



NEWSWAVE

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

NEWSWAVE—Winner of NAGC's 2015 Blue Pencil Award

Winter 2016

“Atlantic Canyons” Study Team Receives “Excellence in Partnering Award”



Recipients of the 2015 NOPP Award and representatives of sponsoring agencies gathered at the Ocean Sciences 2016 meeting in New Orleans for the ceremony. Left to right: Kasey Cantwell (NOAA); Marjorie Weisskohl, Greg Boland and Jack Irion (BOEM); Steve Ross (UNCW); Steve Viada (Continental Shelf Ocean Sciences); Sandra Brooke (FSU); Rodney Cluck (BOEM); Craig Robertson (Bangor University, UK); Amanda Demopoulos (USGS); Liz Baird (N.C. Museum of Natural Sciences); Ivar Babb (UConn-Avery Point); and Alan Leonardi (NOAA). Photo credit: Barbara Bischof, NOPP

See Award page 7

NPS Climate Change Adaptation Strategies

By Rebecca Beavers (NPS), Maria Caffrey (UC-Boulder), Jessica Kershaw (DOI), Jeffrey Olson (NPS), Courtney Schupp (NPS)

The National Park Service (NPS) is taking a variety of actions and strategies to address climate change threats to park infrastructure, recreation, and natural and cultural resources.

A new report, released in November 2015, “Coastal Adaptation Strategies: Case Studies,” was compiled to inspire action, innovation, and dialogue among park managers and other coastal management agencies that are responsible for protecting natural and cultural resources. It will serve as another tool for frontline managers—the park superintendents—to use in tackling diverse coastal challenges.



Investment in repairs to Fort Jefferson, at Dry Tortugas National Park in South Florida, should consider historical integrity and long-term sustainability of the structure and the island, which are vulnerable to climate change impacts. Photo credit: Marcy Rockman, NPS

See Climate Change page 4

Historic Agreement with Cuba Connects Marine Protected Areas

By Jonathan Putnam (NPS)

The marine and coastal ecosystems of Cuba are less than 100 miles south of Dry Tortugas National Park and the Florida Keys National Marine Sanctuary and only slightly farther from the Everglades and Biscayne National Parks. Although managed by two different nations, ocean currents and the movements and migrations of numerous species of wildlife inextricably link these protected areas.

The newly re-opened relationship between the United States and Cuba has created an exciting opportunity between our two nations to collaborate



Pedro Ramos, Superintendent of Everglades and Dry Tortugas National Parks (seated at left) signs the Memorandum of Understanding with Cuba on November 18, 2015. Photo credit: George Schmahl, NOAA

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Illustration credit: Cole Goco



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Frontlines of Climate Change: U.S. Virgin Islands

The U.S. Virgin Islands are a tropical oasis of sandy beaches and warm crystal clear waters. Yet, coral bleaching is becoming more frequent, and seven species of coral found in the Caribbean are now listed as threatened. Rising seas put the U.S. Virgin Islands National Park at risk from erosion. These effects harm the natural resources and also impact the local economy. In March, Interior announced a new grant of more than \$825,000 to the U.S. Virgin Islands to help the islands adapt and plan for climate change.



Mangroves in the U.S. Virgin Islands host a diverse community of corals and other tropical aquatic species. Read more: <https://www.doi.gov/blog/frontlines-climate-change-us-virgin-islands> Photo credit: NPS

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

Visit us online:

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

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Cuba continued from page 1

in protecting these ecosystems and the species that rely on them for survival. On Wednesday, November 18, 2015, Pedro Ramos, Superintendent of Everglades and Dry Tortugas National Parks joined the National Oceanic and Atmospheric Administration (NOAA) in Havana, Cuba, to sign a Memorandum of Understanding (MOU) with Cuba's National Center for Protected Areas on cooperative marine conservation. The MOU will guide efforts to share information ranging from scientific research to education and outreach materials—all of which will help our two countries better manage some of the most ecologically-significant protected areas in the world.

This new agreement establishes “Sister Park” and “Sister Sanctuary” relationships between protected areas in Cuba (Guanahacabibes National Park and Banco de San Antonio) and the Gulf of Mexico and South Florida (Dry Tortugas, Everglades and Biscayne National Parks and Florida Keys and Flower Garden Banks National Marine Sanctuaries). Through this MOU, it will be easier for marine protected area (MPA) managers and scientists in the United States and Cuba to learn from one another's experience.

“Cooperation among protected area managers of Cuba and U.S. national park and marine sanctuaries is a great way to preserve our shared natural heritage of the wider Caribbean and Gulf of Mexico regions. After all, fish, marine mammals, sea turtles, birds and other marine life exist in ecosystems that rarely fall within maps drawn by man,” said NPS Director, Jonathan B. Jarvis.

Marine parks in Cuba protect some of the healthiest and most pristine coral reefs and coastal wetlands in the Caribbean. Guanahacabibes National Park, one of Cuba's largest protected areas, was declared a Biosphere Reserve by UNESCO in 1987. With



Attending the ceremony, from left to right: Pedro Ramos, Superintendent of Everglades and Dry Tortugas National Parks; Carlos Alberto Diaz Maza, Director, National Center for Protected Areas; Dr. Kathryn Sullivan, Administrator, NOAA; Jeffrey DeLaurentis, the Chargé d'Affaires at the U.S. Embassy in Havana, Cuba; Maritza Garcia Garcia, President, Environment Agency; and John Armor, Acting Director, Office of National Marine Sanctuaries, NOAA. Photo credit: NOAA

its diverse marine and coastal habitats, the park is one of the most important places in Cuba where sea turtles come ashore to lay eggs and protects one of Cuba's healthiest coral reef ecosystems. The offshore Banco de San Antonio supports a lush coral reef ecosystem at the confluence of the currents that flow from the Caribbean into the Gulf of Mexico, which have significant influences on the condition of coral reefs in the Gulf of Mexico and South Florida.

More than 20,000 NPS employees care for 409 parks in America's National Park System and work with communities across the Nation to help preserve local history and create close-to-home recreational opportunities.

Visit the NPS at <http://www.nps.gov/>, on Facebook <http://www.facebook.com/nationalparkservice>, Twitter <http://www.twitter.com/NatlParkService>, and YouTube <http://www.youtube.com/nationalparkservice>

The **Memorandum of Understanding** should help facilitate the following cooperative activities:

- Exchange of information (including technical and scientific data, and best practices and experience about MPAs, including staff exchanges and site visits)
- Development of common “best practice” guidelines and methodologies for natural and cultural resource protection within MPAs

Also, the MOU should assist with development, coordination, and evaluation of complementary activities related to:

- research and monitoring,
- outreach and education,
- enforcement methodologies,
- performance assessments, and
- community involvement mechanisms for MPAs, and
- joint publications on the results of collaborative research and management by the participants.

Climate Change continued from page 1



A great blue heron is silhouetted by a sunset in west-central Florida. Photo credit: Cliff Harrison

“What’s happening in our national parks is a small window into the impacts of climate change on natural and cultural resources around the world,” said Secretary Jewell when she highlighted the report during the 21st Conference of Parties (COP21) of the United Nations Framework Convention on Climate Change Conference in Paris this past December. “This report offers positive examples of what we can do, at a local level, to adapt and build resilience in the face of a changing climate—even as we work to curb carbon pollution around the world.”

A total of 24 case studies in the report describe actions used by NPS managers to combat climate change in an already dynamic coastal zone. A few examples include: Everglades National Park in Florida—a World Heritage Site—has the plans for a new visitor’s facility in the Flamingo area that incorporates an elevated design to help reduce the risks from sea-level rise and storm surges; Gateway National Recreation Area in New York has restored salt marsh elevation in Jamaica Bay through the addition of sediment and vegetation; and the National Park of American Samoa in Ofu, part of the American Samoa islands, has a lab that operates a facility that works on unique adaptations of Ofu corals and determines the cause of coral loss and damage.

“Sea level changes are subtle at some parks but already destructive at others where we are losing shoreline and infrastructure and where historical and cultural resources are also at risk,” NPS Director, Jonathan B. Jarvis, said. “The upside is that we’re taking positive action as the result of adaptation planning we began in the National Park Service several years ago. This report illustrates actions we have underway to adapt to our changing climate, and as best we can, to preserve and protect the resources of our coastal parks.”

The report comes in advance of the NPS 100th anniversary in 2016 and is part of Director Jarvis’ Call to Action, in which the NPS has already highlighted a need to plan for climate change.

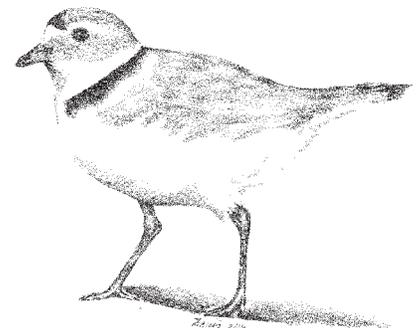
The report is available at <http://www.nps.gov/subjects/climatechange/coastaladaptationstrategies.htm> and it follows a recent NPS study (http://www.nature.nps.gov/geology/coastal/coastal_assets_report.cfm) that revealed sea-level rise caused by climate change could pose a risk to more than \$40 billion worth of national park assets and resources.

Smart Science: App Helps Protect Shorebirds

Have you ever visited a beach and wondered where the waves carry all that sand? On a college camping trip, curiosity about waves and sand sparked Rob Thieler’s desire to study shorelines around the world. Thirty years later as a U.S. Geological Survey (USGS) research geologist, Thieler is combining science and smartphone technology to help study a threatened bird: the Atlantic Coast piping plover.

The piping plover is an iconic shorebird that breeds along the Atlantic Coast, Great Lakes and Great Plains. Rising sea levels and storm surges associated with climate change, as well as increased development in their beach habitats, threaten the species. To help track changes in piping plover habitat, Thieler developed a free app called iPlover. In 2012, Thieler—who never thought that, as a scientist, he would build a smartphone app—decided to make an app with his USGS colleagues to collect habitat data along a long swath of the Atlantic Coast. Using the app is a marked change from the typical way scientists collect data, which involves gathering information using specialized equipment or writing in field notebooks and then transcribing into spreadsheets. *See related story, page 5.*

Read about iPlover: <https://www.doi.gov/blog/smart-science-app-helps-protect-shorebirds>



Piping plover sketch. Illustration credit: Carolyn Zaino

Atlantic Piping Plover Workshop Brings Shorebird Conservation Community Together: Celebrating Milestones and Informing Population Recovery

By Ann Tihansky (USGS), Meagan Racey (USFWS)

Just 30 years ago, the future of the piping plover looked very grim. With just 550 breeding pairs surviving in the United States along the Atlantic Coast, the shorebird was listed as threatened in 1986. Decades later, the outlook has significantly changed for the better—with many biologists believing recovery is in sight.

The piping plover breeding population has more than doubled along the Atlantic Coast thanks to years of dedicated conservation efforts and cooperation of beach communities and visitors. The increase is due to the cooperative work among local, state and Federal agencies, conservation organizations, private landowners, and beach managers in key activities used to manage beaches areas. These include installing symbolic fencing around courtship and nesting areas, requiring dogs to be on leashes, posting signs and keeping other disturbances out of nesting and chick-rearing areas on both public and private coastal lands.

