living shoreline at Fog Point, Glenn L. Martin Refuge. Credit: USFWS

vital tidal wetlands as well as benefiting the communities of Smith Island.

The new living shoreline consists of rock breakwaters to slow wave energy and restored marsh to help stabilize the shoreline and re-create wetlands lost to erosion. Funding for the \$9 million project came from the USFWS under the Hurricane Sandy Disaster Relief Appropriations Act of 2013.

This work will help protect a highly vulnerable shoreline, one that was eroding at rates as high as 10–15 feet per year in some areas. It also protects saltwater habitats important to the area’s soft crab fishery, a resource that local residents of nearby Smith Island depend on for their livelihoods.

Read more: https://www.fws.gov/news/ShowNews.cfm?ref=new-living-shoreline-completed-in-maryland%E2%80%99s-eastern-shore-&_ID=35717

Improvements at Sachuest Point National Wildlife Refuge, RI

In 2012, damage from Hurricane Sandy left the Sachuest Point Refuge without power for almost six months. The new underground utility lines will

stand up better during future storms, improving safety for the public. The new utility lines will also help restore scenic ocean vistas, which help attract nearly 200,000 visitors to the Refuge each year.

A project is underway that will improve recreation and safety at Sachuest Point Refuge in Middletown, RI, by burying 7,000 feet of above-ground power and communication lines along Sachuest Point Road. The \$1.1 million project is funded by the Disaster Relief Appropriations Act following Hurricane Sandy and is expected to be finished by late fall.

This project is part of a larger effort to restore and protect the Refuge after Hurricane Sandy, including restoration of coastal salt marshes to improve natural defenses along the coast. The main access road to the Refuge, which was washed out in the hurricane, has already been repaired.

Read more: https://www.fws.gov/uploadedFiles/Region_5/NWRS/North_Zone/Rhode_Island_Complex/Saschuest_Point/NewsReleaseUtilityundergrounding.pdf

From Icefield to Ocean: Winner of USGS 2015 Shoemaker Award

By Erica Wales (DOI)

Glaciers cover 16% of the northern Pacific coastal temperate rainforest (PCTR), where they are experiencing some of the highest rates of glacier loss on Earth. Melting from these glaciers can produce downstream changes all the way to the ocean, including changes to currents and important resources, such as fish species. Many of these changes are poorly understood, and linkages between glaciers and coastal and ocean ecosystems have not been studied holistically.

Researchers Shad O'Neel (USGS) and fellow authors, Kristin Timm (University of Alaska Fairbanks) and Eran

Hood (University of Alaska Southeast), developed a visualization of the linkages between glaciers and oceans to help illustrate the linkages between glacier and ocean and coastal ecosystems. The poster, "From Icefield to Ocean," won the USGS 2015 Eugene M. Shoemaker Communication Award for communicating and translating science to the public through words and pictures.

The PCTR runs for 4,000 kilometers along Northern California to Kodiak Island, AK, and includes glaciers and old growth forests; residents of the area are dependent on healthy natural resources, such as fisheries, and tourism. Evidence shows global-scale warming is increasingly affecting the PCTR with projections showing the PCTR will experience warming and

become wetter, though with less precipitation falling as snow.

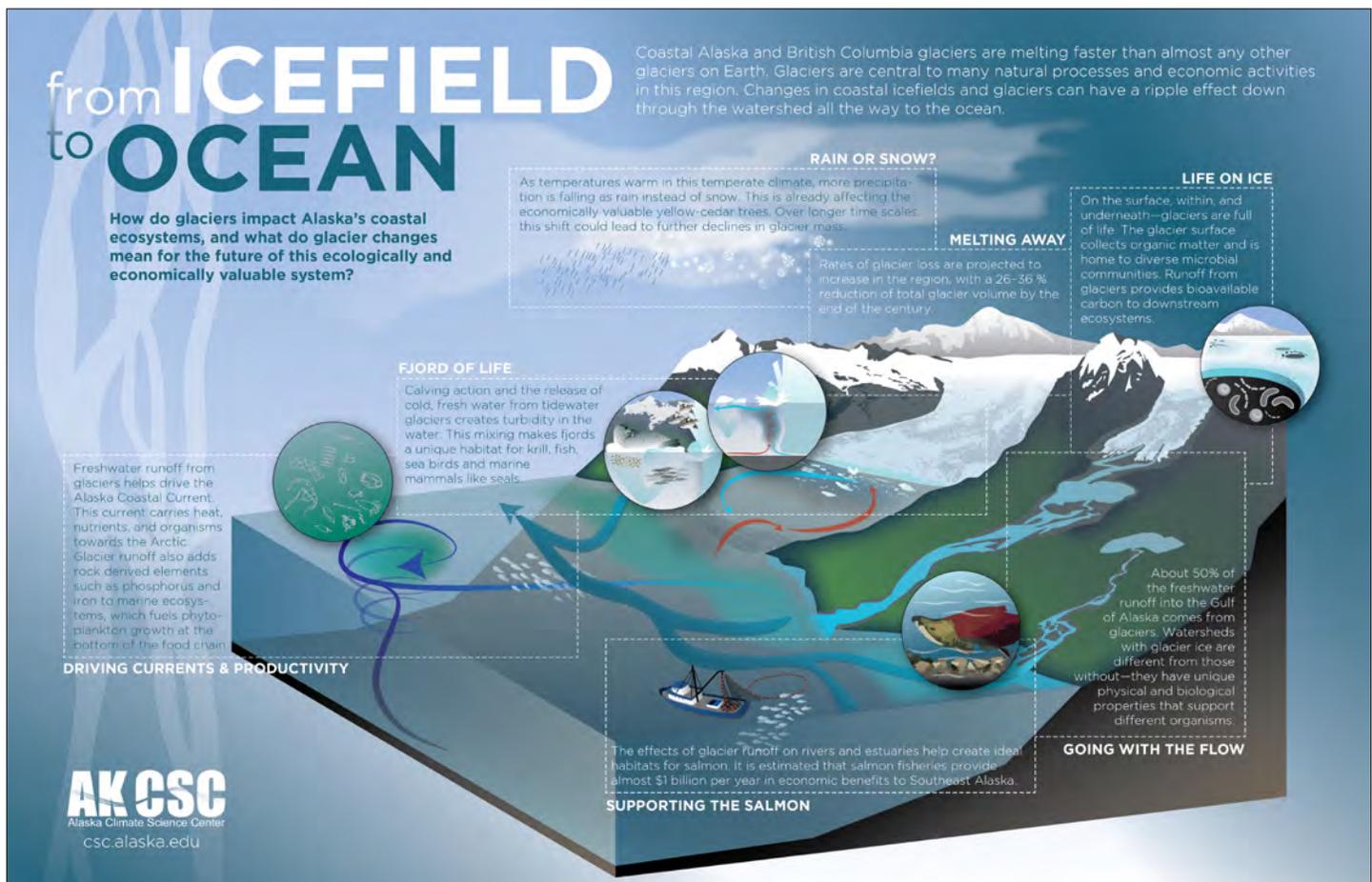
Because of the complex interactions in the PCTR, the authors call for interdisciplinary research that connects ecosystems from the icefields all the way to the oceans. Improving the long-term scientific records through a holistic scientific approach and coordinated research will also help improve decision making for resource use and tourism.

Find the poster online:

<https://www.usgs.gov/news/icefield-ocean-what-glacier-change-might-mean-future-alaska>

Find their research in Bioscience:

<http://bioscience.oxfordjournals.org/content/early/2015/03/12/biosci.biv027.full>



From Icefield to Ocean poster. Image credit: USGS

Harmful Algal Blooms

A New Field and Laboratory Guide to Freshwater Cyanobacteria

By Barry Rosen and Hannah Hamilton (USGS)

A series of 100 photos may reduce the risk of Native Americans and Alaska Natives being exposed to or consuming water or food containing harmful cyanobacteria.

The colorful images are part of a new field and laboratory guide developed by the USGS to help Native American and Alaska Native communities develop an awareness of what harmful algal blooms (HABs) look like in the field and be able to distinguish them from nontoxic blooms.

HABs that are dominated by certain cyanobacteria are known to produce a variety of toxins that can negatively affect fish, wildlife and people. Exposure to these toxins can cause a range of effects from simple skin rashes to liver and nerve damage to even death (although rarely in people).

