



# NEWSWAVE

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

**NEWSWAVE—Winner of NAGC's 2015 Blue Pencil Award**

**Spring 2017**

## Secretary Zinke Announces 73-Million Acre Proposed Lease Sale in the Gulf of Mexico

By Caryl Fagot (BOEM)

On March 6, 2017, Secretary Zinke announced lease proposals for oil and natural gas development on 73 million acres of the Outer Continental Shelf (OCS) in the Gulf of Mexico (GoM).



The Gulf of Mexico hosts most of the oil rigs on the U.S. Outer Continental Shelf. Photo credit: BOEM

“Opening more Federal lands and waters to oil and gas drilling is a pillar of President Trump’s plan to make the United States energy independent,” Secretary Zinke said. “The Gulf is a vital part of that strategy to spur economic opportunities for industry, states, and local communities, to create jobs and home-grown energy and to reduce our dependence on foreign oil.”

The first sale, Proposed Lease Sale 249, will include about 13,725 un-leased blocks and is scheduled for auction on August 16, 2017. The Bureau of Ocean Energy Management

*See Gulf of Mexico Lease page 3*



On January 3, Hawai‘i Volcanoes eruption crew rangers worked to reestablish a new coastal lava viewing area at Kamokuna at Hawai‘i Volcanoes National Park. Photo credit: Janice Wei, NPS

## Volcano Firehose

By Ann Tihansky (USGS)

On January 3, 2017, a "firehose" of lava began pouring into the ocean at Kamokuna, Hawai‘i Volcanoes National Park, Kīlauea. The U.S. Geological Survey (USGS) and National Park Service (NPS) continue monitoring this phenomenon as the volcano continues to make new land on the island.

As of April 26, the firehose of lava continues to pour into the ocean at

*See Volcano Firehose page 3*

### Special Feature—Postcards from the Pacific Northwest

See story, pages 16–18

## Wisdom Hatches Another Chick!

Wisdom, the world’s oldest known wild bird, is a mom again! The 66-year old Laysan albatross (*Phoebastria immutabilis*) successfully hatched her newest chick at Midway Atoll National Wildlife Refuge and Battle of Midway National Memorial. Mom and chick are shown in the photo below taken by USFWS Volunteer Naomi Blinick.



## Arctic Youth Ambassadors

By Ann Tihansky (USGS)

Macy Rae Kenworthy, a native of Kotzebue, Alaska, is one of 22 Arctic Youth Ambassadors who were selected to share her experiences from her childhood as an Iñupiaq, as well as her perspective on the challenges climate change presents to Alaska Native cultures for the year 2015–16.

“With climate change, the seasons are shifting. Our spring season is longer, which means it takes longer for the ice to dissolve, but the period in which the ice is unsafe to travel on is longer. This impacts our seal hunting, which is a vital source of food for my community, especially with grocery costs so high. I finally started paying close

*See Ambassadors page 4*

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## Connect to Images and Multimedia via Social Media

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<https://www.facebook.com/USInterioroceanscoastsgreatlakes/>



The USFWS Instagram account shared this image from Blackwater National Wildlife Refuge. #WildlifeRefuge #heron #sunrise #sunset  
 Connect to other ocean, Great Lakes and coastal social media accounts across the DOI.  
 Photo credit: By the Bay Photos

### LEARN more about Wisdom! (cover story):

[https://www.fws.gov/uploadedFiles/Region\\_1/NWRS/Zone\\_1/Midway\\_Atoll/Sections/News/News\\_Items/NR%20wisdoms%20chick%20021617.pdf](https://www.fws.gov/uploadedFiles/Region_1/NWRS/Zone_1/Midway_Atoll/Sections/News/News_Items/NR%20wisdoms%20chick%20021617.pdf)

**Tumblr:** <http://bit.ly/WisdomsChick2017>

**Flickr:** <http://bit.ly/WisdomPhotos>

### CHECK OUT videos and photos of Wisdom from Midway Atoll Refuge

[https://www.fws.gov/refuge/Midway\\_Atoll/News/Where\\_Is\\_Wisdom.html](https://www.fws.gov/refuge/Midway_Atoll/News/Where_Is_Wisdom.html)

### Watch Wisdom lay her egg:

<https://www.flickr.com/photos/usfwspacific/11214497125/in/set-72157632891366006>

### Facebook:

USFWS Pacific Region: <https://www.facebook.com/USFWSPacific/>

FOLLOW Wisdom on **Twitter** @HawaiiReef @USFWSPacific.

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

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

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*Volcano Firehose continued from page 1*

Kamokuna where a small delta has been growing since late March. Monitor the status here: <https://www.nps.gov/havo/planyourvisit/lava2.htm>

### Watch the videos:

**Video:** You can watch the “firehose” of lava pouring into the ocean as NPS Ranger Jozie explains this unique phenomenon and the challenges for keeping visitors safe: <https://www.nps.gov/media/video/view.htm?id=9C24F08A-IDD8-B71B-0B377D7C71CC9CDC>



Video credit: Janice Wei, NPS

**Video:** Sea cliff collapse: <https://hvo.wr.usgs.gov/multimedia/uploads/multimediaFile-1629.mp4>

Video credit: USGS

**Video:** Tina Neal, USGS Scientist at Hawai‘ian Volcano Observatory, gave a presentation on the lava delta collapse that occurred on January 3, 2017, and created the lava “firehose.” [https://www.youtube.com/watch?v=pjs\\_XSoFO30](https://www.youtube.com/watch?v=pjs_XSoFO30)

**Video:** Watch as USGS scientist Matt Patrick narrates a video with maps of geologic features: <https://www.youtube.com/watch?v=Id3G5UOl9lg>

Learn more: <https://www.nps.gov/havo/learn/news/20170103pr.htm>

Keep up with the latest imagery from the USGS Hawai‘ian Volcano Observatory here: <https://hvo.wr.usgs.gov/multimedia/index.php?display=default>



A close up view of the lava “firehose” and the explosive nature of the lava as it reacts with the seawater. Photo credit: USGS



On February 3, 2017, a “firehose” of lava was pouring into the ocean at Kamokuna, Hawai‘i Volcanoes National Park, Kilauea. Photo credit: Bryan Everett, NPS

### Did you know?

Did you know that this area is considered sacred by native Hawai‘ians? To many Hawai‘ians, molten lava is the kino lau (or body form) of the volcano goddess Pelehonuamea (Pele). When lava reaches the sea, it's where Pele the volcano goddess battles with her sister, the goddess of the ocean.