One key component to this conservation success has been close coordination by Anne Hecht, the U.S. Fish and Wildlife Service (USFWS) piping plover recovery coordinator. For 20 years, Hecht has run a biennial Atlantic Coast Piping Plover and Least Tern Workshop. Hecht brings together a wide variety of scientists, land managers, biologists, conservationists, researchers and other partners to share science, management successes and challenges, and develop strategies that will inform and push progress closer to recovery. The workshop is

an important way to measure success, keep track of activities and energize team collaborations and partnerships.

This year's workshop was held January 12–15 at the National Conservation Training Center in Shepherdstown, WV. The agenda included large plenary sessions, extended small group meetings and interactive group activities. The different formats facilitated exchange and networking among the multiple participants and conservation groups they represented on topics ranging from habitat conservation and predator management to community education and engagement and tools and methods for data collection, analysis and exchange.

“The workshop is an important way to bring everyone together to meet and share findings, resources, techniques and messages. The expertise within the group helps us identify needs and design tools and data collection methods to fill them,” said Hecht. “Across the species' range there are common challenges but also some important differences. Meeting face-to-face expands the perspective of the participants and provides opportunities for feedback from colleagues. These interactions are critical to supporting piping plover recovery.”

The workshop isn't only about current issues and challenges for conserving piping plovers but also about other beach species—such as the least tern, rufa red knot and seabeach amaranth (a plant)—that also rely on habitat at many Atlantic Coast piping plover sites.

See Plover Workshop page 6

“Throughout much of its range, progress towards recovery of Atlantic coast piping plovers has occurred when research findings and field observations made over the past 30 years are effectively applied to state and federal regulatory tools.”

—Dr. Scott M. Melvin, 2013 USFWS Recovery Champion



Abigail Darrah, a postdoctoral research associate at the State University of New York, was recognized at the 2016 Atlantic Piping Plover Workshop with the Scott M. Melvin award. Photo credit: Ann Tihansky, USGS

Meeting participants recognized Abigail Darrah with the Scott M. Melvin award for the most valuable contribution to applied piping plover conservation. Darrah, a postdoctoral research associate at the State University of New York, is working on a decision-support tool to help managers use site-specific information to determine when benefits of exclosures from increased hatching outweigh the risks to adult survival.

The award was established in memory of a founding member of the Atlantic Coast piping plover recovery team and leader in research and management for the shorebird. Hecht said Dr. Melvin regularly touted research that was “news you could use” to better inform conservation implementation.

Learn more: <https://www.fws.gov/angered/what-we-do/recovery-champions/2013.html>

Plover Workshop continued from page 5

Dr. Scott M. Melvin, a 2013 USFWS Recovery Champion, provided leadership through the Massachusetts Division of Fisheries and Wildlife, which was integral to the more than four-fold increase in the Massachusetts plover population. The State's success has led to the development of a draft statewide habitat conservation plan that will shape the future for plover conservation.

"We aim to achieve this long-term security throughout the species' range," Hecht said. The plan demonstrates commitment to balancing recreation and conservation by increasing flexibility for beach managers and ensuring protections for the plover population that depends on those beaches every summer.

The conservation plan was among a list of major topics discussed at the workshop along with improving recovery methods and advancing work with the latest science. *See related story, page 4.*

"Several population trends, especially in New England and the southern part of the breeding range from Delaware to North Carolina, demonstrate that reaching recovery goals for the Atlantic Coast piping plover is possible," Hecht said. "With vigorous work by beach managers, additional cooperation from beachgoers and long-term commitments from the states and federal agencies, including in its wintering range, we could assure the long-term security of this species in as little as two decades."

Learn more about the piping plover: <http://www.fws.gov/northeast/pipingplover/>



Illustration credit: Cole Goco

Atlantic Piping Plover Key Milestones

Protected for 30 years—The piping plover was listed as a protected species under the Endangered Species Act (ESA) on January 10, 1986. Along the Atlantic Coast, it is designated as threatened, which means that the shorebird is likely to become endangered in the foreseeable future. The ESA raises awareness about the need for national and international cooperation and coordination of conservation efforts, enhances research programs and encourages the development of conservation measures that could help slow habitat loss and population declines.

Despite much progress, plovers continue to lose sandy beach habitat, endure disruptions that prevent them from feeding and raising families, and lose large numbers of eggs, chicks and even adults to artificially high numbers of predators.

The ESA also includes regulatory protections regarding import, export and the "take" (killing, harming, harassing or pursuing), and requires Federal agencies to conduct their activities in such a way that conserves listed species.

The 1996 recovery plan and 2009 status review outlined key steps necessary to ensure the future of the Atlantic Coast piping plover.

Migratory Bird Treaty Celebrates the 100 Years—The Treaty was signed in 1916 by the United States and Great Britain, who also acted on Canada's behalf. This treaty was the first major legislation in the United States that protected the birds that migrated across its borders. The act banned the pursuing, hunting, capturing, selling, purchasing, importing and

exporting of designated birds, eggs or nests. The treaty stopped the hunting of birds, like hummingbirds and bluebirds, and also established hunting seasons for other birds.

The 2016 International Piping Plover Census—The 2016 winter census led by the USGS, USFWS, Bahamas National Trust, and National Audubon Society is a widespread effort to count plovers across their wintering range every five years. From January 18–February 1, 2016, staff and volunteers surveyed for piping plovers, Wilson's plovers, and snowy plovers throughout their Atlantic and Gulf Coast winter ranges that include the Bahamas and Caribbean. Censuses like this provide a snapshot of bird populations and document important wintering habitats. Previous surveys have informed significant conservation outcomes, such as the recent establishment of the Bahamas' Joulter Cays National Park, which provides an important wintering ground for piping plovers.

More About Plovers

Enjoy some images, learn more about threats to piping plovers, and discover what you can do to help:

<https://www.audubon.org/field-guide/bird/piping-plover>

<http://www.bnt.bs/Piping-Plover>

The International Piping Plover Census Flickr photo collection:

<https://www.flickr.com/photos/usfwsnortheast/sets/72157629058919613/>

The NPS photo essay:

http://www.nps.gov/featurecontent/caco/plover_slideshow.html

USFWS Recovery Champions:

<https://www.fws.gov/endangered/what-we-do/recovery-champions/index.html>

Award continued from page 1

“Atlantic Canyons” Study Team Receives “Excellence in Partnering Award”

The National Oceanographic Partnership Program Honored BOEM, NOAA, USGS and 14 Other Organizations

By Marjorie Weisskohl (BOEM)

On February 23, the Bureau of Ocean Energy Management (BOEM), NOAA, the USGS and scientists and communicators from 14 other organizations received the National Oceanographic Partnership Program (NOPP) 2015 Excellence in Partnering Award during a ceremony held at Ocean Sciences 2016 meeting in New Orleans.

The partnership between these organizations was recognized for their work in conceiving, managing and conducting the “Atlantic Canyons: Pathways to the Abyss” project over a four year period.

Through close collaboration, the diverse team accomplished what no one organization could have done alone. This multi-year effort leveraged the resources of the BOEM, USGS, NOAA’s Office of Ocean Exploration and Research, 12 universities and research institutions, and two companies to explore Baltimore and Norfolk Canyons about 60 miles offshore of Maryland and Virginia. The work took place under the NOPP research umbrella.

Opening the ceremony, Dr. Rodney Cluck, Chief of BOEM’s Division of Environmental Sciences and co-chair of the NOPP, praised the achievement

as embodying the goals and ideals of the NOPP Act, promoting national goals of “assuring national security, advancing economic development, protecting the quality of life, and strengthening science education and communication through improved knowledge of the ocean. By sharing resources, intellectual talent, and facilities in ocean sciences and education, optimal use can be made of the most important natural resources for the wellbeing of all Americans.”

The Atlantic Canyons research findings are significant and depict a biologically rich region that had not been fully explored in the past, including historically important shipwrecks, extensive deep-sea coral communities, and a vast methane-seep ecosystem. Explore the backstory and many of the exciting discoveries from this project by watching the 23-minute video:

<https://vimeo.com/128444694>

Read more:

See related story, page 28.

<http://www.boem.gov/press02042016/>

<http://www.nopp.org/2016/2015-excellence-in-partnering-award-winner/>

<http://osm.agu.org/2016/>



Nancy Prouty (USGS) collects water samples from different water depths. Photo credit: Art Howard and the Deepwater Canyons—Pathways to the Abyss, NOAA-OER/BOEM/USGS



Archaeologist James Moore (BOEM) lays out survey track lines and interprets multibeam data in the May 2013 excursion, hoping to identify new shipwrecks. Image courtesy of Deepwater Canyons 2013—Pathways to the Abyss, NOAA-OER/BOEM/USGS



Jennifer McClain (USGS), Jill Bourque (USGS), and Amanda Dempoulos (USGS) work with a sediment sample collected by the ROV Jason. Photo credit: Art Howard and the Deepwater Canyons—Pathways to the Abyss, NOAA-OER/BOEM/USGS



Steve Ross (center) (UNC-Wilmington), Esprit Saucier (Univ. of LA-Lafayette), John Tomczuk (NOAA), Katharine Coykendall (USGS), and Cheryl Morrison (USGS) work to identify species found while trawling. Photo credit: Deepwater Canyons 2013—Pathways to the Abyss, NOAA-OER/BOEM/USGS

Find Your National Ocean and Coastal Park!

It might be a National Seashore or Lakeshore, a Monument or National Historic Site.

There are 88 National Park units across the United States that have a coastal or ocean component.