The issue may be increasing in importance, as scientists indicate warming global temperatures may exacerbate the growth of HABs. *See related story, page 13.*

“We are likely to see more cyanobacterial blooms in the future as waters continue to warm,” said Barry Rosen, a USGS biologist and author of the guide. “Cyanobacteria proliferate in warm water temperatures, generally about 25 degrees Celsius, and are more tolerant of these warmer conditions than their competitors, such as green algae. We expect numerous other physiological adaptations will give cyanobacteria an advantage as global climate changes occur.”

Although there are communities worldwide that may find the field and laboratory guide of use, those with people in direct contact with surface water or who consume fish and shellfish may find it particularly helpful.

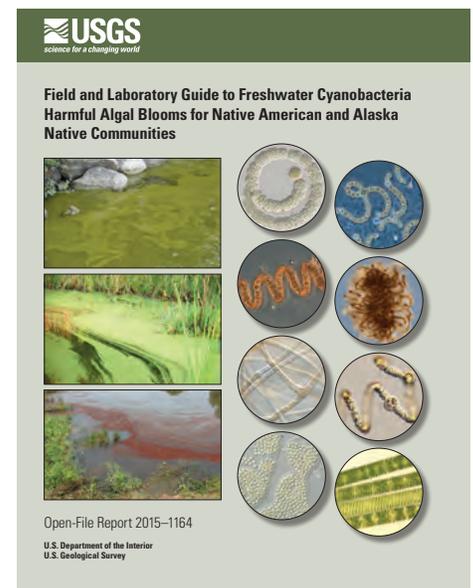


Gloeotrichia echinulata is a planktonic freshwater cyanobacterium that is composed of numerous filaments that are attached at their base in the center of the colony. Collectively, a colony has filaments extending all directions, creating a visible, fuzzy dot the size of a pin-head, as it floats in the water. At the base of each filament is a specialized cell, which has the ability to convert atmospheric nitrogen into organic molecules that nourish the rest of the filament. The organism can also regulate its buoyancy, and it moves up and down the water column daily. This image was photographed under the microscope illuminated by differential interference contrast microscopy. Photo credit: Barry Rosen, USGS

“In the U.S., Native American and Alaska Native communities, especially those reliant on subsistence fishing or who have frequent contact with surface water, have an increased risk of exposure to cyanotoxins,” said Monique Fordham, the USGS National Tribal Liaison. “This guide will give them a new resource to use to monitor the waters they rely on and protect their people.”

Algae serve as the base of the food web in aquatic habitats. Under the correct environmental conditions, including nutrient abundance, stability of the water column, ample light and optimal temperatures, algae can “bloom,” typically causing a surface scum or accumulation on or near a shoreline. Although many different types of algae are responsible for HABs, it is cyanobacteria, which produce natural cyanotoxins that pose the greatest problem and are the focus of this guide. The guide includes photos

of what cyanobacteria blooms look like in a waterbody, as well as photos of cyanobacteria taken through the microscope, which is needed to determine the type of HAB that is present.



Read USGS Open-File Report 2015-1164, the new field and laboratory guide, here: <http://dx.doi.org/10.3133/ofr20151164>

Harmful Algal Bloom and Hypoxia Research and Control Act

In June 2014, Congress reauthorized the Harmful Algal Bloom and Hypoxia Research and Control Act (HABHRCA) by passing the Harmful Algal Bloom and Hypoxia Research and Control Amendments Act of 2014 (HABHRCA 2014, P.L. 113–124). The reauthorization of HABHRCA acknowledged concerns related to HABs and hypoxia, extended the scope of the legislation to include freshwater HABs and hypoxia and recognized the need for further coordinated action across the Federal sector to address these issues.

Additionally, the legislation called for Federal agencies to provide integrated assessments on the causes and consequences of and approaches to reducing HABs and hypoxia nationally, with particular emphasis on the Great Lakes. Finally, the reauthorization included a specific focus on the needs of stakeholders, requiring that Federal agencies engage with stakeholders around the country.

The prevalence and duration of HABs and hypoxia (low-oxygen conditions) in the marine and fresh water environments of the United States, including the Great Lakes, are generating public concern. From extended shellfish closures on the west coast in 2015, to a larger-than-predicted hypoxic zone

in the Gulf of Mexico, these events negatively impact resources across thousands of miles of the Nation's coastal and inland waters and represent some of the most scientifically complex and economically damaging aquatic issues.

HABs and hypoxia pose a significant challenge to the ability to safeguard the health of the Nation's coastal and freshwater ecosystems. HABs and hypoxia have serious effects on a community's social and public health. They may threaten the safety of seafood, drinking water and air quality. HABs and hypoxia events may also result in lost revenue for lakefront and coastal economies that are dependent on aquatic/seafood harvest or tourism, disruption of subsistence activities, loss of community identity tied to aquatic-resource use and disruption of social and cultural practices.

The report from the White House, "Harmful Algal Blooms and Hypoxia Comprehensive Research Plan and Action Strategy: An Interagency Report," presents a comprehensive research plan and action strategy, assessments of harmful algal blooms and hypoxia, as well as an integrated assessment on Great Lakes hypoxia and harmful algal blooms. *See related story, page 12.*

Read the report: https://www.whitehouse.gov/sites/default/files/microsites/ostp/NSTC/final_habs_hypoxia_research_plan_and_action.pdf

What are Harmful Algal Blooms?

Freshwater and marine HABs can occur anytime water use is impaired due to excessive accumulations of algae. HAB occurrence is affected by a complex set of physical, chemical, biological, hydrological and meteorological conditions making it difficult to isolate specific causative environmental factors. Potential impairments include reduction in water quality, accumulation of malodorous scums in beach areas, algal production of toxins potent enough to poison both aquatic and terrestrial organisms and algal production of taste-and-odor compounds that cause unpalatable drinking water and fish. HABs are a global problem, and toxic freshwater and (or) marine algae have been implicated in human and animal illness and death.

Read more: <https://pubs.er.usgs.gov/publication/fs20063147>



An HAB, often referred to as "red tide," offshore of San Diego County, CA. Photo credit: Kai Schumann

Cyanobacteria Assessment Network Project

The Cyanobacteria Assessment Network (CyAN) is a multi-agency project among the NASA, National Oceanic and Atmospheric Administration (NOAA), USGS, and U.S. Environmental Protection Agency (EPA) to develop an early warning indicator system using historical and current satellite data to detect algal blooms in

U.S. freshwater systems. This research supports Federal, State, and local partners in their monitoring efforts to assess water quality to protect aquatic and human health.

CyAN project mission: Support the environmental management and public use of U.S. lakes and estuaries by providing a capability of detecting and quantifying algal blooms and related water quality using satellite data records.



CyAN Project logo. Image credit: U.S. Environmental Protection Agency

Read more: <https://www.epa.gov/water-research/cyanobacteria-assessment-network-cyan-project>

Special Feature— Meet the Fleet!

Great Lakes Research Vessels Restoring and Protecting our Inland Freshwater Seas

By Andrea Miehls and Josh Miller (USGS)

The USGS achieved a major milestone on August 31, 2015, when the Research Vessel (R/V) *Arcticus* was christened and commissioned into service on the Great Lakes under command of the USGS Great Lakes Science Center (GLSC). The historic event marked the final step toward modernizing the entire USGS Great Lakes research vessel fleet with five state-of-the-art floating laboratories. The modernized fleet provides improved research capabilities, enhanced health and safety features and increased fuel efficiency on versatile platforms built to serve a range of large-scale societal needs. The fleet provides scientists access to the 1,300-foot deep waters of these enormous freshwater seas that contain 20% of the world's available freshwater. The GLSC provides scientific information for restoring, enhancing, managing and protecting Great Lakes resources. Science generated from these vessels serves as the linchpin for State, provincial and tribal management decisions regarding sustainable Great Lakes fisheries, native species restoration and invasive species assessment.

The restoration process took only 15 years to complete, with three new vessels built during the past five years alone: the *R/V Arcticus* (2014), which serves Lake Michigan and Lake Huron, and the twin vessels, the *R/V Kaho* (2011), which serves Lake Ontario, and the *R/V Muskie* (2011), which serves Lake Erie. In the 1990s, the USGS

R/V Arcticus

Vessel Specifications

Size—length, 77 ft; beam, 26 ft; draft, 8.9 ft

Cruising speed—9.5 knots

Maximum cruise length—30 days

Sleeping capacity—8

The *R/V Arcticus*, based in Cheboygan, MI, was built in 2014 and currently operates on Lake Michigan and Lake Huron. The *Arcticus* is used primarily to carry out annual prey fish assessments, which have occurred since the 1970s. The annual assessments provide current information on the prey fish base to fisheries managers and are used to facilitate understanding of long-term population trends in the fish community. Data on prey fish populations are especially important in evaluating management strategies such as predator stocking and harvest quotas. The name, "*Arcticus*," is a nod to the rich legacy of her predecessor, the *R/V Grayling*, which was named for the Arctic grayling (*Thymallus arcticus*), a fish native to the Great Lakes region.