*Gulf of Mexico Lease continued from page 1*

(BOEM) developed proposed lease terms after extensive environmental and economic analysis, and the lease includes provisions that mitigate adverse effects on protected species and other biological resources. The final terms of the lease will be published at least 30 days before the sale in the Final Notice of Sale.

Read about Lease Sale 249: <https://www.doi.gov/pressreleases/secretary-zinke-announces-proposed-73-million-acre-oil-and-natural-gas-lease-sale-gulf>

Read about Lease Sale 247: <https://www.doi.gov/pressreleases/successful-gulf-mexico-lease-sale-yields-275-million-high-bids-913542-acres-central>



Illustration by Cole Goco.

*Ambassadors continued from page 1*

attention to how much my people were struggling, but also on how much they were thriving on the land and adapting to all the changes,” said Kenworthy.

The Arctic Youth Ambassador program was established by the U.S. Fish and Wildlife Service (USFWS) Alaska Region, U.S. Department of the Interior (DOI), and U.S. Department of State in partnership with a nonprofit partner, Alaska Geographic. Changes in the Arctic did not happen overnight and younger generations will play an important role in addressing them.

Over the course of 2 years, which coincided with the U.S. Chairmanship of the Arctic Council, the Arctic Youth Ambassadors program brought together diverse youth from across Alaska to serve as ambassadors for their communities and country by building awareness at home and abroad about their lives in the Arctic. Youth ambassadors share their local perspective by engaging with partners and leaders from around the world, adding their voices and solutions to a global conversation about how to sustain communities, cultures, and the environment in a changing Arctic.

Changes in the Arctic did not happen overnight and younger generations will play an important role in addressing them. In 2014, Macy participated in the Alaska Native Science and Engineering Program and had a month-long internship with the NPS in Fairbanks, Alaska, where she participated in the NPS’ BioBlitz program in Bering Land Bridge National Preserve and learned about Dall sheep and how North Slope communities rely on them for subsistence.

“Kotzebue, Alaska, was small-town-life with a Native twist. I grew up running around with my brother and making mud pies, but I also had to learn to hang fish and make seal oil. Through this program, I’ve been able to do amazing things. I’ve met many



Arctic Youth Ambassador Macy Rae Kenworthy has spoken at many events and interacted with the Qikiqtaġruk Iñupiaq Youth Council. Photo credit: Kelli Shroyer, Manillaq Association

politicians and decision-makers. I’ve learned so much. I’ve learned more about my culture and my ancestors while searching for ways to help my people adapt to the changes brought on by a warming Earth. Our seasons are changing and our permafrost is melting. We are working to mend the generation gap and the language barrier. We are fighting for our way of life because we are a resilient people and we know we can bounce back,” said Kenworthy. *See related story, page 8.*

Read more: <https://www.doi.gov/blog/fighting-our-way-life>

Follow the Arctic Youth Ambassadors on Facebook: <https://www.facebook.com/arcticyouthambassadors/>

## Accomplishments for Coastal Conservation

By USFWS Coastal Program

Through the Coastal Program, USFWS has helped restore more than 557,790 acres of wetland and upland habitat, restore nearly 2,625 miles of stream habitat, and protect more than 2,165,855 acres of important wildlife habitat. This program is the USFWS’ primary tool for empowering voluntary, citizen, and community-based fish and wildlife habitat conservation on both public and privately owned coastal lands.

The Coastal Program provides technical and financial assistance to land managers and a diverse set of conservation partners to restore and protect coastal habitats throughout the Nation and U.S. territories. This includes supporting landscape-scale habitat conservation and encouraging community stewardship through technical assistance, outreach, and training. Some examples:

*The National Coastal Wetlands Conservation Grant (NCWCG) Program*—Together, the USFWS Coastal Program and the Wildlife and Sport Fish Restoration (WSFR) Program administer the NCWCG Program, which annually awards between \$18 and \$20 million to protect and restore coastal wetlands and associated uplands that provide valuable habitat for fish and wildlife. Funding for the grant is derived from the Sport Fish Restoration and Boating Trust Fund.

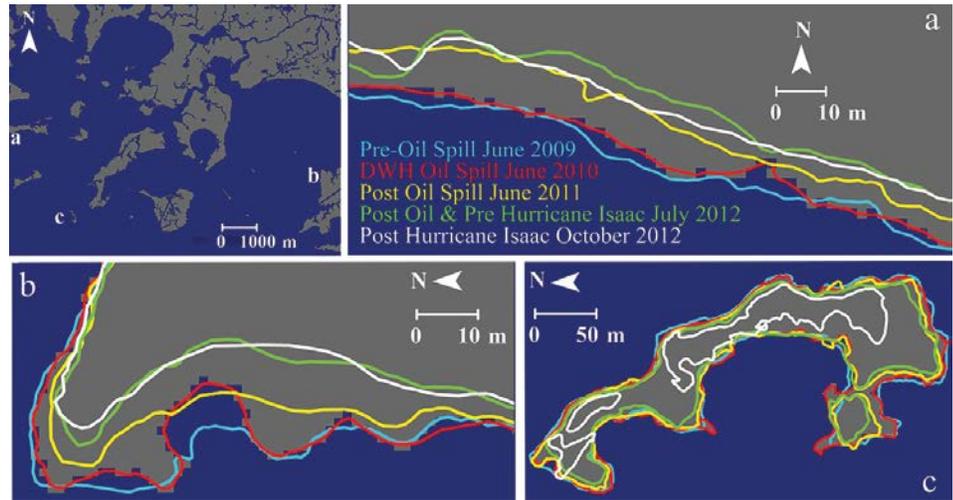
*Nisqually River Delta Carbon Project*—The Nisqually National Wildlife Refuge and the Nisqually Indian Tribe worked together to restore a tidal wetland in the Nisqually River Delta—one of the largest restoration projects in the Pacific Northwest. This restored wetland is part of a study being completed by the USFWS and