Read more: <http://www.nature.nps.gov/water/oceancoastal/oceancoastalmap.cfm>

NPS Ocean or Coastal Park Name	State
Aniakchak National Monument and Preserve	AK
Bering Land Bridge National Preserve	AK
Cape Krusenstern National Monument	AK
Glacier Bay National Park and Preserve	AK
Katmai National Park and Preserve	AK
Kenai Fjords National Park	AK
Klondike Gold Rush National Historical Park	AK
Lake Clark National Park and Preserve	AK
Sitka National Historical Park	AK
Wrangell-St. Elias National Park and Preserve	AK
World War II Valor in the Pacific National Monument	AK, HI, CA
National Park of American Samoa	AS
Cabrillo National Monument	CA
Channel Islands National Park	CA
Fort Point National Historic Site	CA
Golden Gate National Recreation Area	CA
Point Reyes National Seashore	CA
Port Chicago Naval Magazine National Memorial	CA
Redwood National Park	CA
Rosie the Riveter/World War II Home Front National Historical Park	CA
San Francisco Maritime National Historical Park	CA
Santa Monica Mountains National Recreation Area	CA
Big Cypress National Preserve	FL
Biscayne National Park	FL
Canaveral National Seashore	FL
Castillo de San Marcos National Monument	FL
De Soto National Memorial	FL
Dry Tortugas National Park	FL
Everglades National Park	FL
Fort Caroline National Memorial	FL
Fort Matanzas National Monument	FL
Timucuan Ecological and Historic Preserve	FL
Gulf Islands National Seashore	FL, MS
Cumberland Island National Seashore	GA
Fort Frederica National Monument	GA
Fort Pulaski National Monument	GA
War in the Pacific National Historical Park	GU
Haleakala National Park	HI
Hawaii Volcanoes National Park	HI

NPS Ocean or Coastal Park Name	State
Kalaupapa National Historical Park	HI
Kaloko-Honokohau National Historical Park	HI
Pu'uhonua o Honaunau National Historical Park	HI
Pu'ukohola Heiau National Historic Site	HI
Minidoka National Historic Site	ID, WA
Indiana Dunes National Lakeshore	IN
Jean Lafitte National Historical Park and Preserve	LA
Acadia National Park	ME
Saint Croix Island International Historic Site	ME
Fort McHenry National Monument and Historic Shrine	MD
Harriet Tubman Underground Railroad National Monument	MD
Assateague Island National Seashore	MD, VA
Boston Harbor Islands National Recreation Area	MA
Boston National Historical Park	MA
Cape Cod National Seashore	MA
New Bedford Whaling National Historical Park	MA
Salem Maritime National Historic Site	MA
Saugus Iron Works National Historic Site	MA
Isle Royale National Park	MI
Pictured Rocks National Lakeshore	MI
Sleeping Bear Dunes National Lakeshore	MI
Grand Portage National Monument	MN
Gateway National Recreation Area	NJ, NY
Fire Island National Seashore	NY
Governors Island National Monument	NY
Sagamore Hill National Historic Site	NY
Statue of Liberty National Monument	NY
Cape Hatteras National Seashore	NC
Cape Lookout National Seashore	NC
Fort Raleigh National Historic Site	NC
Perry's Victory and International Peace Memorial	OH
Lewis and Clark National Historical Park	OR, WA
San Juan National Historic Site	PR
Charles Pinckney National Historic Site	SC
Fort Sumter National Monument	SC
Big Thicket National Preserve	TX
Padre Island National Seashore	TX
Buck Island Reef National Monument	U.S. VI
Christiansted National Historic Site	U.S. VI
Salt River Bay National Historical Park and Ecological Preserve	U.S. VI
Virgin Islands Coral Reef National Monument	U.S. VI
Virgin Islands National Park	U.S. VI
Colonial National Historical Park	VA
Fort Monroe National Monument	VA
George Washington Birthplace National Monument	VA
Ebey's Landing National Historical Reserve	WA
Olympic National Park	WA
San Juan Island National Historical Park	WA
Apostle Islands National Lakeshore	WI

Resources to Support Living Shorelines

To promote living shorelines, the USFWS Coastal Program worked with the NOAA, Florida Department of Environmental Protection, The Nature Conservancy and others to develop a website with the purpose of informing coastal property owners about the benefits of living shorelines, restoration techniques, and resources that are available to help them create living shorelines. The techniques described on this site, referred to as living shoreline treatments, can be used in relatively low wave energy

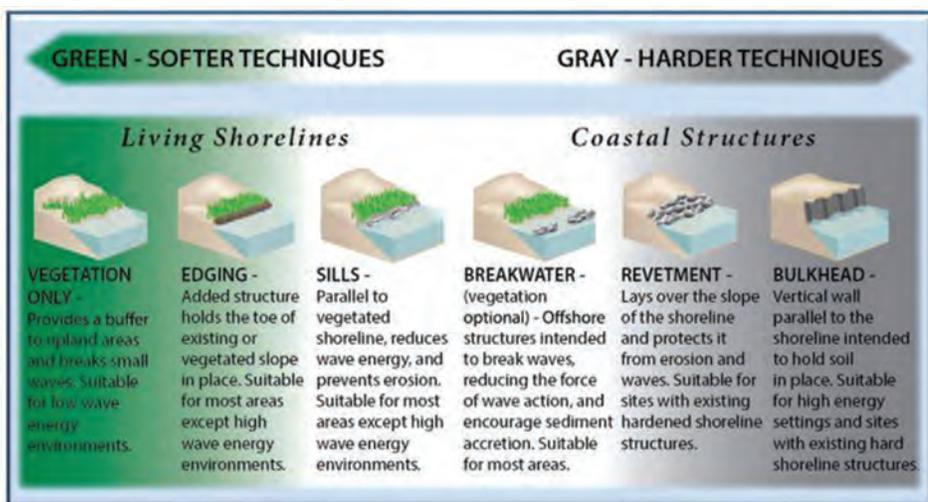
areas instead of traditional coastal armoring systems, such as seawalls and bulkheads. They can also help enhance natural habitat for fish, birds, and other wildlife—creating living, thriving shorelines.

Learn more about the Systems Approach to Geomorphic Engineering (SAGE): <http://sagecoast.org/index.html>

Read more: <http://FloridaLiving-Shorelines.com>



The USFWS Coastal Program worked with the Maryland Department of Natural Resources, Ducks Unlimited, the National Aquarium and 20 partners to implement the Hail Cove Living Shoreline Project in Maryland. The project created 4,000 feet of living shoreline that protects a highly vulnerable shoreline on the Eastern Neck National Wildlife Refuge and more than 400 acres of high quality tidal marsh and submerged aquatic vegetation in the Chester River. Photo credit: USFWS



An alternative to hardened shorelines, living shorelines use materials like oyster reefs, sand and stone, and aquatic and wetland plants, instead of rip-rap, bulkheads or concrete walls. Unlike more structural approaches, living shorelines maintain shoreline processes and provide habitat for aquatic and riparian species. Living shorelines can also improve water quality and be more cost effective. Read more: http://www.habitat.noaa.gov/pdf/noaa_guidance_for_considering_the_use_of_living_shorelines_2015.pdf Image credit: NOAA



Volunteers planting coir fiber logs for a living shoreline project in Maryland. Photo credit: Chesapeake Bay Foundation

National Ocean and Coastal Park continued from page 8



A baby sea turtle swims in the moat surrounding Fort Jefferson at Dry Tortugas National Park. Photo credit: Brett Seymour, NPS

Warm Water Refuges for Florida Manatees

By Kaitlin Kovacs (USGS)

Florida manatees (*Trichechus manatus latirostris*) are a sub-species of the West Indian manatee. They are large, gentle, herbivorous, slow-moving mammals that live in shallow fresh, brackish, and marine aquatic habitats. Most of their time is spent traveling, resting, and eating. They can even consume up to 10–15% of their body weight in vegetation. They favor areas of seagrass beds or freshwater vegetation because they eat a large variety of submerged, emergent, and floating plants. They are entirely aquatic, and their range is limited by temperature. Manatees cannot survive for extended periods in water colder than about 63°F and prefer temperatures warmer than 72°F. In Florida, they travel considerable distances during the winter to access warm water refuges, such

as artesian springs like Three Sisters Springs in the Crystal River National Wildlife Refuge (NWR) Complex. The springs are an important warm water winter refuge for manatees. The refuge was established in 1983 specifically for the protection of the endangered West Indian Manatee

Almost Four Decades of Manatee Research

For nearly four decades, researchers with the USGS Sirenia Project have been committed to understanding the biology and ecology of the West Indian manatee to aid managers in actions that could best help the population. Through long-term, detailed studies on the life history, population dynamics, and ecological requirements of the manatee, USGS scientists work cooperatively with Federal and state biologists and managers on research identified as essential for the recovery of the species. To do this, the

USGS manatee researchers rely on a variety of tools and techniques that come together to form the expertise of the Sirenia Project.

Measuring Manatee Health

Through a collaborative effort between Federal, state, and local government agencies and institutions, USGS researchers use manatee captures and health assessments to gather a wide variety of information on this aquatic mammal. During the last decade, the USGS has successfully captured, examined, and released 201 manatees in Crystal River, Florida, creating an extensive sample and data archive that will be used in the future to gauge the health and status of the population. Of those 201 manatees, 120 were males and 81 were females. Research in the Crystal River and Gulf of Mexico is providing needed baseline health information on West Indian manatees. 2016 is the ninth year of the wild manatee study at the Crystal River NWR.



The aqua blue water of Three Sisters Springs is visible in the foreground of this aerial view of the Crystal River National Wildlife Refuge Complex. Photo credit: USFWS

Manatee Medical Exams

A manatee physical exam includes the following:

- General appearance and activity
- Body condition scoring
- Photo-documentation of lesions and wounds
- Heart/pulse rate
- Respiratory rate
- Temperature
- Body weight
- Complete body measurements (length and girths)
- Eye exam
- Implantation of PIT tags
- Subcutaneous blubber layer measurements
- Analysis of blood, feces, urine, milk and skin
- Reproductive parameters and status

Ready for a Close-Up

Manatees aren't strangers to the camera. The Manatee Individual Photo-identification System (MIPS) is a database containing photographs and life-history information for more than 3,000 individual manatees. As seen in the video, USGS researchers sketch and take photos of the prominent scars and injuries that result primarily from boat propellers or becoming entangled in abandoned fishing gear. These scars allow the researchers to identify individual manatees in the MIPS database and effectively monitor the population. This information is used to estimate adult survival and reproductive rates and study the life history of manatees.

Tag, You're It

Radio and satellite tracking allows the researchers to document manatee movement and habitat use patterns. Tagging manatees can reveal travel pathways and the time they spend in

each area. When coupled with the distribution of resources, such as seagrasses and fresh water, this information is valuable to environmental managers to determine the resources that manatees use most. Tracking information can be used not only to protect habitat, but also the manatees themselves, by showing where they may come into conflict with watercraft or other potential hazards.

Caribbean Cousins

Genetics are another important tool when it comes to managing an imperiled species like manatees. Such studies have found that there is low genetic diversity in the Florida manatee population. Genetics help USGS researchers follow a manatee's life history, without using marks on its body, to better assess the population and help determine genetic relationships between the Antillean manatee—the second sub-species of the West Indian manatee—and the Florida manatee.



Visit With A Manatee

Winter time at the Crystal River NWR is a good time to see manatees because many visit this area for the warm water refuge.

If you can't visit in person, there are a few ways to visit virtually.

Videos:

Take a swim with manatees at the Crystal River NWR without getting wet in this USGS Magical Manatees video: http://www.usgs.gov/blogs/features/usgs_top_story/magical-manatees/?from=title

A tour of the Three Sisters Springs:

The "Friends of Crystal River" organization has created a "Virtual Swim with the Manatees" so you can visit the area through interactive multimedia: <http://www.friendsofcrystalriver.org/tour/ThreeSistersSprings.html>

Learn more:

http://www.fws.gov/refuge/Crystal_River/wildlife_and_habitat/Florida_Manatee.html

http://www.fws.gov/news/ShowNews.cfm?_ID=35428

Learn about manatee manners:

http://www.fws.gov/refuge/Crystal_River/Multimedia/Manatee_Manners_Videos.html

For more manatee multimedia:

http://www.fws.gov/refuge/Crystal_River/multimedia.html



During the winter, manatee populations migrate to the Crystal River National Wildlife Refuge. This unique refuge preserves the last unspoiled and undeveloped habitat in Kings Bay, which forms the headwaters of the Crystal River along Florida's west coast.