Photo credit: Burger Boat Company

acquired an older vessel, which was renovated and christened as the *R/V Sturgeon* in 2004 and is used on Lake Michigan and Lake Huron alongside the *R/V Arcticus*. The largest vessel in the fleet, the *R/V Kiyi*, was built in 1999 and serves Lake Superior.

R/V Kaho

Vessel Specifications

Size—length, 70 ft; beam, 18 ft; draft, 5.5 ft

Cruising speed—12 knots

Maximum cruise length—5 days

Sleeping capacity—6

The *R/V Kaho*, based in Oswego, NY, was built in 2011 and currently operates on Lake Ontario. The new *Kaho* replaced the original *R/V Kaho* (built in 1961), which was the workhorse of the multiagency fisheries research fleet on Lake Ontario for more than three decades. The new *Kaho* participates in long-term data collections including population studies of prey fish and stocked lake trout (*Salvelinus namaycush*), fish and environmental sampling for contaminants monitoring and documentation of changes in food webs and fish distributions associated with invasive species. The name, "*Kaho*," is a shortened version of a colloquial Ojibwe word meaning "searcher" or "hunter."



Photo credit: USGS

The modern Great Lakes fleet supports multijurisdictional science for managing Great Lakes resources. The fleet plays a crucial role in the sustainability of the Great Lakes fishery and by extension the renowned recreation and tourism economy of the region. The Great Lakes fishery alone is worth more

R/V Kiyi

Vessel Specifications

Size—length, 107 ft; beam, 27 ft; draft, 10 ft

Cruising speed—10 knots

Maximum cruise length—14 days

Sleeping capacity—9

The *R/V Kiyi*, based in Bayfield, WI, was built in 1999 and currently operates on Lake Superior. The *Kiyi* conducts fish stock assessment, fisheries research and habitat monitoring, particularly in the Apostle Islands area of Lake Superior. The *Kiyi* annually samples prey fish populations and tracks progress in the sustainability of lake trout (*Salvelinus namaycush*) populations. The *Kiyi* is also used to collect fish and environmental samples for a wide spectrum of studies, including contaminant monitoring. The name, “*Kiyi*,” honors the fish species of the same name, Kiyi (*Coregonus kiyi*), which is a type of freshwater whitefish—a deepwater cisco—endemic to the Great Lakes. Kiyi previously inhabited multiple Great Lakes but are now believed to persist only in Lake Superior.



Photo credit: USGS

R/V Muskie

Vessel Specifications

Size—length, 70 ft; beam, 18 ft; draft, 5.5 ft

Cruising speed—12 knots

Maximum cruise length—5 days

Sleeping capacity—6

The *R/V Muskie*, based in Sandusky, OH, was built in 2011 and currently operates on Lake Erie. The *Muskie* replaced the *R/V Musky II*, which was the primary USGS research platform on Lake Erie beginning in 1960. The *Muskie* is used to assess annual recruitment of major prey and predator fish in western Lake Erie, as well as in lake trout (*Salvelinus namaycush*) restoration research in eastern Lake Erie. The *Muskie* also participates in studies designed to determine the impacts of environmental changes and invasive species on the Lake Erie ecosystem. The name, “*Muskie*,” was based on the names of her predecessors, the *R/V Musky I* and *R/V Musky II*, which reference the native Great Lakes sport fish, the Muskellunge (*Esox masquinongy*).



Photo credit: USGS

R/V Sturgeon

Vessel Specifications

Size—length, 104 ft; beam, 25 ft; draft, 10 ft

Cruising speed—11 knots

Maximum cruise length—15 days

Sleeping capacity—10

The *R/V Sturgeon*, based in Cheboygan, MI, was built in 1974 and currently operates on Lake Michigan and Lake Huron along with the *R/V Arcticus*. The *Sturgeon* was transferred from the Smithsonian Institution to the GLSC in the 1990s and was later retrofitted and commissioned in 2004. The *Sturgeon* supports fisheries related science, including deepwater studies, restoration ecology and invasive species, to aid in management decisions for top fish predators. Research completed by the *R/V Sturgeon* meets the needs of many partners, including the EPA, seven border states and Ontario, Canada. The name, “*Sturgeon*,” derives from one of the most ancient native fish in the Great Lakes, the Lake Sturgeon (*Acipenser fulvescens*).



Photo credit: USGS

than \$7 billion annually—and that’s just on the U.S. side. For more than 50 years, the USGS has provided unbiased scientific information about the status and trends of fish communities in the Great Lakes, particularly prey fish communities, as well as the ecosystem as a whole. This information is essential

to partners such as the Great Lakes Fishery Commission and Council of Lake Committees. These entities bring together State, provincial and tribal management authorities on each Great Lake to set management objectives, such as catch limits and stocking targets of sport species like salmon and lake trout. The

information is also critical to the work of other partners, including the USFWS, multiple State natural resource agencies, Fisheries and Oceans Canada, the Ontario Ministry of Natural Resources, Tribal partners, and multiple university partners.

See *Meet the Fleet* page 16

Meet the Fleet continued from page 15

All of the Great Lakes research vessels are state-of-the-art, "multi-platform" vessels, meaning scientists can deploy multiple sampling gears from a single vessel, including trawl nets, gill nets, plankton and larval fish nets, hydroacoustic sampling technology, water sampling gear and technology that measures water chemistry. Learn more about each vessel by reading their profiles on pages 14 and 15.

Great Lakes Fleet Overview

The GLSC exists to meet the Nation's need for scientific information for restoring, enhancing, managing and protecting living resources and their habitats in the Great Lakes basin ecosystem. Headquartered in Ann Arbor, MI, the GLSC has biological stations and vessel bases across the Great Lakes Basin with research vessels on each of the Great Lakes. The data collected annually on board the vessels are invaluable for fishery resource managers throughout the basin. The datasets generated on prey fish abundances, some dating back more than 60 years, are foundational to a binational fishery management regime that has ensured sustainable sport and commercial fisheries on the Great Lakes for half a century.



Splashing of the R/V Arcticus, Manitowoc, Wisconsin. Photo credit: USGS



The Great Lakes research fleet covers a large area with a dedicated port for each vessel. Illustration credit: USGS

"Building a research vessel fleet is a big undertaking, but deploying an adequate science platform is essential to providing the information needed to support healthy fish communities and ecosystem services that benefit the people of the United States, Canada, and Indian tribes. The modernization of the Great Lakes vessel fleet is an achievement that will benefit the Great Lakes region for many decades."

—Russell Strach, GLSC Director

How an R/V is Built

Curious to learn more about Great Lakes R/Vs? Check out the USGS GLSC video series, "Science Afloat: How a Research Vessel is Built," to see from start to finish how a R/V is created. From the first piece of metal welded to the last touch of paint, you'll see how ideas, materials and hard work came together to create the R/V Arcticus, a 77-foot steel vessel designed to explore Great Lakes

ecosystems. Watch the videos at: <https://www.youtube.com/playlist?list=PLIxIFowAfHBBnESaKdn8VXhE1ft-423ar>

For more information about the R/V Arcticus build, including the exciting culmination in the christening and commissioning ceremony during August 2015, view the featured story on the USGS GLSC website: <http://www.glsc.usgs.gov/features#146961>

Read more about the Great Lakes Fleet:

- <http://www.glsc.usgs.gov/sites/default/files/infosheets/Arcticus20150818.pdf>
- <http://www.glsc.usgs.gov/sites/default/files/infosheets/Kaho20150818.pdf>
- <http://www.glsc.usgs.gov/sites/default/files/infosheets/Kiyi20150818.pdf>
- <http://www.glsc.usgs.gov/sites/default/files/infosheets/Muskie20150818.pdf>
- <http://www.glsc.usgs.gov/sites/default/files/infosheets/Sturgeon20150818.pdf>