*See Accomplishments page 6*

## Higher Erosion Rates in Coastal Louisiana Associated with 2010 Oil Spill

By Amina Rangoonwala, Elijah Ramsey III, Gabrielle Bodin, and Jason Burton (USGS)

A study by the USGS and the National Aeronautics and Space Administration (NASA) demonstrated a pattern of widespread shoreline loss along the GoM coast associated with the 2010 BP *Deepwater Horizon* oil spill. Oil reduces vegetation biomass and weakens salt marsh soil, which causes sediment to erode more easily. Researchers compared NASA's annual maps of shoreline imagery, obtained by Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR), along the upper Barataria Bay before and after the oil spill. They determined that although storm-induced erosion occurred at isolated shoreline sections, the pre-spill shoreline from 2009 to 2010 was largely stable; however, widespread erosion occurred the first year after the spill (from June 2010 to June 2011), with the highest rates of erosion corresponding to areas that had moderate to heavy oiling. During that year, the length of shoreline eroding increased fourfold, with most of that erosion contained within 4–8 meters. The second year after the spill, the higher erosion rates expanded to include areas that had



Map showing island fragmentation and changes in the Louisiana shoreline between June 2009 (blue line) and October 2012 (white line) as a result of the 2010 *Deepwater Horizon* oil spill and 2012 Hurricane Isaac. Image credit: USGS

less oiling. Additionally, the oil spill and subsequent loss of plant material increased the fragmentation of wetlands, which can reduce natural coastal defenses against flooding.

The team also compared the erosion patterns after the oil spill to land loss caused by severe storms. Hurricane Isaac hit Barataria Bay in August 2012, causing severe erosion (>12 meters) in isolated areas of the bay. The spatially limited erosion pattern from severe storms contrasts with the progressive and extensive loss of shoreline from the oil spill. The difference in storm-driven and oil-driven erosion patterns has allowed the researchers to identify the causal relation between oil spills and shoreline

loss. These patterns were revealed by coupling high spatial resolution radar and geographic processing to create a repeatable and quantitative mapping method that will promote monitoring of erosion after future oil spills.

Read more: <https://www.usgs.gov/news/usgs-nasa-study-finds-widespread-coastal-land-losses-gulf-oil-spill>

### USFWS Coastal Program 2016 Accomplishments <https://www.fws.gov/coastal/>

In 2016, USFWS Coastal Program projects leveraged \$25 for every Coastal Program dollar.

#### The Approach

- Engage willing partners and landowners.
- Provide technical and financial assistance to conserve fish and wildlife resources in priority coastal landscapes.

#### 2016 Results

- 462 partners and landowners
- 280 projects
- 16,376 acres of wetlands
- 50,410 acres of upland
- 108 miles of stream habitat



Louisiana marsh shoreline in Barataria Bay during the peak of the Deepwater Horizon oil spill crisis, June 23, 2010. Photo credit: Bruce A. Davis, U.S. Department of Homeland Security

## Big Steps Forward for Gulf of Mexico Restoration in 2016

By Nanciann Regalado and Nadine Siak  
(DOI Gulf Restoration Team)

In April 2016, a global legal settlement with BP, the party primarily responsible for the 2010 *Deepwater Horizon* oil spill, was approved through a consent decree that added more than \$20 billion to State and Federal efforts over the next two decades to rehabilitate and improve the natural resources of the GoM region. This money is being disbursed through several channels, two of the largest being the *Deepwater Horizon* Natural Resource Damage Assessment and Restoration (DWH NRDAR) Trustee Council and the RESTORE (Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States) Council. As a DWH NRDAR Trustee and member of the RESTORE Council, the DOI is playing an important role in GoM restoration efforts.

As a part of the global settlement’s consent decree, the DWH NRDAR Trustee Council is now responsible for oversight and coordination for seven newly formed and independent trustee implementation groups (TIGs). These TIGs are responsible for planning and implementing almost \$9 billion worth of restoration projects for geographically based restoration areas, one for each of the five coastal States, one for the open ocean, and one region wide. Thus far, the Louisiana TIG has approved its first postsettlement restoration plan, and the Mississippi and Alabama TIGs have released draft restoration plans. This work is in addition to five “early restoration plans” approved before the settlement. Together, those restoration plans contain 65 projects with a combined value of \$868 million.

The RESTORE Council is responsible for approximately \$3.2 billion of GoM restoration funding. In December 2016, the RESTORE Council released a finalized update to its 2013 Comprehensive Plan that

provides a framework for making decisions on funding projects and activities moving forward. Updates to the plan include commitments to advancing large-scale restoration projects and coordinating with other restoration funding streams. A key goal of the plan is to find the most effective ways to collaborate with the TIGs to maximize the coordination and results of both programs.

One of the early projects approved for funding by the RESTORE Council is the Strategic Conservation Assessment Framework that will bring together the breadth of conservation plans from State, Federal, and nongovernmental organizations (NGOs) to help identify high value lands most suitable for conservation efforts. This is important as the USFWS works together with others to connect lands and waters to sustain fish, wildlife, and plants. *See related story, page 4.*

More information is available at <https://www.restorethegulf.gov> and <http://www.gulfspillrestoration.noaa.gov>

*Accomplishments continued from page 4*

USGS to evaluate how effectively and efficiently wetland sequester carbon.

**Landscape Conservation Design**—Through the Upper Midwest and Great Lakes Landscape Conservation Cooperative, the Coastal Program and the National Oceanic and Atmospheric Administration (NOAA) are leading the Coastal Conservation Working Group to develop Landscape Conservation Design decision support tools that will guide on-the-ground wetland conservation to maintain or improve functional landscapes and ecosystems by improving the science, planning, delivery, and monitoring of habitat conservation.