Left, manatees rest in the clear spring water of Three Sisters Springs. Photo credit: David Hinkel, USFWS. **Right**, an aerial view of manatees congregating in the shallow protected zone near the outflow of Three Sisters Springs where curious snorkelers can get a close-up view. Photo credit: USFWS. **Top right**, the head of a manatee is bulbous with deeply-set, small eyes that have no visible upper or lower lids. Inconspicuous ear openings are located just behind the eyes. Even though the ears are small and lack external lobes, manatees can hear well and communicate through different squeaks, chirps, grunts, and groans that are within human audible range. Two nostrils located on the upper snout are tightly closed when underwater. The manatee uses the short, stiff bristles and the enlarged, lobed upper lip with muscular prehensile pads to locate and feed on aquatic vegetation. Photo credit: Robert Bonde, USGS

Marshes to Mudflats— New Study

By 2110 Sea-Level Rise Will Drown Most Wetlands Along Oregon and Washington Coasts

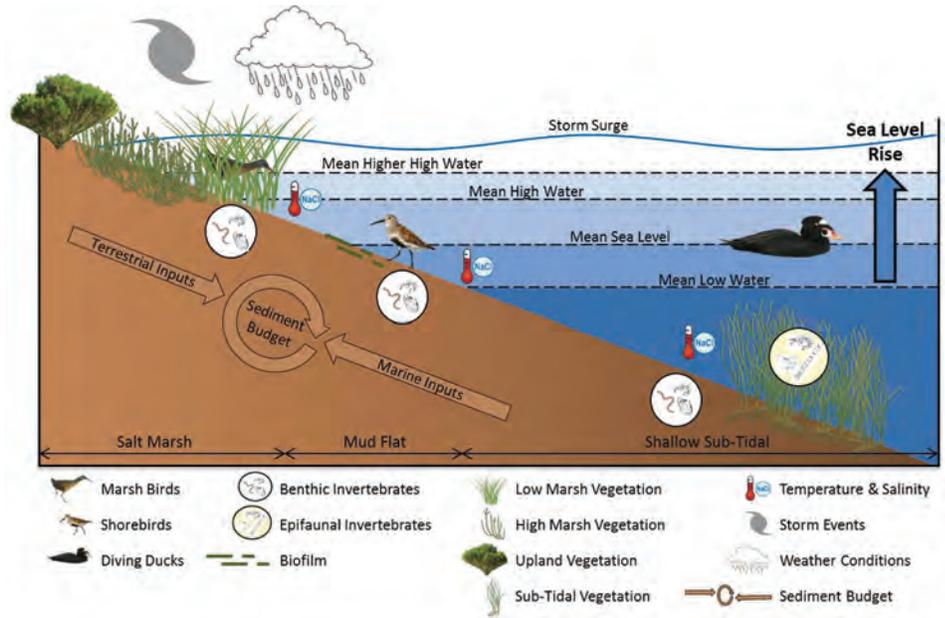
By Karen Thorne, Ryan McClymont (USGS)

Tidal marshes provide habitat for endangered wildlife and protect coastal communities from flooding. A new report from the USGS suggests that Oregon and Washington may lose most of these habitats in the next century. Although their models showed most marshlands will remain during the next 50–70 years, scientists predict that none of the wetlands will build up enough sediment to outpace sea-level rise and consequently will convert to mudflats by 2110.

“Our main model finding is that most tidal marsh study sites are resilient to sea-level rise over the next 50–70 years, but that sea-level rise will eventually outpace marsh accretion and drown most habitats of high and middle marshes by 2110,” said Karen Thorn, USGS scientist and lead of the project, “Coastal Ecosystem Response to Climate Change—Modeling Wetland Response to Sea-Level Rise on the Pacific Coast.”

In the Pacific Northwest, coastal wetlands support a wealth of ecosystem services for wildlife, fisheries and flood protection. The tidal marshes, mudflats, and shallow bays of coastal estuaries link marine, freshwater, and terrestrial habitats for multiple species, and provide economic and recreational benefits to local communities. Climate change effects, such as sea-level rise, are altering these habitats.

This study examined the effects of sea-level rise on nine tidal marshes in Washington and Oregon between 2012 and 2015, with the goal of providing scientific data to support future coastal planning and conservation. Multiple factors affected marsh persistence,



Conceptual model of linkages among physical and biological processes along the coast to assess climate-induced changes. Image credit: USGS



A USGS technician collects critical elevation data using a Real-Time Kinematic Global Positioning System at the Bandon National Wildlife Refuge, managed as part of the Oregon Coastal Refuge Complex, in southern Oregon. Photo credit: Katherine Powelson, USGS

including initial elevation, marsh productivity, sediment availability, and rates of sea-level rise.

Under a low sea-level rise scenario, all marshes remained vegetated with little change in the present configuration of communities of marsh plants or gradually increased proportions of middle-, high-, or transition-elevation zones of marsh vegetation; however, at most sites, mid sea-level rise projections led to loss of habitat of middle and high

marshes and a gain of low marshes. Under a high sea-level rise scenario, marshes at most sites eventually converted to intertidal mudflats.

Learn more about this project: <http://www.werc.usgs.gov/Project.aspx?ProjectID=222>

Read the report: <http://dx.doi.org/10.3133/ofr20151204>

Read more: http://www.usgs.gov/newsroom/article_pf.asp?ID=4287

Sea Otter Recovery Requires Restoring Ecological Relationships

By USFWS

Sea otters were believed to be extinct in the contiguous United States by the time protections were enacted in the early 20th century. The maritime fur trade of the 18th and 19th centuries had reduced the original sea otter population from a probable few hundred thousand animals, distributed along the North Pacific coast between northern Japan and central Baja California, Mexico, to less than a few thousand. A small group of sea otters, however, had managed to survive in an isolated area off the rugged Big Sur Coast of California.

Numbering about 50 when they were first documented by a state biologist in 1915, these animals founded today's Southern sea otter population. The southern sea otter population index now registers approximately 3,000 animals—within sight of the threshold for delisting consideration. The southern sea otter was listed as threatened under the ESA in 1977. It has since gradually reoccupied parts of its historic range. Because the science of ecology developed after sea otters were eliminated from much of their native habitat, some of the ecological effects of this apex predator are still unknown. Because of their large-scale community effects—which are disproportionate to their abundance—sea otters are considered to be a “keystone” species. Recovery of Southern sea otters requires more than rescuing the species from the brink of extinction—recovery is also about the restoration of complex ecological relationships.

Read the full story: <http://www.fws.gov/ventura/newsroom/release.cfm?item=347>



A territorial male sea otter in Moss Landing forages for shore crabs in the pickleweed. Photo credit: Lillian Carswell, USFWS



A territorial male sea otter in Moss Landing prepares to eat an invasive exotic green crab. Photo credit: Lillian Carswell, USFWS

Science for Understanding Coastal Storm Impacts

By Ann Tihansky, Alex Demas, Leslie Gordon, Erika Lentz, Kathleen Wilson (USGS)

Multiple storms this fall and winter have provided research opportunities that are helping our Nation better understand storms and their effects on our coastlines. Such research is an important component of the national plan to help community planners and leaders make decisions that reduce vulnerability and loss as they adapt to changing conditions.

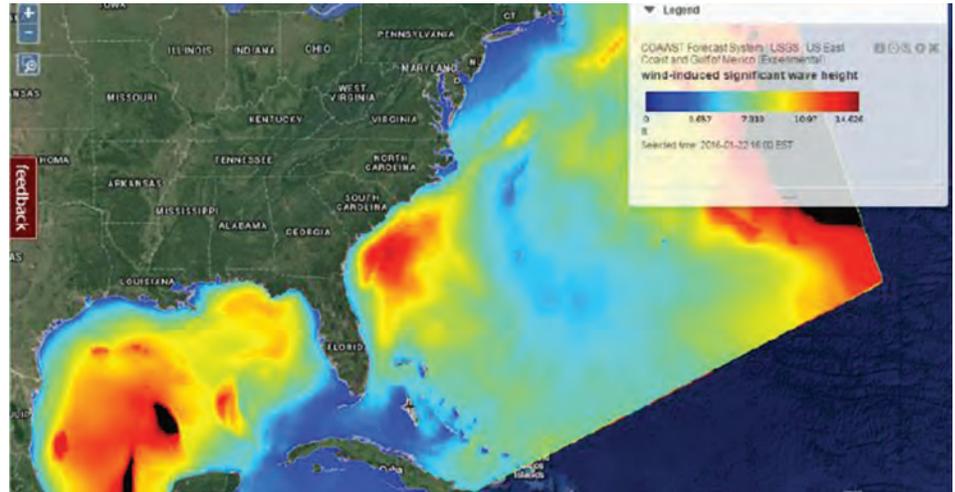
USGS scientists are supporting national preparedness by improving networks, developing tools and models to measure flood events, refining our ability to forecast coastal flooding and erosion, monitoring contaminant movement associated with stormwater and identifying areas vulnerable to storm conditions. These advancements improve our Nation's ability to prepare for storms, as well as anticipate and adapt to future changes.

Double Trouble: Hurricane Joaquin and Nor'easter

In late September-early October 2015, the Atlantic seaboard experienced a combination of two storm systems—Hurricane Joaquin and a nor'easter—that interacted with each other and caused flooding and coastal erosion. The USGS deployed crews from South



Large waves overwash a seawall during a 2013 Nor'easter along the coast in Scituate, MA. Photo credit: NOAA-NWS



The COAWST model output image for wave heights associated with the January 2016 winter storm. Image credit: USGS

Carolina to Connecticut to respond and test several relatively new systems dealing with floodwaters, coastal hazards, and environmental health.

Winter Storm Nor'easter January 22

On January 22, 2016, a winter storm warning issued for the northeast Atlantic Coast forecast strong winds and waves. USGS scientists responded by deploying an array of sensors and running several forecast tools to help predict coastal change hazards associated with flooding, coastal erosion, sediment transport, and cutting breaches in barrier islands.

COAWST

An experimental USGS Coupled Ocean Atmosphere Wave Sediment-Transport (COAWST) modeling system ran results for the January 22, 2016, Nor'easter to predict ocean conditions and large coastal waves. See the Winter Storm Nor'easter January 22 conditions here: <http://woodshole.er.usgs.gov/project-pages/cccp/public/COAWST.htm>

The COAWST modeling system is designed to better understand how large storms, such as hurricanes and nor'easters, affect sediment transport

in the coastal zone. The goal of this work is to investigate the interactions of shoreline, nearshore and offshore sediment transport processes, and develop physics-based models that hindcast and predict these interactions over a variety of spatial and temporal domains.

Forecasting Storm Surge and Coastal Change

The Coastal Change Hazards Portal, which evolved during Hurricane Sandy research, was used to forecast coastal impacts for Joaquin and the Winter Storm Nor'easter January 22. Before landfall of these storms, the USGS generated coastal change forecasts by incorporating NOAA weather data and other USGS coastal data into models to help predict the storm's coastal impacts on beaches and coastal communities. USGS coastal information, combined with National Weather Service forecasts, allowed coastal scientists to forecast probabilities of coastal change, along with information on dune elevations and how high water levels might reach during the storm. The Portal also provides additional information and tools designed for emergency managers, coastal planners and community leaders who can combine it with local information to

identify where hazards pose the greatest risks to their communities. This new forecast tool gives emergency managers time to take action before storm impacts occur.