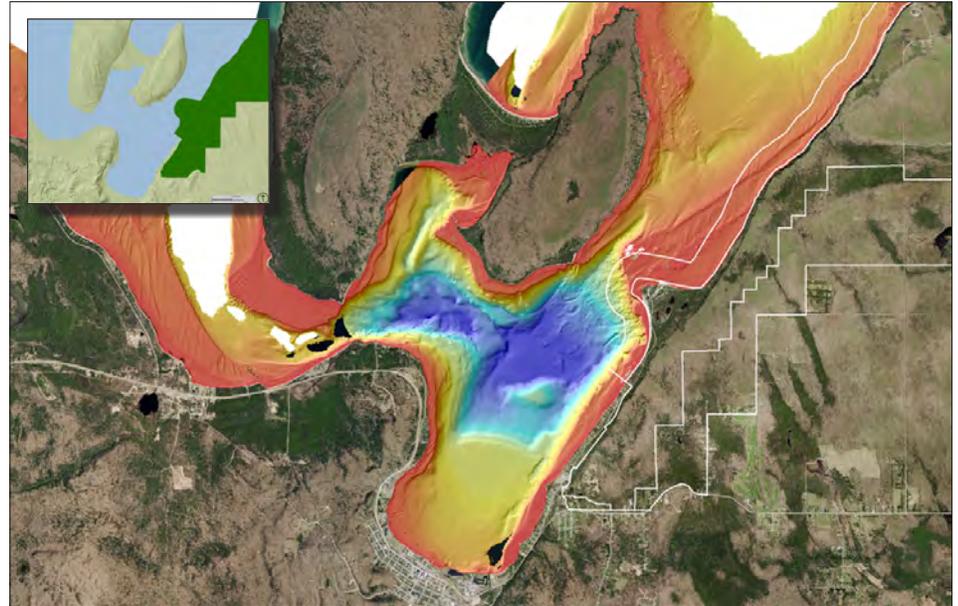
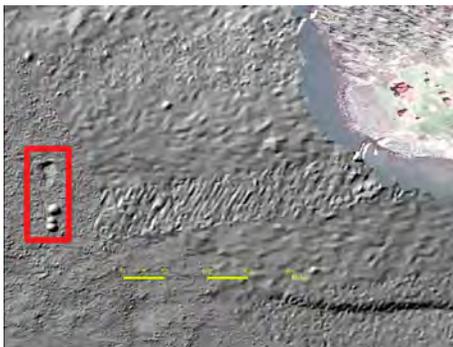
Adding Depth to the Great Lakes

By Ted Gostomski (NPS)

Like the topographic maps used by hikers, maps of the lake bottom, called bathymetric maps, show the contours—the shape and depth—of the lake floor. A 28-foot vessel equipped with a multibeam sound navigation and ranging (sonar) system is being used by the NPS to collect the data to make bathymetric maps for four Great Lakes national parks.

Why do we need these maps? Because natural and cultural resources—such as shipwrecks and fish habitat—lie below the waves. Although we have maps, photos and studies detailing land-based features, much of what lies beneath the lake surface has remained hidden and is relatively uncharted and unstudied.

In 2010, with support from the Great Lakes Restoration Initiative (GLRI), the NPS began mapping in Lake Superior within the park boundaries of Apostle Islands National Lakeshore (WI), Isle Royale National Park (MI), and Pictured Rocks National Lakeshore (MI). Mapping in Lake Michigan is being done within the boundaries of Sleeping Bear Dunes National Lakeshore (MI).



Many maps show the Great Lakes as large expanses of flat blue (inset, top left), but in fact, there is much more to see below the waves. Sonar data reveal a hidden world of canyons and shoals that link the exposed landforms to the subterranean features. Image credits: NPS

The bathymetric maps created from this work are useful for NPS managers and their partners in many different ways:

- At Isle Royale and Apostle Islands, maps of reefs used by native fish for spawning are informing fisheries conservation efforts by DOI agencies and partners,
- At Apostle Islands and Pictured Rocks, mapping data are supporting analysis of sand movement and shoreline restoration efforts,

- At Sleeping Bear Dunes, maps of the lake bottom are being used to identify where sediment is deposited and algae are accumulating—and potential hot spots where bacteria produce a botulinum toxin that is killing fish and birds along the Lake Michigan shoreline, and
- Finally, this work is providing a clearer picture of submerged cultural resource sites—providing new context for known sites, discovering new ones and expanding our knowledge about unique submarine historical treasures.

Sonar data revealed a pit and three symmetrical mounds in about 25 feet of water offshore from Raspberry Island in the Apostle Islands National Lakeshore (inset area shown in red box [left] is enlarged in second image [right]). Divers discovered the three mounds were piles of raw iron ore. Research revealed they were cast off from a ship that ran aground there in the late 1800s. Image credits: NPS



One particularly interesting feature was found offshore from Raspberry Island in Apostle Islands, WI. After the sonar data were processed, an oval-shaped depression and three curiously symmetrical mounds were seen. No one could say for sure what they were, but many were curious, so an NPS dive team visited the site. What they found was a very large pile of rocks. Apostle Islands' cultural resource specialist, Dave Cooper, did some detective work and the mystery began to unfold.

See Great Lakes Depth page 25

Sitka Tribe Strategic Science

Creating Opportunities for Safe Shellfish Harvesting

By Esther Kennedy (Sitka Tribe of Alaska—Resource Protection Department)

Communities in Southeast Alaska are dependent on the ocean for their livelihoods and most of their local foods, with shellfish being an important part of traditional diets. As Alaskan waters warm, however, those shellfish have become increasingly exposed to marine biotoxins produced by algae and phytoplankton. Through support from many Federal and State partners, the Sitka Tribe of Alaska is taking steps to respond to the increasing threat of HABs in Southeast Alaska and restore access to safe shellfish for subsistence harvesters.

The Sitka Tribe of Alaska and 14 other southeast Alaska Tribes have partnered together to form



A variety of bivalve mollusks such as cockles, littlenecks, and butter clams collected from a local beach by Sitka Tribe of Alaska employees await further processing for saxitoxin and domoic acid concentration. Photo credit: Bethany Goodrich, Sustainable Southeast Partnership



Sitka Tribe of Alaska employees, Kyle Rosendale (right) and Callie Simmons (left), dig for clams at Starrigavan Beach, Sitka. Every major low tide cycle, Tribal employees collect samples of each species of clam to monitor baseline biotoxin levels. Photo credit: Chris Whitehead, Sitka Tribe of Alaska Environmental Program Manager

the Southeast Alaska Tribal Ocean Research (SEATOR) network. The focus of SEATOR is to work together to address climate change related issues that could have negative impacts on subsistence resources. One of the main projects is to monitor HABs and biotoxins in shellfish. Using EPA Indian General Assistance Program funds, each community is collecting weekly phytoplankton data to determine if HAB-producing species are present and collecting shellfish samples to be analyzed for biotoxins. With funding from the Administration for Native Americans, the Sitka Tribe was able to develop the Sitka Tribe of Alaska Environmental Research Laboratory (STAERL) to test and analyze all SEATOR partner shellfish samples for biotoxins. Each community can then use the data to assess their vulnerability for human health risks associated with harvesting subsistence shellfish.

Training and outreach are key components of SEATOR's research.