**Coastal Flooding and Sea-Level Rise**—The Coastal Program is providing help for coastal communities

in Texas to address coastal flooding and sea level rise. By working with partners, this project is developing restoration design criteria for marshes to increase wildlife benefits, reduce wave energy, and promote sediment deposition rates equal to sea level rise.

**Gulf of Mexico Restoration**—One of the most complex and comprehensive conservation efforts ever undertaken is following the *Deepwater Horizon* oil spill. This effort requires coordination among multiple Federal agencies, five GoM coast States, hundreds of local governments, conservation organizations, and citizens. The Coastal Program provides critical links between partners who are implementing landscape-scale conservation projects, as well as providing direct technical assistance and contributing additional project funds.

**Community-Based Sea Turtle Monitoring**—The Coastal Program is working with communities to document Hawai‘ian green turtle (*Chelonia mydas*) nesting and basking sites along the North Shore of O‘ahu, Hawai‘i. Volunteers are recording observations of basking turtles to help better understand turtle behavior on the main Hawai‘ian Islands.



Green sea turtles basking along Pacific island shores. Photo credit: Megan Nagel, USFWS

## USFWS Sends Coastal Barrier Resource System Report to Congress

### Updated Maps for 65 Units

By Terri Fish and Katie Niemi (USFWS)

The USFWS has completed a pilot project for updating the Coastal Barrier Resources System (CBRS) maps and submitted a report with a final set of recommended maps to Congress on November 29, 2016. The 65 affected units are in Delaware, North Carolina, South Carolina, Florida, and Louisiana. The revised maps will only take effect if adopted by Congress through legislation. Read more here: <https://www.fws.gov/ecological-services/habitat-conservation/coastal.html>

The criteria used to complete the maps for the pilot project are also now being used to modernize the maps for the eight States affected by Hurricane Sandy (Connecticut, Delaware, Maryland, Massachusetts, New Jersey, New York, Rhode Island, and Virginia). This project and the resulting map modernization will help enhance coastal resiliency and the ability of coastal communities and associated habitats to withstand future storms and reduce the amount of damage to life, property, and wildlife habitat.

The Coastal Barrier Resources Act (CBRA) of 1982 is a map-based law that uses a free-market approach to natural resource conservation. Development within the CBRS is allowed; however, most new Federal expenditures and financial assistance that encourage development—such as flood insurance—are prohibited, meaning developers or other non-Federal parties must bear the full cost. This prohibition saves the American taxpayer money and helps conserve these storm-prone and biologically rich areas.



Aerial view of North Topsail Beach, North Carolina, after Hurricane Ophelia showing homes in the surf. Photo credit: Program for the Study of Developed Shorelines, Western Carolina University

The USFWS administers the CBRA and is charged with updating the maps and making recommendations to Congress for appropriate changes to the CBRS.

At the time the CBRA was enacted in 1982, President Ronald Reagan said, “This legislation will enhance both wise natural resource conservation and fiscal responsibility. It will save American taxpayers millions of dollars while, at the same time, taking a major step forward in the conservation of our magnificent coastal resources.”

Since 1982, the CBRA has saved American taxpayers well over \$1 billion by removing Federal incentives to develop and redevelop sensitive coastal areas. It continues to save taxpayer money while benefitting fish and wildlife, including migratory birds and species listed under the Endangered Species Act, and today the CBRA is more relevant than ever. The costs of armoring vulnerable shorelines, replenishing eroded beaches, rebuilding washed out roads, dredging channels, and subsidizing coastal flood insurance will only continue to rise with the projected increase in frequency and severity of storms affecting our coasts.

*Since 1982, the CBRA has saved American taxpayers well over \$1 billion by removing Federal incentives to develop and redevelop sensitive coastal areas.*



Aerial view of a breach across Fire Island National Seashore, New York, caused by Hurricane Sandy. Photo credit: John Vahey, DOI



Illustration by Cole Goco.

## Cultural Impacts of Coastal Erosion and Flooding

### Iñupiaq Village of Kivalina

By Rebecca Behrens and Vanitha Sivarajan (DOI)

The Iñupiaq village of Kivalina is on a narrow barrier island in the southern Chukchi Sea. For hundreds of years, this island has served as an important corridor for nomadic coastal peoples connecting Kotzebue Sound with the Arctic Ocean and has been historically used as seasonal subsistence hunting grounds. Today, about 400 people reside year-round on the barrier island. Kivalina's economy relies heavily on subsistence hunting and fishing, and the buildup of sea ice provides a platform for bowhead whale hunting.

"Seventy-nine percent of our foods come from the land and the sea," said Janet Mitchell, Kivalina's city administrator. The thinning sea ice is making subsistence hunting more difficult, and causing serious erosion and flooding problems that, in addition to overcrowded housing conditions, have led Kivalina to plan to relocate. Ice thinning in the Arctic has been clearly documented, and Arctic sea ice has declined by 8 percent in the last 30 years. In addition, the Arctic melt season has lengthened, with the Chukchi Sea exhibiting one of the strongest trends towards both earlier spring melt and later autumn freeze. These changes have affected the food security of the Iñupiaq people and infrastructure of their homes.

Whaling is an important indigenous activity that brings the community together and gives them pride and a reason to push through the hard winter. However, hunters are now forced to travel north to find ice thick enough to travel on. In addition, the thinner ice allows whales to have a greater range further from shore. These difficulties have led to increased danger



Kivalina has undertaken several erosion control measures, such as the rock revetment wall installed by the U.S. Army Corps of Engineers in 2010, but will still need to relocate. The picture above was taken after the revetment was put into place. Photo credit: Kotzebue ShoreZone, Creative Commons Licensing Attribution 2.0 Generic

and a decreased yield from the hunt. The last successful bowman-shale hunt took place in 1994, more than 20 years ago. Similar hunting difficulties are seen as thinning ice and earlier ice melt has led to fewer walrus and

fish, inaccessible caribou herds, and a shorter hunting season of bearded seals. To compound the problem, the meat that residents are able to catch is becoming more difficult to preserve; ice cellars that historically kept meat frozen well into spring are freezing later in the year and are warming earlier.