USGS coastal scientists also conducted GPS monitoring surveys at Fire Island, NY, immediately before and after the Winter Storm Nor'easter January 22. The work is part of Hurricane Sandy recovery research and builds on a three-year data series to assess post-Hurricane Sandy beach and dune recovery. The surveys captured the impacts of the largest storm to make landfall at Fire Island since Hurricane Sandy. Storm-induced high tides and wave attack resulted in widespread beach erosion, isolated dune scarping, and damage to dune walkways and sand fencing in all Fire Island communities. Additionally, many low-lying areas flooded. The data are being used to evaluate ongoing recovery, develop predictive models, and provide important baseline monitoring for the planned beach nourishment projects at Fire Island.

Expanded Coastal Storm Tide Monitoring

Also born from the lessons of Hurricane Sandy, the USGS Surge, Wave and Tide Hydrodynamics (SWaTH) Network was built on the historic strengths of USGS water science. The SWaTH Network unites all the various USGS gauges and sensors into a single, robust system that delivers critical data rapidly to emergency agencies and local emergency responders. Consisting of 71 existing and new flood-hardened, real-time telemetered tide gauges, 61 rapid deployment gauges, and up to 555 temporary storm-tide sensors, this network stretches from the coasts of North Carolina to Maine, including Chesapeake Bay and Long Island Sound.

Before the arrival of significant coastal storm events, scientists and

technicians deploy storm-tide and wave sensors as part of the USGS SWaTH Network to monitor the coastal impacts of the storm and provide data to support emergency managers and coastal scientists. The SWaTH Network system is being developed to enhance agency preparedness, as well as enhance the availability of historical hurricane data. These data are stored in a Nation-wide database and made available via a mapping application and direct web services. These services are structured to allow other agencies to directly use the data as it is collected and approved during, or shortly after, a flood event.

Tracking Contaminants

The USGS also tested the Sediment-bound Contaminant Resiliency and Response (SCoRR) to look at the impacts of storms on the spread of contaminants in sediments. One of the lessons from Hurricanes Sandy and Katrina is that storm-tide, flooding, and other impacts from coastal storms can deposit contaminants on the bottom of water bodies, such as streams and estuaries, or transport pre-existing contaminants in sediments from place to place. That, in turn, can have negative effects on the health and resilience of coastal communities and ecosystems already reeling from the direct impacts of the storm itself. The SCoRR team collected sediment samples in tandem with several SWaTH Network sites before Hurricane Joaquin arrived to serve as baseline information. After Hurricane Joaquin passed by, the USGS collected new sediment samples to see what, if any, effects occurred at these same sites as a result of the storm. These samples are being analyzed for a broad suite of chemical and microbial contaminants.

Read about the USGS response:

http://www.usgs.gov/blogs/features/usgs_top_story/hurricane_response/



USGS scientist Carlos Rodriguez deploying a sensor at Newmarket Creek at Mercury Boulevard in Hampton, VA. Photo credit: USGS



USGS scientists preparing sediment quality sampling supplies for deployment in advance of Hurricane Joaquin. Photo credit: Shawn Fisher, USGS



Sections of Fashion Valley Road, San Diego, were closed by flooding of the San Diego River. Closed roads were a common scene in San Diego and throughout California during the El Niño-related storms, January 6–7, 2016. Photo credit: Dianna Crilley, USGS

CoSMoS for an El Niño Winter

El Niño is a phenomenon that occurs when unusually warm ocean water piles up along the equatorial west coast of South America. When this occurs, it affects weather patterns around the globe, including the winter weather along the west coast of North America. El Niño weather is not just a single severe storm; rather, it can increase the number and intensity of storms during a season, triggering floods, landslides, coastal erosion, and damage to ecosystems. The USGS is on the scientific front line in studying the impacts of El Niño and is using all the tools at their disposal to explore the many facets of this complex El Niño phenomenon. On the U.S. Pacific Coast and in the Pacific islands, USGS research focused on El Niño conditions includes stream flow measurements, flooding, coastal erosion, and sea-level rise. Winter is normally the rainy season in California, and during past El Niño winters, greater-than-usual numbers of storms arrived, one after another, resulting in wetter-than-usual winters with large amounts of rain on the coast and snow in the mountains. The USGS has responded to a series of frontal storms this past January, which has contributed to flooding and coastal erosion.

During the 20th century, about 75 percent of coastal erosion and storm damage in central California occurred during El Niño years. Understanding the effects of severe storms fueled by El Niño and advancing the scientific knowledge of the impacts helps coastal managers prepare communities for the expected erosion and flooding associated with this climate cycle. With El Niño bringing more storms and more large waves than typical during the season, the potential for serious beach erosion and cliff retreat is possible. Retreating coastal cliffs cause structural damages, property loss and can lead to extreme coastal flooding in populated regions across



Image of beach erosion impacts along Fire Island, NY, associated with the January 22, 2016, winter storm left many houses and structures vulnerable to future storm tides. Photo credit: Kathleen Wilson, USGS

the Pacific Ocean. The Coastal Storm Modeling System, also known as **CoSMoS**, is being used to project extreme-storm flooding and erosion along the California coast. State and local agencies use these modeled projections to plan for coastal impacts from El Niño storms

The USGS national streamflow network provides an invaluable historical record of previous hydrologic conditions and continues to install, maintain and monitor gaging sites to ensure that the data are accurate and timely for emergency response.

El Niño, Global Climate Change and Sea-Level Rise

The impact of El Niño and other storms is not presently included in most studies on future coastal vulnerability in a changing climate, which look primarily at long-term sea-level rise. New research suggests the predicted El Niño increase in storms will exacerbate coastal erosion. USGS scientists are committed to learning

from studies of past El Niño events to prepare for future occurrences and make communities more resilient to nature's cycles.

Science to Weather the Storm

The USGS is working to ensure that the best information is available for community planners, emergency responders, Federal, State, and local agencies, as well as the public.

See Science for Storm Impacts page 17



Illustration credit: Cole Goco

Science for Storm Impacts continued from page 16

Coastal Research on the Radio

By Ann Tihansky (USGS)

On December 15, 2015, Federal News Radio hosted USGS scientist Rob Thieler on the “Disaster Resilience for America” show.

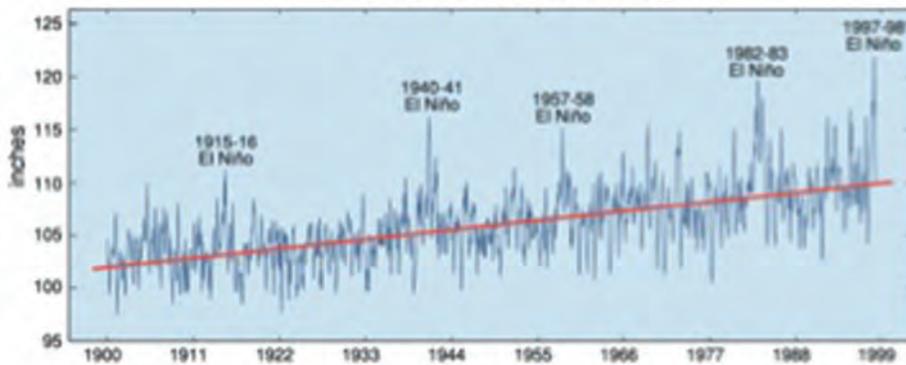
A significant challenge to our Nation’s long-term disaster resiliency is understanding the potential effects of rising sea levels along our coastlines and developing long-term plans for the Nation’s shoreline. Thieler discussed USGS research on the geologic framework and evolution of the coastal zone focused on understanding relationships between geology, sediment transport, climate and sea-level change, and coastal erosion to help assess sea-level rise vulnerability for the United States and locations worldwide.

“Coastal communities are vulnerable to the potential impacts of erosion, flooding, and storm damage related to sea-level rise,” said Thieler. “In order to address these problems, the U.S. Geological Survey is developing a variety of tools to characterize the relative vulnerability of different U.S. coastal environments to future rises in sea level.” *See related story, page 14.*

Thieler recently served as a lead author of a U.S. Global Change Research Program report on potential effects and impacts of sea-level rise. He works with many Federal and state agencies to develop science and policy plans for addressing climate change. Rob also studies habitat use and availability for beach nesting and migratory shorebirds (see related stories about piping plovers). Rob developed the widely-used DSAS software package for measuring coastal erosion and accretion and has recently developed smartphone applications for coastal science.

You can hear the interview online: <http://federalnewsradio.com/category/sponsored-content/disaster-resilience-for-america/>

FORT POINT SEA-LEVEL RECORD



Sea-level measurements collected at Fort Point in San Francisco since before 1900 form the longest continuous sea-level record for any site on the west coast of North America. This record was analyzed by USGS scientists, who found that four major factors influence sea level at Fort Point—daily tides, annual sea-level cycles, a long-term trend of slowly rising sea level (red line), the occurrence of atmospheric events such as El Niño and La Niña conditions. Read more: <http://pubs.usgs.gov/fs/1999/fs175-99/fs175-99.pdf> Image credit: USGS

Learn More About Science and Coastal Change



Follow @USGS Coast Change to keep up with the science behind coastal change hazards.

http://www.usgs.gov/blogs/features/usgs_top_story/usgs-science-for-an-el-nino-winter/

Read more about USGS response to the Winter Storm Nor'easter January 22 on Facebook:

<https://www.facebook.com/notes/us-geological-survey-usgs/plowing-through-snowzillas-stormsurge-data/1028955753817892>

For more information on the Hurricane Sandy Supplemental Fire Island project, visit:

<http://coastal.er.usgs.gov/fire-island/>
See related story, page 17.

COAWST: <http://woodshole.er.usgs.gov/project-pages/cccp/public/COAWST.htm>

USGS Coastal Change Hazards Portal: <http://marine.usgs.gov/coastalchangehazardsportal>

USGS storm-tide mapper: <http://stn.wim.usgs.gov/noreasterjan2016>

Prepare for severe weather: <http://www.ready.gov/>



Illustration credit: Cole Goco

2015 Winning King Tide Images from the Gulf of Maine

Local Residents Help Visualize Inundation Impacts

The Gulf of Maine King Tides Project helps communities in the Northeastern United States and Atlantic Canada anticipate impacts from rising sea levels. This project aims to promote awareness of the impacts of sea-level rise and help to visualize coastal areas that are vulnerable to tidal inundation, which can be monitored over time. King Tide images help scientists and planners assess and communicate future flood risks and anticipate associated hazards.

Residents from around the Gulf of Maine turned out to photograph the exceptionally high tides on October 28–29, 2015. More than 100 images were submitted. Below are the top winners.

It is possible that, by 2060, we could experience tides of the magnitude of king tide events every month due to sea-level rise induced by climate change.

Join in this international volunteer effort to document—via cameras and smart phones—extreme high tides, which will become average water levels in coming years.