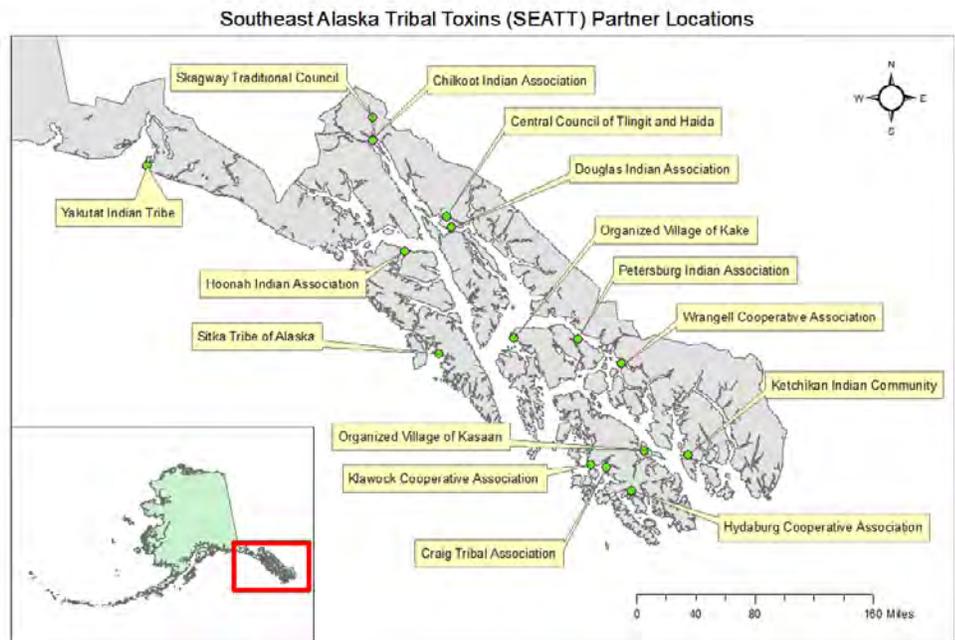
The DOI's Bureau of Indian Affairs (BIA) Climate Change Program has contributed direct funding to support technical workshops to train Tribal environmental staff on sampling technique and protocols. Each workshop brings top HAB scientists and resource managers from the NOAA and other State agencies to Sitka where they instruct and train Tribal staff. The BIA Climate Change Program has also provided funding to develop training material and the SEATOR website (<http://www.seator.org/>). The SEATOR website is the main conduit for data, risk communication plans and public health advisories regarding toxin levels at each site. This is a critical component of this monitoring effort and completes the data circle to the end user—subsistence harvesters.

HABs are a present and growing threat to virtually all U.S. coastal waters, with impacts ranging from extensive marine animal die-offs to wide-scale contamination of shellfish

with potent biotoxins. Although many coastal states have strict monitoring programs in place to protect recreational shellfish harvesters from those toxins, Alaska does not. As climate change makes Alaskan waters more hospitable to toxic plankton, the increasing frequency and severity of HABs in Alaska have combined to make wild shellfish unacceptably risky for many harvesters. Challenges to addressing this issue include: Alaska's enormous coastline, low population and lack of State governmental support. Additionally, Alaskan residents' high reliance on wild, local foods brings traditional shellfish harvesters into contact with potentially toxic shellfish on a regular basis.

Wild shellfish harvesters face two primary threats from HABs. The most well known is Paralytic Shellfish Poisoning (PSP), a life-threatening illness that sends Alaskan residents to the hospital every year caused by the phytoplankton *Alexandrium* that produces saxitoxin, a poison that inhibits nerve function, leading to paralysis and death at high concentrations without supportive care. In an HAB, filter-feeding shellfish concentrate that saxitoxin in their flesh. Certain shellfish species can hold on to saxitoxin for years after an HAB, making PSP a threat long after the summer growing season is over. Without a testing facility for subsistence harvesters, Alaskans have been playing "toxin roulette" no matter what time of year they've chosen to harvest. With the SEATOR network and the STAERL, harvesters will finally be able to track their risk of PSP.

In addition to PSP, Alaska residents have become increasingly aware of the possibility of Amnesic Shellfish Poisoning (ASP), an illness caused by domoic acid produced by *Pseudo-nitzschia*. Although ASP is less deadly than its sister illness, domoic acid concentrates in shellfish tissues the same way as saxitoxin and



A map of all Tribal governments participating in baseline HAB monitoring and shellfish testing. All partner Tribes monitor one or more beaches for their communities and keep them updated about the risks of harvesting. Image credit: Sitka Tribe of Alaska

has shown increased ability to move up the food chain into forage fish and marine birds. Last summer, a *Pseudo-nitzschia* HAB stretched from southern California to Kachemak Bay, AK, and shut down crab fisheries from California to Washington. The HAB alerted many residents to the increasing severity and visibility of HABs and the immediacy of the risk of contaminated shellfish. The STAERL will also test shellfish for high domoic acid contamination, reducing public exposure to ASP well before it becomes as dangerous and widespread as PSP. *See related stories, pages 12–13.*

Construction of the STAERL was completed in late 2015, and it ran its first shellfish samples in early 2016. Although the lab's primary purpose is to test shellfish biotoxins, it will also

test marine mammals for evidence of more pervasive and widespread bioaccumulation. Currently, shellfish are collected by SEATOR Tribal staff at local beaches during low-tide cycles, but by early summer, recreational shellfish harvesters will be able to bring in a portion of their own harvest for testing. Testing will take as little as one business day, allowing harvesters to keep the rest of their catch alive while waiting for confirmation of its safety. In the event that toxic shellfish are detected, STAERL immediately issues a community advisory for the area. As STAERL opens its doors to the public and picks up momentum, the Sitka Tribe hopes that despite the increasing frequency of HABs and shellfish toxins, wild shellfish will become a safe and common food source for Southeast Alaskans again.



Illustration credit: Cole Goco

Yaquina Head Outstanding Natural Area Offers a Robust Experience

By Janet Johnson (BLM)

From exploring tide pools teeming with life, to climbing 114 stairs to the top of Oregon's tallest lighthouse, there is something for every visitor at Yaquina Head Outstanding Natural Area on the central Oregon Coast.

Managed by the BLM, the Yaquina Headland extends out from the Oregon coast, one mile into the Pacific Ocean. The Yaquina Lighthouse stands 93 feet tall at the westernmost point of the basalt headland and has been a beacon in the night since 1873, guiding ships and their supplies along the rugged Pacific coast.

The offshore islands are a year-round refuge for harbor seals and a spring-summer home for thousands of nesting seabirds. Gray whales (*Eschrichtius robustus*) can be spotted during their annual migrations—heading south to Mexico during late fall and early winter, and north to Alaska during late winter and early spring. During the summer months, gray whales can be seen feeding in the shallow waters around the headland.

Cobble Beach is made up of millions of round basalt rocks that produce an applause-like sound as the waves roll in. When the tide is low, a vibrant ocean floor is exposed—with tidal pools full of colorful animals including orange sea stars (*Astroidea* spp.), purple sea urchins (*Echinoidea* spp.) and giant green anemones (*Anthozoa* spp.). Yaquina rangers are at hand to answer questions and point out all of the amazing plants and animals that call these tide pools home.

The energetic Oregon Coast is a magnet for many thousands of tourists from all over the world. The naturalists/interpretive rangers who interact daily with these visitors must be knowledgeable on many coastal topics. Each spring, rangers from Yaquina Head Outstanding Natural Area partner with Oregon Parks and Recreation, scientists from Oregon State University's Hatfield Marine Science Center, the USFWS and others to present the "Rocky Shores Interpretive Training." The week-long hands-on training focuses on the natural and cultural stories that are the heritage of the Oregon Coast.

Through the "Rocky Shores Interpretive Training" program, students learn to identify intertidal organisms, how to spot and assist visitors in identifying



The lighthouse at Yaquina Head still shines for ships at sea. Photo credit: Bob Wick, BLM

gray whales' migration, feeding and behavior patterns and a basic understanding of the ebb and flow of tides. They also learn to identify the many seabirds that nest on the coastal rocks and islands along Oregon's coastline. Part of the training includes a unit called "Love on the Rocks" that covers the daily soap opera of activity associated with birds such as murrelets (*Uria* spp.), cormorants (*Phalacrocorax* spp.), and eagles (*Accipitridae* spp.). Another unit on Oregon Coast geology focuses on how the coastal features fit into Oregon's geologic landscape. There is also a unit on mammals such as seals, sea lions (*Otariidae* spp.) and otters (*Enhydra* spp.). The educational program also includes current coastal issues such as sea star wasting, marine debris and how stewardship and missions of different government agencies vary.

Yaquina Head offers spectacular scenery, intriguing history and fascinating marine gardens within a small geologically distinct peninsula, one of many outstanding protected areas along the northwest Pacific coast of the United States.



Green anemones living in the tide pools near the Yaquina lighthouse. Photo credit: Bob Wick, BLM

National Parks BioBlitz

The NPS Needs Your Help Celebrating Biodiversity!

By Alexandria Warneke (NPS)

To celebrate 100 years of stewardship, the NPS is planning a shared Nationwide quest to discover and document biodiversity in our parks. You are invited to help as parks across the country host “BioBlitzes” of different sizes and scopes at a hundred different parks across the country from now through October 2016.

What is a BioBlitz? A BioBlitz is an event that focuses on finding and

identifying as many species as possible in a specific area over a short period of time. At a BioBlitz, scientists, families, students, teachers, and other community members work together to get an overall count of the plants, animals, fungi, and other organisms that live in a place.