The later freeze-up of the Chukchi Sea also means that the Kivalina village faces greater damage from fall storms. Extreme flooding from higher fetch (the distance that wind travels while generating waves), greater storm surges, and a lack of ice threatens the village. These floods not only damage infrastructure on the island, but consume the island itself. Extreme storms in 2004 and 2005 claimed 25 to 30 feet of beach along the shoreline, and 20 feet of erosion towards their airstrip—the primary way to

*See Cultural Impacts page 9*

### DOI Plays a Key Role in Managing the Arctic

By Sarah Abdelrahim and Gina Digiantonio (DOI)

Arctic communities are increasingly experiencing coastal erosion, flooding, permafrost degradation, shifting prey resources, changing ecosystems, and other challenges. The DOI Office of Policy Analysis (PPA) coordinates within the DOI Bureaus and between other Federal agencies, international entities, and Alaska natives to improve basic science, manage energy development, and preserve natural and cultural resources for the Arctic.

In order to meet these goals, PPA has taken action to:

- Under the U.S. Chairmanship of the Arctic Council, facilitate the sharing of information and best practices with international partners to adapt to changes in the Arctic;
- Coordinate the department's leadership of an Interagency Working Group for energy permitting in Alaska;
- Co-chair the interagency Community Resilience Working Group to increase Alaskan community resilience;
- Consolidate publicly available Arctic-related climate data and resources that help communities build resilience;
- Compile Federal programs and resources that could be useful for Alaskan communities seeking to address erosion, flooding, and other challenges; and
- Advance a science-based, whole-of-government approach to stewardship and planning in the U.S. Arctic that integrates and balances environmental, economic, and cultural needs and objectives.

Read more about PPA's work in the Arctic at: <https://www.doi.gov/ppa/office-policy-analysis-activities-related-arctic#main-content>

*Cultural Impacts continued from page 8*

get in and out of the isolated village. Extreme storms in 2006 eroded 50 feet inland, exposing permafrost and leaving Kivalina increasingly vulnerable. In 2007, another storm pounded the coast and 250 villagers were evacuated to nearby Red Dog Mine and Kotzebue. Repeated storms in subsequent years continue to affect the community. *See related story, page 1.*

Because of the flooding and erosion, the village voted to relocate as far back as 1992, yet little progress has been made on relocation. Cost estimates for relocating Kivalina range from \$100 million to more than \$400 million, and no single agency has the authority to control and respond to flooding and erosion effects. The Stafford Act, which governs disaster relief, is limited because it cannot be used to address coastal erosion. The Army Corps of Engineers (USACE) completed a rock revetment to protect the community in 2010, but this was meant to be a temporary solution for 15 years. Plans are underway to build an evacuation road and school 7 miles from the community; and much needs to be done to secure all the needed funds.

The lack of authority for relocation, combined with the lack of funding and the limitations of the Stafford Act, leave the Iñupiaq way of life, traditions, and cultural resources of Kivalina at great risk to the powerful ocean.

In 2013, DOI was part of an inter-agency working group that prepared this report, “Managing for the Future in a Rapidly Changing Arctic:” <https://www.doi.gov/sites/doi.gov/files/migrated/news/upload/ArcticReport-03April2013PMsm.pdf>

Read more: <https://toolkit.climate.gov/case-studies/relocating-kivalina>

## Sediment Deficits— The Silent Killer of Salt Marshes

By Neil Ganju (USGS)

If coastal salt marshes are like savings accounts, with sediment as the principal, all eight Atlantic and Pacific coast salt marshes considered in a new USGS study are “in the red.”

USGS scientists working on a quick way to predict salt marsh vulnerability were surprised to find that all eight of the Atlantic and Pacific Coast marshes where they field tested their method are losing ground. Half of them will be gone in 350 years’ time if they don’t recapture some lost terrain. The method, already in use at two national wildlife refuges, uses any one of several remote sensing techniques, such as aerial photography, to gauge how much of an individual marsh is open water and how much of it is covered by marsh plants.

Read more: <https://soundwaves.usgs.gov/2017/02/research2.html>

<https://www.usgs.gov/news/new-technique-quickly-predicts-salt-marsh-vulnerability>



USGS scientist Zafer Defne measures water and sediment movement at Forsythe National Wildlife Refuge, New Jersey. Photo credit: Sandra Brosnahan, USGS

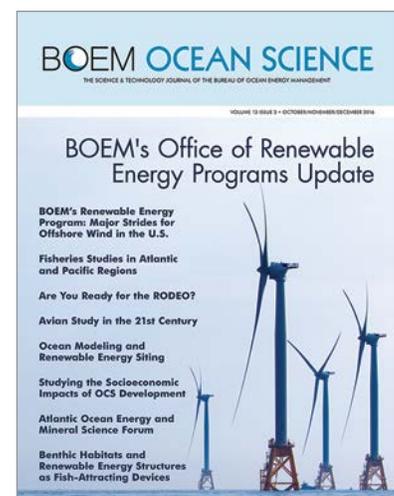
## Renewable Energy Programs Update

By Melanie Damour (BOEM)

The *BOEM Ocean Science* Oct/Nov/Dec 2016 issue (<https://www.boem.gov/Ocean-Science-Oct-Nov-Dec-2016/>) highlights recent updates of the BOEM’s renewable energy programs. As a regulatory agency with jurisdiction in Federal waters of the United States, the BOEM is responsible for oversight of conventional and renewable energy development and marine minerals extraction, while complying with Federal laws enacted to protect the environment. To date, the BOEM has issued more than 10 commercial wind energy leases in Federal waters, generating more than \$16.4 million in winning bids for the development of 1.18 million acres of submerged bottomlands.

“In 2016, we also witnessed the Nation’s very first offshore wind farm becoming operational in Rhode Island state waters off the coast of Block Island in the Atlantic,” said Acting BOEM Director Walter Cruickshank.

Commercial wind energy is no longer simply an aspiration for a sustainable energy future. Development



The Oct/Nov/Dec 2016 issue of *BOEM Ocean Science* provides an update on renewable energy programs, as well as other energy-related studies.