Read more: <http://gulfofmaine.kingtides.net/>



King Tide 2015 in Newbury, MA. Photo credit: Heidi Davis



King Tide 2015 in Hampton, NH. Photo credit: Mike Barron



King Tide 2015 in St. John, New Brunswick, Canada. Photo credit: Neil Robichaud

Congratulations! Wisdom's Chick Hatched

Wisdom the Albatross is the Oldest Living, Banded, Wild Bird

By USFWS

On November 19, 2015, after a year at sea, the bird named Wisdom—who is at least 65-year-old—returned to Midway Atoll NWR within the Papahānaumokuākea Marine National Monument. A few days later, she was observed with her mate and laid her egg. On November 30, her mate (called Goo or Mr. Goo) took the first very long shift on the nest while Wisdom headed out to sea in search of squid and fish eggs to replenish her body. The chick was observed hatching on February 1, 2016, and days later was named Kūkini, which is a Hawaiian word for messenger. Shortly after Wisdom returned, Wisdom's mate Mr. Goo marched toward the shoreline and immediately took flight in search of food. Mr. Goo had been on the nest since January 20 when he took over incubation duties while Wisdom headed out to sea.

“From a scientific perspective, albatrosses are a critical indicator species

for the world's oceans that sustain millions of human beings as well. In the case of Wisdom, she is breaking longevity records of previously banded birds by at least a decade. With over a million albatross on Midway Atoll alone, this shows just how much is left to learn about the natural world around us. Wisdom is an iconic symbol of inspiration and hope,” said Robert Peyton, Midway NWR Manager. In the face of dramatic seabird population decreases worldwide—70% drop since the 1950's when Wisdom was first banded.

“We are a part of the fate of Wisdom, and it is gratifying to see her return because of the decades of hard work conducted to manage and protect albatross nesting habitat,” Peyton said.

Wisdom was first banded in 1956. And because Laysan albatross do not return to breed until they are at least five years old, it is estimated Wisdom is at least 64 years old, but she could be

older. Wisdom has likely clocked over six million ocean miles of flight time.

Midway Atoll NWR is home to the largest albatross colony in the world and 70 percent of the world's Laysan albatross population. Refuges provide habitat for more than 700 species of birds, 220 species of mammals, 250 reptile and amphibian species and more than 1,000 species of fish.

See photos and videos here: <https://www.flickr.com/photos/usfwspacific/albums/72157659537930074>

Read more: http://www.fws.gov/uploadedFiles/Region_1/NWRS/Zone_1/Midway_Atoll/Documents/WisdomsChickHatches.pdf

USFWS Tumblr page: <http://usfwspacific.tumblr.com/post/133964943840/something-to-be-thankful-for-wisdom-has-returned>

<http://usfwspacific.tumblr.com/post/138959299310/wisdoms-chick-hatches-at-midway-atoll-national>



Kūkini gets a band. This is a temporary band (ID Pink 100) that fits the chick's small leg. The metal band will go on in a couple months when the chick grows enough. Photo credit: USFWS



Wisdom's mate, Mr. Goo (named for his tag that you can see in this image), is seen here with the newly hatched chick named Kūkini. Photo credit: Kiah Walker, USFWS Volunteer

Understanding Tsunami Threats—Seafloor Mapping Solves Decades-Old Tsunami Mystery

By Helen Gibbons, Leslie Gordon, Ann Tihansky (USGS)

On March 27, 1964, the giant Alaskan earthquake had barely stopped shaking the ground when a local tsunami swept through the remote village of Chenega in the Prince William Sound, killing 23 inhabitants and destroying all but two of the buildings. It was the second-largest earthquake of the 20th century. The geologic explanation for the Chenega tsunami, however, remained a mystery until USGS geophysicist, Daniel Brothers, mapped a large submarine landslide complex in the seafloor of a nearby fjord known as Dangerous Passage in southeastern Alaska.

Research led by Brothers and his coworkers points to the underwater landslides as the tsunami's source. "What makes this slide unusual is that much of the material that slid was at a water depth of 820 to 1150 feet," said Peter Haeussler, USGS geologist and a coauthor of the report. "The deeper initiation depth made it particularly good at generating a tsunami."

The researchers calculated the time it would take for a tsunami triggered by a large landslide in the mapped areas to reach the village of Chenega

and found a good fit with eyewitness reports: a tsunami wave triggered in the areas where they found landslide evidence would take three to four minutes to reach the village, which is consistent with the arrival time of the most destructive waves.

"It is exciting to see the technology evolve so we can now get high-resolution images of the seafloor that we could not back then and to pinpoint the most likely source for the waves," said USGS geologist emeritus, George Plafker, who investigated the Chenega disaster 50 years ago.

"What I saw was the most stunning morphological expression of a strike-slip fault I had ever seen," said Brothers, describing the quintessential fault cutting straight across the seafloor, offsetting seabed channels and submerged glacial valleys, the evidence all perfectly preserved since the last ice age. "It was an unusual opportunity to observe how a fault has evolved in 20,000 years," he explained, "because rivers and glaciers obliterate much of the record on land." See related story, page 21.

Watch Tsunami Science Video

The 1964 earthquake is the largest U.S. earthquake ever recorded. Watch this video and learn how advancing geologic science contributes to improved understanding of natural hazards like earthquakes and tsunamis: http://www.usgs.gov/blogs/features/usgs_top_story/the-1964-great-alaska-earthquake-tsunami/

Better understanding of submarine landslides and the tsunami hazards they can pose in fjords will help many coastal and port communities around the world. In the United States, the new Alaskan findings serve as a reminder that a giant earthquake generated along the Pacific coast of Washington State is likely to set off underwater slides in the inland waters near Seattle. Hazard-related science studies like these are important for preparing communities. See related story, page 21.

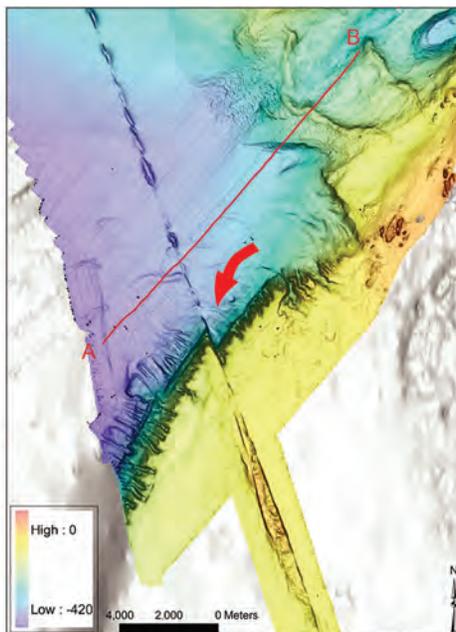
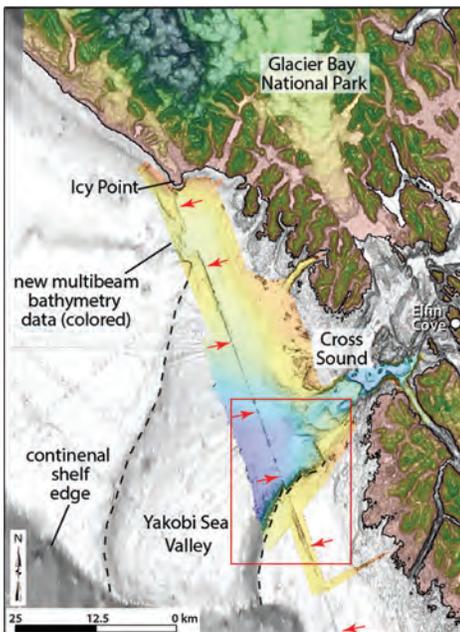
The research was published by USGS scientists and their colleagues from Boise State University and the Alaska Department of Fish and Game in the journal, *Earth and Planetary Science Letters*: <http://www.sciencedirect.com/science/article/pii/S0012821X16000157>

Read more: <http://soundwaves.usgs.gov/2016/01/>

<http://earthquake.usgs.gov/earthquakes/events/alaska1964/>

Read USGS Professional Paper 1707 here: <https://pubs.er.usgs.gov/publication/pp1707>

You can "see" the tsunami through this animation: <https://www.youtube.com/watch?v=4W2iUI0VB8c>



Two maps of southeast Alaska showing (at far left) the area of new multibeam bathymetry data (rainbow colors) acquired on the R/V Solstice near Cross Sound and Glacier Bay National Park, southeastern Alaska. **Far left**, Red arrows highlight the trace of the Queen Charlotte-Fairweather fault. The red rectangle is the inset area shown in map at right. **At left**, Red arrow points to the lateral offset of the south wall of the Yakobi Sea Valley along the fault. Image credits: USGS

Reducing Pacific Northwest Tsunami Risk

By Ann Tihansky and Kris Ludwig (USGS)

The Cascadia Subduction Zone, a tectonic area in the Pacific Northwest of North America (*See related story, page 20*) not only hosts erupting volcanoes but also produces mega-thrust earthquakes that can generate ocean-crossing tsunamis. As geologic science advances, it is shedding light on understanding how and where tsunamis occur.

A new edition of USGS book, “The Orphan Tsunami of 1700,” tells the scientific detective story of a giant earthquake and an extraordinary tsunami that arose along the Pacific coast of North America a little more than 300 years ago. The tsunami wreaked havoc on North America while also racing across the ocean to Japan, where it caused minor flooding and damage. This historic tsunami has been referred to as an “orphan” because no one in Japan felt the usual before warning of the earthquake that caused it to occur; however, scientists discovered that an earthquake along the Cascadia Subduction Zone could have caused the historic geological event. The modern scientific discovery of the “Cascadia tsunami of January 26, 1700” sheds light on the “orphan” tsunami’s origins.

Originally published in 2005, authors Brian Atwater and David Yamaguchi updated the preface in the new edition and described the 1700 tsunami as something of a mirror image of

Japan’s disastrous tsunami of 2011. They note that a tsunami’s greatest effects, as well as shaking from a parent earthquake, can be expected on shores that adjoin a tsunami’s source.

The book also calls attention to North America’s first engineered tsunami refuge. The story of this refuge goes back to a 2013 bond issue for school reconstruction along the Pacific coast in Westport, WA, where voters approved \$13.8 million to create a rooftop platform with space for as many as 1,000 people to escape tsunami floodwaters. The construction of this platform, atop a specially designed gymnasium, is nearing completion.

Not far from Westport are some of the clues used in the geologic detective story of the 1700 Cascadia earthquake and the tsunami associated with it. These clues include standing dead trunks of trees killed by post-earthquake tides. Tree-ring scientists dated this tree death to the months between August 1699 and May 1700—a finding that strengthened links to written records of a January 1700 “orphan” tsunami in Japan.

Scientists believe that the 1700 Cascadia earthquake was capable of causing underwater slides that could have set off fast-arriving tsunamis in the inland waters near Seattle. *See related story, page 20.*



Construction of the first engineered tsunami refuge takes place in Westport, WA, in 2015. The completed tsunami refuge will span the flat roof of a gymnasium (9 meters above ground), with doors at ground level providing access to stairs within the corner towers. Photo credit: Sonya Miller, Ocosta School District

How Can You Prepare?