Find a BioBlitz event near you: <https://www.nps.gov/subjects/biodiversity/upload/2016BioBlitzTable-12-3.pdf>

Check out the map online to find out which parks are hosting a BioBlitz in 2016: <https://www.nps.gov/subjects/biodiversity/national-parks-bioblitz.htm>

Bringing Oceans into Classrooms

As part of its Centennial Celebration, the NPS is working to bring the ocean into every classroom and bring classes into our ocean, coastal and Great Lakes National Parks. A big part of that effort was our outreach to 500 teachers, aquarium educators and others at the National Marine Educators Association conference this summer in Orlando, FL, from June 25 to July 1.

As a major sponsor of the conference, NPS staff presented on climate change in the Everglades, citizen science opportunities at Gulf Islands National Seashore and lionfish (*Pterois* sp.) invasions at Biscayne National Park. There was also a booth in the exhibit hall and a field trip to watch sea turtles nest at Canaveral National Seashore. The annual Stegner Memorial Lecture was a heartfelt and moving presentation of songs and stories about how national parks connect us to the natural world, our Nation's history and one another. Follow #NMEA2016, #FindYourPark and #NPS100

National Marine Educators Association conference schedule: http://www.marine-ed.org/page/NMEA_2016_Schedule

Learn more: <http://www.marine-ed.org/general/custom.asp?page=conferences>



To help bring the ocean into every classroom, the NPS participated in the National Marine Educators Association conference this summer in Orlando, FL, June 25 to July 1. Image credit: Florida Marine Science Educators Association

A BioBlitz Example

The Cabrillo National Monument hosted a BioBlitz and Biodiversity Festival on May 21–22 in Washington, D.C. Cabrillo National Monument collaborated with the San Diego Natural History Museum, USGS, Climate Science Alliance, Audubon Society, University of California-San Diego, San Diego State University, Space and Naval Warfare Systems Center-Pacific, local public lands groups and park partners.

This event was precluded by three “mini-blitz” events in local schools throughout the county and an Intertidal BioBlitz that took place on March 6. Cabrillo is creating a new park curriculum that focuses on biodiversity and provides activities and guidance on how to use iNaturalist, a citizen science database, on school grounds.

For the main BioBlitz, the NPS recruited 27 taxonomic experts from several fields of study to interact with students through public presentations, interactive demonstrations, “Ask a Scientist” displays, and by leading survey teams throughout the park. They used iNaturalist to record all species discovered during a 24-hour period. Cabrillo also had 20 exhibitors lead science, technology, engineering and math (STEM) activities with visitors



The Cabrillo National Monument BioBlitz welcomed the public to learn about the unique ecosystems of the Monument, participate in science-based activities, and help park biologists quantify the plants and animals that call Cabrillo home. Image credit: NPS

on the topics of climate change, sustainability and natural history.

Four Cabrillo NPS Artists-in-Residence made linkages between science and art through an activity where visitors created art made of recycled materials and trash, the “Wildflowers of Cabrillo” exhibit, guided walks with iNaturalist pro-observers and #InstaMeets that encouraged people to use the power of photography and social media.

Refugee Tutoring: The Power of “Life Art”

By Alexandria Warneke (NPS)

By combining the power of art and nature to transcend boundaries, a unique program at the Cabrillo National Monument in San Diego, CA, is using the natural coastal environment to enrich the lives of refugee youth. Artist-in-Residence, Jason Rogalski, and NPS Centennial Ambassador, Alexandria Warneke, joined forces with the San Diego Refugee Tutoring (SDRT) program to bring 32 refugee students to Cabrillo National Monument, San Diego’s only national park. The students, who have been living in the United States from as little as one month to as much four years, have been relocated to San Diego with their families from all across the globe. The “Life Art” project gave them a chance to get outdoors and explore, learn and express themselves.

The mission of SDRT is to achieve social justice through educational access. The goal of SDRT is to provide one-on-one tutoring and holistic academic support to refugees at Ibarra Elementary School in eastern City Heights.

Read more:

<http://sdrefugeetutoring.com/>



San Diego Refugee Tutoring Program (SDRT) students exploring the tidepools at Cabrillo National Monument. Photo credit: SDRT



Julian Charter School students created clay artwork to help share their recent experience of visiting the tide pools at Cabrillo National Monument. Photo credit: San Diego Refugee Tutoring Program (SDRT)

The SDRT works with refugee students from Ibarra Elementary and their siblings (preschool, middle school and high school). Most of the students speak several languages other than English, including Burmese, Karen, Karenni, Burundian, Democratic Republic of Congo, Nepali, Iraqi, Somali, Sudanese, Mozambican, Ethiopian and Eritrean. The SDRT was formed in 2008 out of a brainstorming session of teachers who saw that a growing refugee population in an eastern City Heights

neighborhood of San Diego had specific needs beyond simple education to become better integrated with American society. Teachers noticed that wide cultural gaps made it difficult for refugee students to keep up with their peers. Most students do not receive any additional instruction outside of school from someone who is fluent in English or assimilated into American culture because they often live in ethnic enclaves. Additionally, there are extremely limited options for after-school tutoring or extracurricular activities. As their parents join the work force, they have less time to participate in programs with their children.

The NPS staff worked with SDRT to tailor a program for the students using a visit to Cabrillo National Monument as an extracurricular experience combining art and nature. As many of these students had never even seen the ocean before, it was a unique educational opportunity as well. Before their park visit, Rogalski introduced the students to the aquatic organisms of the rocky intertidal zone at Cabrillo using artistic crafted clay models, created by Rogalski’s students at Julian Charter School.



San Diego Refugee Tutoring Program (SDRT) students splashing water in the tidepools at Cabrillo National Monument. Photo credit: SDRT

A Day at Cabrillo National Monument

The students started the morning with a nature hike down Cabrillo's popular Bayside Trail. Halfway down, students spent some time at an historical World War II bunker that was recently converted into an art studio for the Artist-in-Residence program. Here they learned about different artistic techniques and created paintings of their favorite ocean animals.

After a lunch spent overlooking the great Pacific Ocean, students

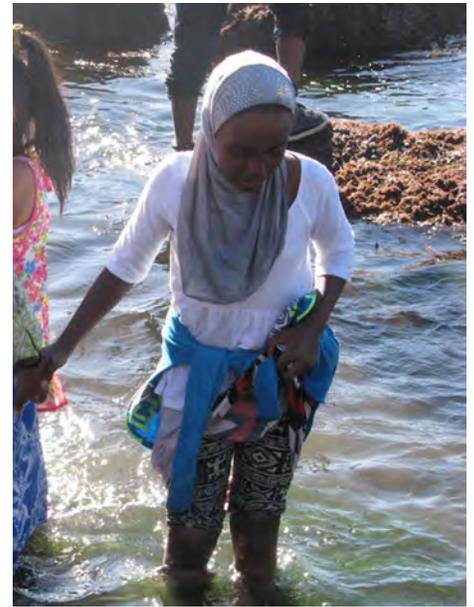
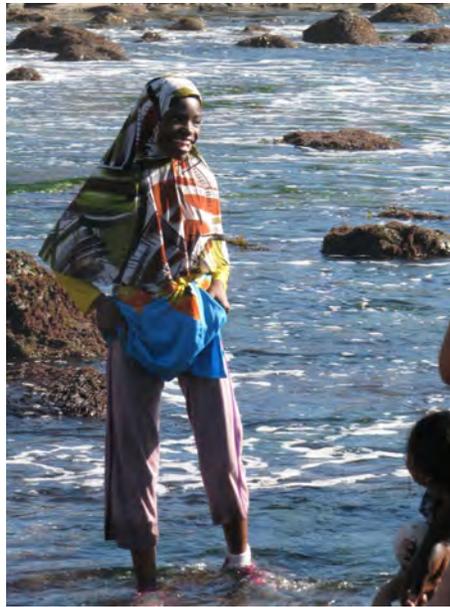
trekked down to the Cabrillo tide-pools. Warneke, along with dedicated members of the Volunteers-in-Parks program, guided the children on an exploration through the high, middle and low intertidal zones. Students discovered firsthand the power of ocean waves, the unique adaptations that organisms have to withstand the extremes of this area and the beauty found within each small pool.

Through the power of art and nature, the program connected with a special generation of environmental stewards.

Every student walked away fascinated with this watery world and eager to learn more. This partnership of the staff of SDRT, NPS Cabrillo education team and student ambassadors of Julian Charter School is a great example of the power of our national parks. What a great way to celebrate the NPS Centennial!