*See Renewable Energy page 10*

*Renewable Energy continued from page 9*

of renewable energy is of critical importance to the Nation and is now a reality onshore and offshore. The Block Island Wind Farm may set the stage for a long-awaited and even more expansive development of wind energy facilities on the Federal OCS. Because OCS wind is an abundant source of environmentally friendly domestic energy, it is well-positioned to contribute to the economic growth and energy independence of the Nation.

Developing renewable energy resources in a responsible manner is a priority for the BOEM. The Office of Renewable Energy Programs has funded 32 studies (6 in progress) that focus on filling technical knowledge gaps and informing best management practice recommendations. The BOEM also funds research through its Environmental Studies Program to inform decision-making related to extraction and development of renewable energy and mineral resources on the OCS. *BOEM Ocean Science* is a great way to keep up with these ocean resource studies: <https://www.boem.gov/Ocean-Science/>.



Illustration by Cole Goco.

## Sport Fish Restoration Grants Make Texas Marina a Showplace

By Craig Springer (USFWS)

Modernization of the popular Texas boating facility, Corpus Christi Municipal Marina, began in 2000 with funds provided through seven grants from the USFWS WSFR Program.

Sixteen years later, boaters and anglers from across the United States and around the world come to the Texas GoM coast to enjoy a top-notch marina for boats of all sizes. It's an excellent launch point for nearshore anglers, as well as for recreational boaters on long sojourns.

"This marina is hugely important to both boaters and anglers on the Texas Gulf Coast, and exemplifies how the Wildlife and Sport Fish Restoration Program works in partnership with others to improve boating access and infrastructures," said Cliff Schleusner, Chief of WSFR in the Southwest Region. "Boaters and anglers paid for it in excise tax, and now they and others reap the benefits."

The supportive funding made possible through the WSFR Program stems from two acts of Congress, laws originally enacted in 1937 and 1950

that laid the path for a user-pay, user-benefit system where the end outcome is improved public access to hunting, fishing, and boating.

Since 2000, the marina has received \$1,764,050 in Federal funds through WSFR grants that were specifically targeted to improve marina infrastructure, access for boaters, and sanitary facilities to maintain clean water. The grant monies, matched by the City of Corpus Christi and Texas Parks and Wildlife Department, have built modern septic pump-outs, restrooms and showers, a laundry, meeting rooms, a four-lane boat ramp, and more than 80 slips for boats greater than 26 feet in length.

The new infrastructures replaced outdated and aged materials and were designed to better withstand future coastal storms and hurricanes. Other infrastructure upgrades included internet systems needed for navigation.

"Boating and angling are to Corpus Christi and the Texas Gulf Coast what finance is to Wall Street: inseparable," said Schleusner. "The upgrades made to the Corpus Christi Municipal Marina should be a boon to boating and business."

Learn more about the WSFR Program: <https://wsfrprograms.fws.gov/>



An aerial view of the newly renovated Corpus Christi Municipal Marina is a launch point for both anglers and recreational boaters in coastal Texas waters. Photo credit: City of Corpus Christi

## USGS Experts Assess Tsunami Hazards for U.S. Atlantic and Gulf Coasts

By Ann Tihansky (USGS)

Tsunamis generated by submarine landslides constitute the most frequent and largest amplitude tsunami hazard to the U.S. Atlantic and GoM coasts, according to the USGS. The technical letter report, "Tsunami Hazard Assessment for the U.S. Atlantic and Gulf Coasts," was prepared in response to a request from the U.S. Nuclear Regulatory Commission (US-NRC) tasking the USGS to evaluate tsunami sources and their probability to affect the U.S. Atlantic and GoM coasts. The report augments and updates previous USGS reports to the US-NRC:

- "The Current State of Knowledge Regarding Potential Tsunami Sources Affecting the U.S. Atlantic and Gulf of Mexico Coasts" (2007),
- "Evaluation of Tsunami Sources with the Potential to Impact the U.S. Atlantic and Gulf Coasts" (2008), and
- "NRC/USGS Workshop Report: Landslide Tsunami Probability" (2012).

Read the report: <https://goo.gl/9isR4v>

The research was led by Uri ten Brink, who was recognized in July 2016 by the American Geophysical Union (AGU) as a member of the 2016 class of AGU Fellows, an honor given to individual AGU members who have made exceptional scientific contributions and gained prominence in their respective fields of Earth and space sciences. The 2016 class of AGU Fellows was recognized during the Honors Tribute on December 14 at the 2016 AGU Fall Meeting in San Francisco.

**At right:** USGS scientist Uri ten Brink (at left) stands with Margaret Leinen, AGU President, during the Honors Tribute. Photo credit: Gary Wagner, AGU

## Deep Sea Minerals Champion Recognized

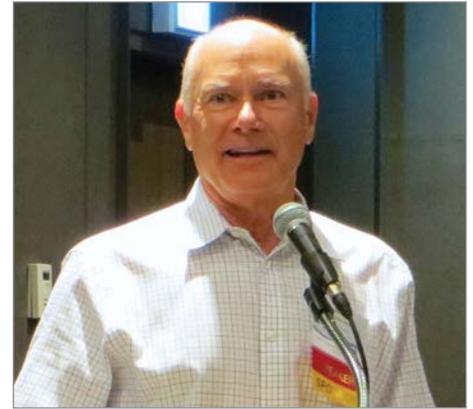
By Kira Mizell (USGS)

In 2016, the International Marine Minerals Society (IMMS) awarded its highest honor, the Moore Medal, to Dr. James Hein of the USGS Pacific Coastal and Marine Science Center in recognition of his 43-year scientific career dedicated to the USGS study of deep-ocean mineral deposits.

The IMMS, a professional society focused on the study and application of marine minerals, esteems Hein as a cornerstone scientist in the field of marine minerals, having a permanent effect on the field's continued development. In 2015, Hein was also recognized with a DOI Distinguished Service award, the highest award that can be granted to an employee within the DOI.