There are several measures one can take to improve individual, family, and workplace emergency preparedness. Learn about the risks where you live, work, and travel. One of the best ways to learn about what to do during an earthquake is to practice the protective actions, “Drop, Cover, and Hold On,” while participating in the annual ShakeOut earthquake drills. Additional information: <http://www.shakeout.org> To learn more about seismic activity and shaking hazards in your area, see the USGS National Seismic Hazard Maps: <http://earthquake.usgs.gov/hazards/products/>

For those living or visiting tsunami-prone coasts, it is important to know what a tsunami looks like and how to respond. Resources are available at: <http://www.tsunamizone.org/>

You can participate in these drills as an individual, family, school, or group of co-workers. Some coastal regions also organize tsunami drills to help you learn evacuation routes: http://www.oregonlive.com/entertainment/index.ssf/2015/09/can_you_outrun_a_tsunami.html

Because earthquakes and aftershocks can cause fires, limit transportation, and cause power outages, it’s important to store critical supplies and documents and establish a communication plan with your family. Tips on earthquake readiness are available at: <http://goo.gl/DkA2nB>

Sign up to receive earthquake notices through the USGS Earthquake Notification System: <https://sslearthquake.usgs.gov/ens/>



Illustration credit: Cole Goco

Open House Showcases BOEM Arctic Science

By John Callahan (BOEM)

How do BOEM researchers...

- monitor food security in Beaufort communities?
- understand fish and marine mammal behaviors in the Beaufort Sea?
- identify ice hazards, improve spill modeling, or detect contaminants near offshore oil facilities?

On January 20–21, a small group of representatives from BOEM’s Alaska Outer Continental Shelf (OCS) Region visited Barrow and Nuiqsut, Alaska, to give an overview of BOEM’s ongoing Arctic Studies. The researchers met with the public to answer questions about their studies and research in a relaxed, informal setting. The group included: Dee Williams, supervisor of BOEM’s Alaska Region Environmental Studies Program (ESP); Mark Storzer, the Alaska Regional Supervisor for Environment; Mike Haller, Alaska’s tribal and community liaison; Kate Wedemeyer, Fisheries Oceanographer; and Chris Campbell, Sociological and Archeology Specialist.

BOEM’s ESP operates on a national scale to assist in projecting, assessing and managing potential effects on the human, marine and coastal environments of the Outer Continental Shelf that may be affected by oil and gas exploration, development, and production.

Since the ESP began in 1973, the DOI and BOEM have funded nationally more than \$1 billion for environmental studies through fiscal year (FY) 2015. Nearly \$450 million of that



Members of BOEM’s Alaska Environmental Studies Program (Sociocultural and Archeology Specialist Chris Campbell, at right and Fisheries Oceanographer Kate Wedemeyer, center) discuss recent Beaufort studies with science open house attendees in Nuiqsut, Alaska. Photo credit: John Callahan, BOEM.

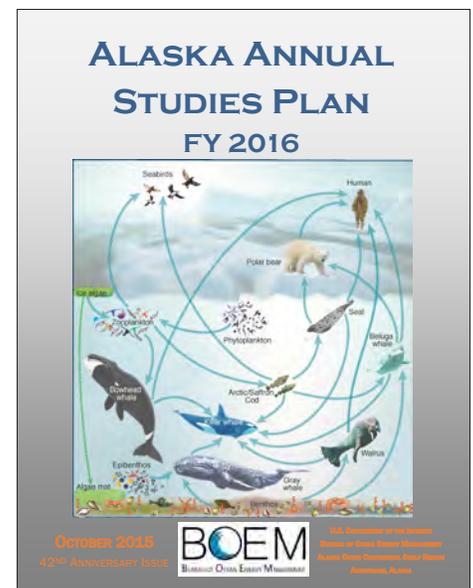
amount has funded studies in Alaska across 15 planning areas in the Arctic, Bering Sea and Gulf of Alaska sub-regions to produce more than 1,000 technical reports and peer-reviewed publications. The ESP manages ongoing study projects in Alaska (currently about 60) in disciplines such as physical oceanography, air quality, fate and effects of pollutants, protected and endangered species, marine ecology, and the social sciences, including traditional knowledge.

Completed study reports are posted here: <http://www.boem.gov/ESPIS/> or you can browse Alaska Region study reports by year: <http://www.boem.gov/AKpubs>

A wide range of scientists, stakeholders and decision makers use these study products with final reports being used most directly by teams of National Environmental Policy Act (NEPA) analysts within the BOEM

Environmental Analysis Sections when they prepare Environmental Impact Statements and Environmental Assessments, and review Geological and Geophysical permit applications, Exploration Plans and Development and Production Plans.

BOEM’s Alaska Studies Plan: <http://www.boem.gov/2016-Alaska-Studies-Plan/>



Cover of BOEM’s Alaska Studies Plan: <http://www.boem.gov/2016-Alaska-Studies-Plan/>
Image credit: BOEM



Illustration credit: Cole Goco

Gifts from the Sea

By Jessica Fitzpatrick, Nadine Golden, Seth Ackerman (USGS)

Over the holiday season, the USGS shared several new collections of coastal and marine imagery completed as part of the second phase of releasing thousands of photos and videos of the seafloor and coastline through their Coastal and Marine Video and Photography Portal: <http://cmgvideo.usgsportals.net/>

This USGS portal is unique due to the sheer quantity and quality of data presented. It is the largest database of its kind, providing detailed and fine-scale representations of the coast and seafloor. The “geospatial context” is also unique, with maps that display imagery in the geographic location where the images were recorded.

In total, approximately 165,500 photographs have been collected, as well as 1,210 hours of trackline video covering almost 3,200 miles of coastline.

Dive in and watch tutorials on how to use the portal. Scientists explain the basics of navigating the portal and also how to search the data catalog and work with multiple data layers.



This photograph of Puget Sound seafloor shows a sandy area with partial hydroid and algae cover occupied by two sea pens. This image was collected as part of USGS efforts to help with rockfish recovery in Puget Sound. Scientists are mapping their ecosystem and habitat to understand population distribution. Photo Credit: USGS

Read the full story here: http://www.usgs.gov/blogs/features/usgs_science_pick/gifts-from-the-sea/



This photograph of the seafloor off the California coast shows coarse sand, shells and a sunflower sea star. This photograph supports the California Seafloor Mapping Program, a cooperative program established in 2007 initiated by state and Federal agencies, academia and private industry. Data collected during this project reveal the seafloor offshore of the California coast in unprecedented detail and provide an ecosystem context for the effective management of this precious marine resource. Photo Credit: USGS

Hola from Puerto Rico! News from the U.S. Coral Reef Task Force

By Cheryl Fossani (DOI)

In late October, the U.S. Coral Reef Task Force (USCRTF) held its 34th meeting in Fajardo, Puerto Rico. This meeting brought together stakeholders and partners to address diverse issues affecting the health of coral reefs along the coasts of Puerto Rico and the communities that rely on them. Secretary of the Puerto Rico Department of Natural Resources, Carmen Guerrero Perez, opened the meeting with USCRTF co-chairs Lori Faeth, DOI’s Deputy Assistant Secretary for Policy and International Affairs, and Eileen Sobek, Assistant Administrator for NOAA National Marine Fisheries Service. All acknowledged the important collaborative efforts of the USCRTF agencies and organizations that have developed a coral reef program that ranges from large scale planning efforts to individual conservation projects.

This year’s meeting brought together over 180 registered participants and highlighted regional watershed management and coral reef conservation and restoration efforts. Dr. Jorge Garcia, from the University of Puerto



Local community, university, commonwealth, and Federal officials discuss partnerships to replenish stormwater runoff buffers and natural water flow at a beach access point on Culebra Island. Photo credit: DOI



USCRTF co-chairs Lori Faeth (DOI, center) and Eileen Sobeck (NOAA, center) stand with Secretary Carmen Guerrero Perez (DNR, center) and the rest of the principal members and several steering committee points of contact during the 34th Meeting of the USCRTF. Photo credit: Cheryl Fossani, DOI

Rico, informed the USCRTF of the status of Puerto Rico’s coral reefs, and Dr. Edwin Hernandez, also from the University of Puerto Rico, highlighted the progress that coral nurseries have made in support of restoration efforts in the region.

The meeting included several site visits and workshops to address coral reef issues specific to the challenges that Puerto Rico faces in managing and conserving their reefs. The USFWS, in collaboration with the NOAA, Puerto Rico Department of Natural Resources (DNR), and other local organizations, sponsored a tour of watersheds restoration efforts taking place in Culebra, a small island off the east coast of Puerto Rico, where historical defense activity and recent development pressures have stressed the surrounding coral reef ecosystem. During the tour, participants received an overview of how the DNR, with local and Federal partners, has worked together to implement watershed restoration techniques that abate land-based sources of pollution, establish coral nurseries to grow coral fragments to use in restoration, and identify areas to propagate and expand coral habitat areas.

The Watershed Partnership Initiative (WPI) Working Group convened a Watershed Workshop focusing on the

successes and lessons learned in managing coastal watersheds that impact coral reefs. Workshop participants shared information about developing and implementing watershed management plans, identified challenges to implementing watershed management plans, and brainstormed solutions on overcoming barriers to implementation. Academics, Federal and local agencies, and students highlighted their research and activities in various watersheds during a poster session where the USCRTF honored five university student posters with an award for their outstanding work.

The meeting included several decision items for USCRTF Principals, including adoption of Resolution 34.1: A Framework for Action for FY16-20. The Resolution includes continuing the ongoing coral reef actions in the National Ocean Policy, building on the successful WPI, and addressing several inter-jurisdictional issues, such as injury and mitigation, climate change, ocean acidification, and enforcement. Other decisions items included finalizing the Accomplishments Report on priority actions from FY 2011–14 and adopting strategic guidance for implementing the WPI.

The USCRTF held its annual Washington, D.C., meeting on February 15–19, 2016. <http://www.coralreef.gov>

Outstanding Service Award

This year, Brian Carlstrom, former Superintendent of Biscayne National Park, was recognized with the James D. Webb Public Service Award by the Everglades Coalition during their 31st Annual Conference in Coral Gables, FL, January 7–10, 2016. The citation read: “In his capacity as the Superintendent, Brian demonstrated exemplary leadership and a clear commitment to protecting the resources and wildlife of Biscayne Bay, a critical area of the Greater Everglades Ecosystem. Under his tenure, both the General Management Plan and the Fishery Management Plan for the Park were finalized, including a broad suite of protections designed to restore native ecosystem, protect valuable biodiversity, improve water quality, and provide enhanced visitor experiences to the public.

At the core of these efforts was the decision by the NPS, prompted by Brian’s strong leadership, to create a marine reserve within Biscayne National Park to protect the park’s unique but severely threatened coral reef ecosystem. Despite enormous obstacles and intense pressure from opponents, he was successful in ensuring that future park management plans include the best and most effective resource management options to protect the resources of Biscayne for future generations. He has built and maintained strong relationships with the environmental community and demonstrated the commitment of the NPS to protect and restore the Everglades.”