For more information on the Cabrillo Education Program and how to participate, please visit:

<http://www.cabrilloeducation.org>



The students spent their time both exploring nature as well as expressing themselves through art during their visit to Cabrillo National Monument's rocky intertidal environment. For some it was their first visit to the ocean. Photo credits: **left and center**, Jason Rogalski, Cabrillo National Monument Artist-in-Residence; **right**, San Diego Refugee Tutoring Program (SDRT)

"See Life" Collection

Cabrillo Artist-in-Residence, Michael Ready, uses the camera to document the biodiversity at the Cabrillo National Monument. He gets into the intertidal zone using it as a field studio to bring home images that share things a lot of people don't see. The "See Life" Collection is a unique project highlighting the stunning and diverse ecosystems and animals that call Cabrillo National Monument home. These images include some of

the commonly occurring and easily discovered species and others that are rarely seen due to their small size or ephemeral existence. Merging the worlds of science and art, "See Life" challenges us to take a closer look and garner a deeper appreciation for our diverse world.

Watch the NPS video:

<https://www.nps.gov/media/video/view.htm?id=892B358C-1DD8-B71B-0B0574F6E87F46E7>



A close-up view of a California two-spot octopus (*Octopus bimaculoides*), one of the images from the "See Life" Collection. Photo credit: Michael Ready, Cabrillo National Monument Artist-in-Residence.

Wildlife Stewardship Through Strategic Habitat Conservation and Partnership

Coastal habitats support 40% of the USFWS's Refuges and are vital to fish and wildlife because 40% of our Federally listed species, 25% of our wetlands and more than 30% of North American wintering waterfowl occur in our Nation's coastal areas. Coastal wetlands also provide important spawning grounds and nurseries for commercial and sport fish.

The USFWS's Coastal Program is the primary tool for voluntary, citizen and community-based fish and wildlife habitat conservation on both public and privately-owned land. The Coastal Program provides partnership, financial and technical assistance, for conservation and restoration of coastal habitats throughout the nation.

In 2015, 266 projects with 455 partners and landowners assessed, improved and protected more than 64,440 acres of wetlands, 29,910 acres of uplands and 194 miles of stream habitats across the United States. The 2015 Annual Accomplishment Report is available online: https://issuu.com/nationalwildliferefugesystem/docs/cp_2015_annual_accomplishment_repor/3?e=7776505/35263759



USFWS Coastal Program logo. Image credit: USFWS

USFWS Sea Turtle Conservation Hero Wins Lifetime Achievement Award

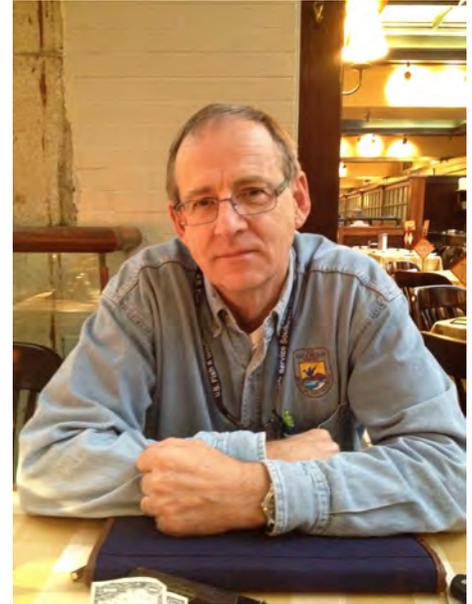
Inspirational for His Dedication, Vision and Passion

In March, USFWS biologist Earl Possardt was presented with the International Sea Turtle Society's Lifetime Achievement Award, one of the most prestigious awards in the sea turtle community.

Possardt is currently the USFWS International Sea Turtle Coordinator, a position he has held for the past 18 years; however, his sea turtle career and conservation accomplishments reach back much further, to the late 1980s, when he was based in Florida but working throughout the southeast United States as the USFWS Southeast Sea Turtle Coordinator.

As the USFWS Southeast Sea Turtle Coordinator, Possardt worked tirelessly to raise awareness and address the critical conservation issues facing sea turtles in the southeast United States after they were listed under the U.S. Endangered Species Act. Possardt was a key player in the vision and planning that led to the creation of the Florida Index Nesting Beach Program in 1989, a monitoring program that is now in its 28th year. The program has served as a model for the development of standardized nesting survey programs in many places around the world. Possardt's crowning achievement during his tenure in the southeast United States was his vision of a new National Wildlife Refuge for sea turtles along the high density nesting beaches of the central east coast of Florida.

Possardt lit the flame that galvanized action and support within the USFWS, DOI and U.S. Congress to



USFWS biologist Earl Possardt. Photo credit: USFWS

turn his dream into reality. In 1991 the Archie Carr Refuge was officially established; and, although it appropriately honors Dr. Carr, it also honors Possardt, without whom the opportunity to permanently protect the most important loggerhead nesting beaches in the world would likely have been lost. In the late 1990s Possardt took up the mantle of international sea turtle conservation for the USFWS and, as he had done in the southeast United States, he brought his wisdom, vision, can-do attitude and commitment to



Possardt on an African boat. Although many people were beginning to understand the global importance of beaches to the loggerhead sea turtle (*Caretta caretta*), Possardt had the foresight and vision to recognize that something permanent was needed to protect them in perpetuity. Photo credit: USFWS



Green Sea Turtle (*Chelonia mydas*) hatchling at USFWS Archie Carr Refuge. Photo credit: Keenan Adams

the global sea turtle community. It was Possardt's vision to expand the USFWS International Affairs Program to include sea turtles, and with help from the nongovernmental community, his vision became reality with the signing of the Marine Turtle Conservation Act (MTCA) in 2004. Through the MTCA, Possardt cooperatively worked on sea turtle conservation activities on every continent where sea turtles nest, forage or migrate.

More than just funding, Possardt has traveled the world to remote places planting the seeds of sea turtle protection with budding sea turtle conservationists and helping to instill in them the sense of wonder and desire to protect and conserve these animals that we love. His efforts have helped give people hope, and his friendships around the world are many and varied—all with their roots in sea turtles but with their branches extending far beyond.

His nomination for the award was written by Barbara Schroeder, who has worked closely with Possardt for more than 30 years. Schroeder wrote,

“Earl’s achievements are exemplary, far-reaching and meaningful, spanning four decades and crossing local, regional, national and international boundaries. He has left his mark, in his unassuming but expert and convincing way, in so many places and in so many people, from the beaches of Florida, to west Africa, to the Omani coast, to the remote beaches of Vietnam. He is a true example of all that is good about sea turtle conservation and sea turtle people and his legacy is significant and long-lasting. Earl’s unwavering commitment to sea turtles, his ability to galvanize action and commitment for their protection, and his vision for long-term sea turtle conservation programs and policies set him apart and make him wholly deserving of the International Sea Turtle Society Lifetime Achievement Award.”

Read more: <http://www.fws.gov/news/blog/index.cfm/2016/4/15/Sea-Turtle-Conservation-Hero-Wins-Lifetime-Achievement-Award>

Read about the Archie Carr Refuge: <http://www.fws.gov/archiecarr/>

Great Lakes Depth continued from page 17

The rocks turned out to be iron ore, and Cooper’s research points to the stranding of the steamer Marion, loaded with iron ore from Two Harbors, MN. She became grounded on a shoal off Raspberry Island on June 18, 1898, and had to dump part of her cargo in order to be towed off. There are records of other groundings off of Raspberry Island, but so far as is known, the Marion is the only one that carried iron ore.

According to Cooper, the Raspberry Island light keeper’s log for 1898 contains entries that document the grounding of the Marion on June 18, the arrival of a tug boat on June 20 to free her, and then the arrival a month later of officials from the hydrographic office in Duluth who were “trying to locate the cargo that was thrown overboard by the [Steamer] ‘Marina’ and the place she struck.” Note how the keeper now refers to the ship as the steamer “Marina” instead of “Marion.” That slight error made more than 100 years ago may be why current lake charts show the name “Marina Shoal” for this location. The shape world beneath the Great Lakes is a comparatively unexplored mystery. As part of the mission for conserving our cultural history, the NPS is exploring the submarine world, solving some mysteries and raising questions about entirely new ones.