The Moore Medal is given to members of the IMMS who exhibit distinction in the field of marine minerals and contribute notably to the objectives and initiatives of the IMMS. Hein has been a member of the IMMS for 30 years, has authored and co-authored more than 500 papers and abstracts, served as an unbiased academic consultant to numerous studies, and has mentored many students and professionals working at marine mineral programs throughout the world.

Read more: <https://soundwaves.usgs.gov/2016/12/awards.html>



Dr. James Hein accepts the Moore Medal award in South Korea on October 11, 2016. Photo credit: USGS

*"Hein has become the worldwide expert in all types of deep-ocean mineral deposits, including manganese nodules, ferromanganese crusts, seafloor massive sulfides, phosphorites, and barites. Dr. Hein recognized the importance of studying land-based mineral deposits to gain insight into these deep-sea deposits. The body of his work has focused on the need for critical minerals for high-tech, green-tech, energy, and military applications."*

—from the 2015 DOI Distinguished Service award citation; read the full citation here: <https://www2.usgs.gov/humancapital/pc/documents/2015ConvocationProgram.pdf>

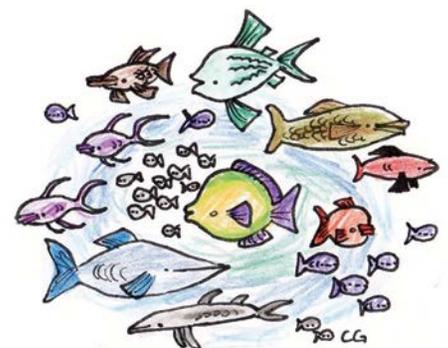


Illustration by Cole Goco.

## Lifetime Achievement for Law Enforcement

By Brent Lawrence (USFWS)

On March 9, 2017, the National Fish and Wildlife Foundation (NFWF) named Gary Young (USFWS) the 2017 National Guy Bradley Award winner for his outstanding lifetime achievements in wildlife law enforcement.

Young's 34-year career involved wildlife and natural resource protection, including marine mammal enforcement along the Alaskan coastline and 5 years of upholding fish, shrimp, and oyster commercial fishing regulations in Corpus Christi, Texas *See related story, page 10*. In 2012, Young was named Special Agent in Charge for the USFWS Pacific Region, which

includes Idaho, Oregon, Washington, Hawai'i and the Pacific Islands.

"Gary has been a tireless protector of our wildlife resources," said Jeff Trandahl, Executive Director and Chief Executive Officer of NFWF.

The prestigious award is presented to one State and one Federal agent each year and is named after Guy Bradley, the first wildlife law enforcement to be killed in the line of duty in 1905.

"Our wildlife resources have always played an important part in my life. But this huge honor isn't about me. It's about all the wonderful people I've worked with who helped me learn and progress, and it's about the agents who work so many long, hard days in the name of conservation. They make me proud to be a part of the USFWS Law Enforcement," Young said.



After a 34-year career in USFWS law enforcement, Young received the 2017 National Guy Bradley Award from the NFWF. Photo credit: USFWS

Adapted from: <https://www.fws.gov/news/ShowNews.cfm?ID=B8638C4C-FFDE-62D1-241F37696F481E83>

## Protecting U.S. Island Territories from Invasive Species

By Jhoset Burgos Rodriguez (National Invasive Species Council)

The ecosystems on U.S. island territories are particularly vulnerable to biological invasions caused by factors such as tourism and substantial importation of goods through air and sea. On island ecosystems, invasive species are the leading cause of documented extinctions and a leading threat to many other species. An estimated 45 percent of species listed under the Endangered Species Act and about 40 percent of all threatened species on the International Union for the Conservation of Nature (IUCN) Red List are found on islands.

In addition to causing ecological and cultural harm, invasive species can cost billions of dollars in economic damages by threatening water and food availability, impairing human and wildlife health, compromising

infrastructure, and increasing wildfire propensity. Invasive species such as the Crown of Thorns starfish (*Acanthasteridae*) and lionfish (*Pterois volitans*) are examples of marine species that threaten U.S. island territories.

On December 5, 2016, Executive Order 13751, "Safeguarding the Nation from the Impacts of Invasive Species," was issued to address invasive species threats. Around the same time, the governments of the U.S. island territories of American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, and the U.S. Virgin Islands, with Federal policy coordination by the DOI through the Office of Insular Affairs, signed a Memorandum of Understanding to establish the U.S. Territories Invasive Species Coordinating Committee (USTISCC). These steps offer promising improvements to addressing the challenges of managing invasive species.

The USTISCC works to prevent, eradicate, and control terrestrial and aquatic invasive species, and to

*"Invasive species" means, with regard to a particular ecosystem, a non-native organism [including seeds, eggs, spores, or other biological material capable of propagating that species] whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health.*

*—from Executive Order 13751*

protect and restore natural and cultural resources from the effects of invasive species.

Currently, USTICC members are finalizing their territorial invasive species action plans and are strengthening or creating local invasive species councils. By coordinating invasive species management we can fulfill the mission of conserving invaluable natural and cultural resources in the U.S. territories, as well as reduce potential invasions to the continental United States.

## Are you prepared for a tsunami?

Find out here: <https://www.ready.gov/tsunamis>



The brain coral boulder, 8 feet in diameter, stands 750 feet inland on Anegada, U.S. Virgin Islands. Geologists say that the coral was brought ashore, along with others, by an unusual tsunami or storm between the years 1200 and 1480 (<https://www.usgs.gov/news/enormous-caribbean-waves-1492>). These new findings reinforce precautions against coastal hazards. Photo credit: Brian Atwater, USGS

## 36th Nonnative Marine Fish Species Found in Florida

By Pamela Schofield (USGS)

A citizen scientist spotted and reported a nonnative blotched foxface (*Siganus unimaculatus*) offshore Dania Beach, Florida. Within 24 hours of the report, the USGS and Reef Environmental Education Foundation (REEF) captured the fish.