Read about the James D. Webb Public Service Award:

<http://www.evergladescoalition.org/awards-webb.html>

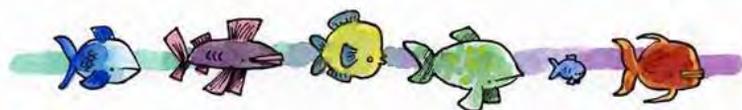


Illustration credit: Cole Goco



National Ocean Policy News

By Liza Johnson (DOI)

In January, the National Ocean Council finalized the 2016 Annual Work Plan (AWP), which will guide the implementation of the President's National Ocean Policy over the course of this calendar year. The DOI, along with several other agencies, helped draft the plan and is contributing to working group efforts to complete deliverables in all outlined priority and emerging areas.

The AWP concentrates on four priority areas for 2016:

- Illegal, Unreported, and Unregulated (IUU) Fishing and Seafood Fraud,
- Harmful algal blooms and hypoxia,
- Regional marine plans and
- Ocean acidification.

The AWP also includes the remaining actions in the 2013 National Ocean Policy Implementation Plan and highlights two emerging areas:

- Coastal resilience and sea-level rise tools and
- Coastal mapping.

Interagency working groups are already hard at work on these tasks.

The National Ocean Council's 2016 AWP: https://www.whitehouse.gov/sites/default/files/microsites/ostp/2016_annual_work_plan_final_-_160105.pdf

Read more: <https://www.whitehouse.gov/blog/2016/02/12/releasing-new-guidance-under-national-ocean-policy>

<http://www.whitehouse.gov/oceans>



Image credit: DOI

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)
Norman Grannemann (USGS)
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

Susan Russell-Robinson (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: midatlanticocean.org

Northeast

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

West Coast

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

Moving Forward on Regional Ocean Plans

By Bob LaBelle, Leann Bullin (BOEM)

The Northeast and Mid-Atlantic regions are moving forward with developing regional ocean plans as part of implementing the National Ocean Policy. These activities include bringing Federal, state and tribal partners and stakeholders together to enhance communication, improve coordination, and maximize available resources. The Northeast and Mid-Atlantic RPBs are planning to deliver final draft Ocean Action Plans to the National Ocean Council for concurrence in June and September 2016, respectively.

Northeast

Approximately 75 people attended the public Ecosystem-based Management (EBM) Working Group meeting in-person or via webinar/phone on January 6, 2016, in Providence, RI, including members of the Northeast Regional Ocean Council, the Northeast Regional Planning Body, representatives from the EBM Working Group, the Marine Life Data and Analysis Team and other interested stakeholders. During the meeting, participants reviewed the status of the draft Northeast Ocean Plan and associated marine life and habitat data and provided feedback on the Important Ecological Areas framework, including data and science/research needs.

The Northeast RPB held its eighth meeting in March 2016, with the

objective of releasing a draft North-east Ocean Plan and beginning collection of public comments to inform a final version of the regional ocean plan that will be submitted to the National Ocean Council in June.

Learn more: <http://neooceanplanning.org>

Mid-Atlantic

Over 100 stakeholders attended the Mid-Atlantic Regional Council on the Ocean (MARCO) Forum on Ocean Assessment and Data Syntheses Products on January 29 in Dewey Beach, DE. The final deliverables from the MARCO-supported work conducted in 2015 to inform the Mid-Atlantic RPB were presented, including the Mid-Atlantic Regional Ocean Assessment, the ecological data synthesis and data products from the human-use data synthesis. The forum presentations and information are available at: <http://midatlanticocean.org>

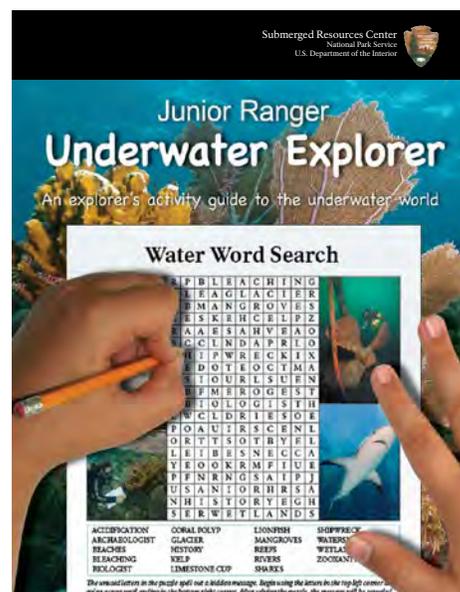
The Mid-Atlantic RPB held its in-person public meeting March 22–24, 2016, in Baltimore. During the meeting, the RPB reviewed, considered, and reached general agreement on content for the first iteration draft Ocean Action Plan, which will be developed and released for public comment this summer. The meeting included a half-day workshop-style public engagement session and public comment opportunities to receive input on topics under consideration by the RPB. Details are available at: <http://www.boem.gov/MidA-New/>

Want to be an Underwater Explorer?

The NPS has a 36-page activity guide to the underwater world. This booklet is full of fun activities to help you discover what is underwater. Dive with us as we explore different environments, animals, and the people who work beneath the surface.

There are 88 ocean, coastal and Great Lakes parks across 26 states and four territories. Established for their beauty and national significance, the parks conserve over 11,000 miles of coastline and 2.5 million acres of ocean and Great Lakes waters, including coral reefs, kelp forests, seagrass meadows, tidewater glaciers, estuaries, beaches, mangroves, marshes, wetlands, lighthouses, historic forts, and shipwrecks.

The NPS ocean and coastal parks comprise a system of tremendous biological and recreational value to the nation. They attract over 86 million visitors each year and generate over \$3.5 billion in economic benefits to local communities.



NPS Junior Ranger Underwater Explorer activity guide is available online: <http://www.nature.nps.gov/water/oceancoastal/assets/docs/UnderwaterExplorerJuniorRangerBooklet.pdf>



Illustration credit: Cole Goco

San Diego Refuges Launches Instagram Page

By USFWS

The USFWS manages four Urban NWRs in Southern California—connecting people with nature in their backyards.



If you're on Instagram, follow @sandiegorefuges for a more inside look at day-to-day happenings and cool animal facts through photos and videos: <https://www.instagram.com/sandiegorefuges/>

If you hashtag #SanDiegoRefuges on your pictures, maybe your pictures will be featured!

Find more ways to connect to the DOI through many different social media outlets: <https://www.doi.gov/news/social-media>



Recent rains and king tides have washed up tires, plastic and styrofoam pieces, fast food containers and everyday trash along the San Diego Bay Refuge shorelines. Girl Scout Troop #5912 helped in one of the recent clean-ups along with 52 community volunteers to remove over 700 pounds of debris. Thank you goes to "Team-up to Clean-up" volunteers! Photo credit: USFWS

National Park Service's Junior Ranger Word Search

	R	P	B	L	E	A	C	H	I	N	G	
	I	L	E	A	G	L	A	C	I	E	R	
	V	B	M	A	N	G	R	O	V	E	S	
	E	E	S	K	E	H	C	E	L	P	Z	
	R	A	A	E	S	A	H	V	E	A	O	
	S	C	C	L	N	D	A	P	R	L	O	
	S	H	I	P	W	R	E	C	K	I	X	
	C	E	D	O	T	E	O	C	T	M	A	
	O	S	I	O	U	R	L	S	U	E	N	
	R	B	F	M	E	R	O	G	E	S	T	
A	B	I	O	L	O	G	I	S	T	H		
L	W	C	L	D	R	I	E	S	O	E		
P	O	A	U	I	R	S	C	E	N	L		
O	R	T	T	S	O	T	B	Y	E	L		
L	E	I	B	E	S	N	E	C	C	A		
Y	E	O	O	K	R	M	F	I	U	E		
P	F	N	R	N	G	S	A	I	P	J		
U	S	A	N	I	O	R	H	R	S	A		
N	H	I	S	T	O	R	Y	E	G	H		
S	E	R	W	E	T	L	A	N	D	S		

- | | | | |
|---------------|---------------|-----------|---------------|
| ACIDIFICATION | CORAL POLYP | LIONFISH | SHIPWRECK |
| ARCHAEOLOGIST | GLACIER | MANGROVES | WATERSHED |
| BEACHES | HISTORY | REEFS | WETLANDS |
| BLEACHING | KELP | RIVERS | ZOOXANTHELLAE |
| BIOLOGIST | LIMESTONE CUP | SHARKS | |



The San Diego Refuges invite you to connect through Instagram account @sandiegorefuges

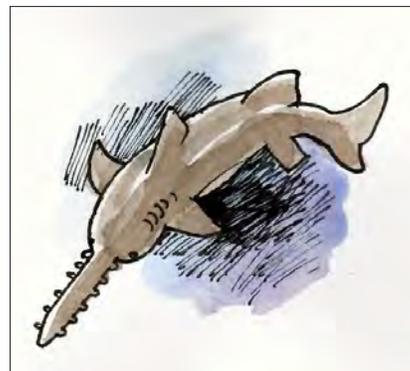


Illustration credit: Cole Goco

Explore the Atlantic Canyons— "Pathways to the Abyss" Research Cruises

The Surfing Bison



Expedition Summary and Multimedia 2012:

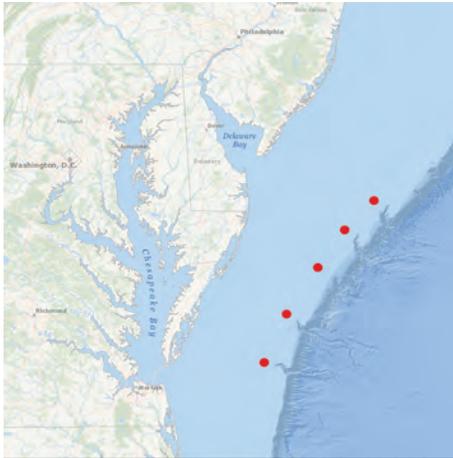
<http://oceanexplorer.noaa.gov/explorations/12midatlantic/welcome.html>

Expedition Summary and Multimedia 2013:

<http://oceanexplorer.noaa.gov/explorations/13midatlantic/welcome.html>

Expedition Summary and Multimedia 2014:

<http://oceanexplorer.noaa.gov/oceanos/explorations/ex1404/welcome.html>



Left, locations of the five mid-Atlantic canyons off the Delmarva Peninsula are shown from south to north: Norfolk, VA; Washington, VA; Accomac, VA; Baltimore, MD; and Wilmington, DE. Map data: U.S. Department of Commerce, NOAA, NESDIS, NCEI. **Center and right**, the ROV Jason is used to explore and collect samples from the canyons. Photo credits: Deepwater Canyons 2013—Pathways to the Abyss, NOAA-OER/BOEM/USGS

The multi-year interagency effort explored submarine canyons about 60 miles offshore of Maryland and Virginia. The research shows biologically rich areas that had not been fully explored in the past, including historically important shipwrecks, extensive deep-sea coral communities, and a vast methane-seep ecosystem. *See related story, page 7.*

Watch the video here: <http://www.boem.gov/Atlantic-Canyons-Pathways-to-the-Abyss/>

Below, NOAA Ship Okeanos Explorer docked at her home port in North Kingstown, RI. Image credit: NOAA Okeanos Explorer Program, Our Deepwater Backyard: Exploring Atlantic Canyons and Seamounts 2014