Read about the GLRI: <https://www.glri.us/index.html>

Read about Great Lakes bathymetry: <https://www.ngdc.noaa.gov/mgg/greatlakes/greatlakes.html>

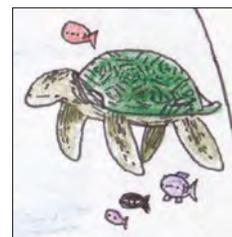


Illustration credit: Cole Goco

Celebrating Excellence in Protecting Wetlands—2016 National Wetlands Award Winners

By Chris Darnell (USFWS), Ann Tihansky (USGS)

On May 11, 2016, the Environmental Law Institute (ELI) held the 37th annual award ceremony recognizing five individuals who have excelled in wetlands protection, restoration and education. Two of the awards are highlighted here recognizing contributions to partnership work in conserving and restoring wetlands in the Great Lakes and community leadership in watershed restoration that provides downstream benefits to coral reefs.

Peter David of Odanah, WI, received the award for “Conservation and Restoration, recognizing his many contributions in the Great Lakes.” Peter David is a wildlife biologist with the Great Lakes Indian Fish and Wildlife Commission. For 30 years, he has fostered partnerships between Federal, State, county, and tribal agencies, nongovernmental organizations and concerned citizens to encourage wetland stewardship, research and restoration, with a primary emphasis on wild rice (known as manoomin, which translates to “the good berry” in Ojibwe). This plant has significant ecological and cultural importance in the upper Midwest. He is considered by many to be one of the country’s foremost experts in rice ecology and conservation. David was intricately involved in establishing the Circle of Flight Program, which became the primary funding source for regional tribal wetland conservation efforts. He was a technical advisor for the Wild Rice Monitoring Handbook and Field Guide and was the lead author of a report identifying and describing more than 300 northern Wisconsin manoomin waters. He coordinates a cooperative interagency restoration program



John Schmerfeld (USFWS), at left, presents the Conservation and Restoration award to Peter David. Photo credit: Environmental Law Institute (ELI)

that has increased rice abundance in Wisconsin and the Upper Peninsula of Michigan by 25%.

John Schmerfeld, USFWS Chief of Habitat Restoration, presented the award saying, “several of Peter’s colleagues heaped praise on him, but I wanted to share one that struck a chord with me:

“Peter’s technically solid and even-keeled approach to conservation issues goes a long way to calming the waters and getting people to talk to each other. He’s a valuable mediator between environmental groups, tribes, and state and federal managers. These inter-personal skills are harder to quantify than his scientific achievements, but in many ways they may be his most valuable contributions to the preservation and management of wild rice.”

The “Wetland Community Leader” award was presented to Roberto Viqueira of Yauco, Puerto Rico, by Eileen Soback, Assistant Administrator for NOAA Fisheries and co-chair of the U.S. Coral Reef Task Force.

Roberto Viqueira is the founder of the nonprofit *Protectores de Cuencas*



Eileen Soback (NOAA) presents the Wetland Community Leader award to Roberto Viqueira. Photo credit: Environmental Law Institute (ELI)

(Watershed Protectors), a science and community-based nonprofit dedicated to supporting wetland conservation and restoration throughout Puerto Rico. After serving as the coordinator for the Guánica Bay Watershed, which was designated the first U.S. Coral Reef Task Force Watershed Partnership Initiative site in 2009, he has expanded his work to wetland sites across Puerto Rico. Through partnerships and leveraging more than \$7 million in funding from numerous Federal and local agencies, he has reduced pollution to the Guánica Bay by preserving Guánica Lagoon, creating sewage treatment wetlands and launching the “Think Before You Drop It” campaign with NOAA to reduce marine debris. He also promotes sustainable agricultural practices such as shade-grown coffee through the development of a certification program and has helped develop a regionally adapted hydroseed for shoreline stabilization, beach restoration and habitat rehabilitation.

This awards program is administered by the ELI and supported by the EPA, USFWS, USFS, Natural Resources Conservation Service, NOAA Fisheries, and Federal Highway Administration.

Learn more: <http://elinwa.org/2016-national-wetlands-awards-winners>



Illustration credit: Cole Goco



Regional Contacts

DOI leadership supports state-led regional ocean partnerships (ROPs), as well as Federal-state-tribal marine planning partnerships called regional planning bodies (RPBs). Five geographic regions now have operational RPBs: Northeast, Mid-Atlantic, Caribbean, the Pacific Islands and the West Coast.

Alaska/Arctic

Jim Kendall (BOEM)
(Alaska)

Caribbean

Sherri Fields (NPS)
(Puerto Rico, U.S. Virgin Islands)
ROP: <http://caribbean-mp.org/en/>

Great Lakes

Phyllis Ellin (NPS)
Charlie Wooley (USFWS)
(Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin)
Great Lakes Research Initiative:
<http://www.epa.gov/glnpo/glri/>
ROP: <http://www.cglg.org/>

Gulf of Maine

Walter Barnhardt (USGS)
(Maine, New Hampshire, Massachusetts, New Brunswick, Nova Scotia)
ROP: <http://www.gulfofmaine.org/2/>

Gulf of Mexico

Linda Walker (USFWS)
(Alabama, Florida, Louisiana, Mississippi, Texas)
ROP: <http://www.gulfofmexicoalliance.org>

Mid-Atlantic

Bob LaBelle (BOEM)
Leann Bullin (BOEM)
(New York, New Jersey, Delaware, Pennsylvania, Maryland, Virginia)
RPB: <http://www.boem.gov/Mid-Atlantic-Regional-Planning-Body/>
ROP: <http://midatlanticocean.org>

Northeast

Bob LaBelle (BOEM)
Leann Bullin (BOEM)
(Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut)
RPB: <http://neoceanplanning.org/>
ROP: <http://northeastoceanCouncil.org/>

Pacific Islands

Matt Brown (USFWS)
(American Samoa, Commonwealth of Northern Mariana Islands, Guam, Hawaii)
RPB: <http://www.PacificIslandsRPB.org>

South Atlantic

Eric Strom (USGS)
(North Carolina, South Carolina, Georgia, Florida)
ROP: <http://southatlanticalliance.org/>

West Coast

Joan Barminski (BOEM)
(California, Washington, Oregon)
RPB: <http://www.westcoastmarineplanning.org>
ROP: <http://www.westcoastoceans.org>

The Surfing Bison

Alaska's Maritime National Wildlife Refuge

https://www.fws.gov/refuge/Alaska_Maritime/

Take a virtual visit by watching this video:

<https://www.youtube.com/watch?v=rFzAJbFHJsY>



By Erica Wales (DOI)

The Alaska Maritime Refuge includes 3.4 million acres with volcanic islands in the Aleutians, steep cliffs in the Pribilof Islands and icebound lands in the Chukchi Sea. Volcanoes and earthquakes have shaped the Aleutians into a surreal landscape. The area is strikingly diverse with more than 2,500 islands, sea stacks and headlands. The Refuge was established to conserve marine mammals, seabirds and other migratory birds, and the marine resources upon which they rely. The Refuge is very remote and provides a safe haven for 40 million seabirds and more than 30 species.

Follow the Refuge on Facebook:
<https://www.facebook.com/Alaska-MaritimeNationalWildlifeRefuge>

Explore Other Alaskan Refuges

USFWS manages nearly 77 million acres in 16 Alaskan Refuges. Most of them include ocean and coastal resources.

Alaska Peninsula Refuge:
https://www.fws.gov/refuge/alaska_peninsula/

Arctic Refuge: <https://www.fws.gov/refuge/arctic/>

Yukon Delta Refuge: https://www.fws.gov/refuge/yukon_delta/

Becharof Refuge: <https://www.fws.gov/refuge/becharof/>



Murre colony in the Semidi Islands, part of the Alaska Maritime Refuge. Photo credit: Jeff Williams, USFWS



The view of "Islands of Four Mountains," a grouping of volcanoes on the eastern end of the Aleutian chain within the Alaska Maritime Refuge. Photo credit: Ed Bailey, USFWS

Izembek Refuge: <https://www.fws.gov/refuge/izembek/>

Kenai Refuge: <https://www.fws.gov/refuge/kenai/>



The researchers use the *R/V Tiglax* to travel across the Gulf of Alaska. Steller's sea lions (*Eumetopias jubatus*) bask in the sun. Photo credit: USFWS

Kodiak Refuge: <https://www.fws.gov/refuge/kodiak/>

Selawik Refuge: <https://www.fws.gov/refuge/selawik/>