The blotched foxface is a type of rabbitfish that is native to the western Pacific Ocean. This is the first spotting of the blotched foxface outside of its native range, and it marks the 36th nonnative fish found in Florida. The rabbitfish is popular in aquariums but is a venomous and voracious fish that preys on marine vegetation such as seaweeds, algae, and seagrasses. *See related story, page 12.*

“Nonnative fish compete with and prey on native marine life and can spread diseases,” said USGS Research Fishery Biologist Pam Schofield. “Some can even be harmful to humans.” It is unclear if there are other blotched foxface fish in state waters since only one was found, but early detection and quick capture of nonnative fish is vital to preventing future invasions. The USGS and REEF have collaborated since 2008 by sharing reports of exotic fish between REEF’s online reporting with USGS researchers who maintain USGS’ Nonindigenous Aquatic Species database.

“Any organism outside its normal range has the potential to cause negative impacts,” said Lad Akins, Director of Special Projects for REEF. “If we wait to see what those impacts are going to be, it’s too late—they’ve already happened.” Together, the USGS and REEF have coordinated the live capture of 4 nonnative fish from Florida waters, including the blotched foxface.

*See Nonnative Species page 14*

## The IUCN Red List

<http://www.iucnredlist.org>

Over the past 50 years, the IUCN Global Species Programme and IUCN Species Survival Commission have created a compilation of species conservation status, called the IUCN red list. The IUCN red list highlights species that are threatened to determine their relative risk of extinction and share information regarding their distribution.



The NPS killed 6,433 Crown of Thorns starfish over 3 weeks in an effort to protect coral reefs in American Samoa. The starfish, known as alamea in Samoan, can quickly consume a coral reef, leaving a field of coral skeletons in its wake. National park divers are killing the alamea by injecting them with sodium bisulfate, a common chemical used to balance swimming pool pH levels. While toxic to alamea when injected, the chemical is harmless to people or other marine life. Photo Credit: NOAA

## Learn more:

National Invasive Species Council: <https://www.doi.gov/invasivespecies>

“Ecological and Socioeconomic Impacts of Invasive Alien Species in Island Ecosystems”: <https://doi.org/10.1017/S0376892907003815>

## Florida Corals Tell of Weather Past and Future

By Jennifer Flannery and Heather Dewar (USGS)

Boulder corals in the waters of Dry Tortugas National Park, 70 miles from Key West, contain evidence that confirms a centuries-old sea temperature cycle linked to rains, droughts, and hurricanes. Similar to tree rings that document past weather patterns on land, scientists have determined that long-lived boulder corals contain the chemical signals of past water temperatures.

By analyzing coral samples, USGS researchers and their colleagues have found evidence that an important 60- to 85-year-long cycle of ocean warming and cooling has been taking place in the region as far back as the 1730s.

The cycle, called the Atlantic Multi-decadal Oscillation (AMO) is linked to rainfall over most of the United States, Midwestern droughts, hurricane intensification and landfalls, and the transfer of ocean heat from the tropical Caribbean Sea to the North Atlantic Ocean by way of the Gulf Stream.

“The AMO has a huge impact on human populations and the economy, mainly through its influence on rainfall patterns,” said geochemist Jennifer Flannery of the USGS Coastal and Marine Science Center in St. Petersburg, Florida, who led the study. “Climatologists suspect the AMO is a natural climate cycle that has existed for more than 1,000 years. But until recently most of the evidence came from ships at sea, and only went back 150 years or so. That’s where the Dry Tortugas coral cores come in.”

While they are alive, corals take up strontium and calcium from seawater, depositing the two minerals in their skeletons in a ratio that varies with water temperature. By measuring the

## eDNA Shares Secrets

By: Gina Digiantonio (DOI)

Environmental deoxyribonucleic acid (eDNA) is a new technique that uses the DNA from feces, milt, slime, or carcasses that organisms leave behind as they pass through an area. The eDNA technique sheds light on ecological assemblages of a given habitat and organismal behaviors, such as habitat preferences.

USGS scientist Cathy Richter discussed her work during the DOI PPA seminar on February 13. “Environmental DNA (eDNA): A tool to determine species presence and abundance” and her collaboration with the USGS Columbia Environmental Research Center in Missouri.

strontium-to-calcium ratio in corals, scientists can reconstruct past sea surface temperatures. Working with two boulder corals cored by divers in 2008 and 2012, Flannery’s team used a dentist’s drill to collect and analyze samples at intervals as short as 1 month, going back as far as 1837. The Dry Tortugas samples precisely track major climate phenomena like the Little Ice Age that ended in the early 1800s and the lethal Dust Bowl drought of the 1930s.

“The record we obtained from the Dry Tortugas coral cores captures several complete AMO cycles stretching back 278 years. That gives climate modelers a lot of new evidence to work with as they try to understand past AMOs and predict future ones,” said Flannery.

Read the press release:

<https://www.usgs.gov/news/florida-corals-tell-cold-spells-and-dust-bowls-past-foretell-weather-come> Research paper: <https://doi.org/10.1016/j.palaeo.2016.10.022>

The group has applied eDNA techniques to the invasive Asian carp to determine where the species is present, locate spawning areas and times, and estimate relative biomass. The introduction of Asian carp into the Great Lakes would cause ecological devastation and has been prevented thus far. The information from eDNA provides data on the spread of the species and can prepare managers for quick response in the case of range expansion.

## Learn More About DOI's Mission

The PPA seminars are held monthly on the 2nd Monday, 12:15 to 1:15 EST. Watch live broadcasts and archived talks: <https://livestream.com/USInterior>

*Nonnative Species continued from page 13*

Read more: <https://www.usgs.gov/news/blotched-foxface-fish-found-florida-waters>

If you spot this fish or any other non-native or invasive aquatic species, please report the sighting to:

USGS’ Nonindigenous Aquatic Species database: <https://nas.er.usgs.gov/default.aspx>

REEF’s exotic species sighting program: <http://www.reef.org/exotics>

You can also sign up for USGS Non-indigenous Aquatic Species alerts: <https://nas.er.usgs.gov/AlertSystem/default.aspx>



The invasive blotched foxface rabbitfish found in Florida waters. Photo credit: James Fatherree

## California Explores Ocean Renewable Energy

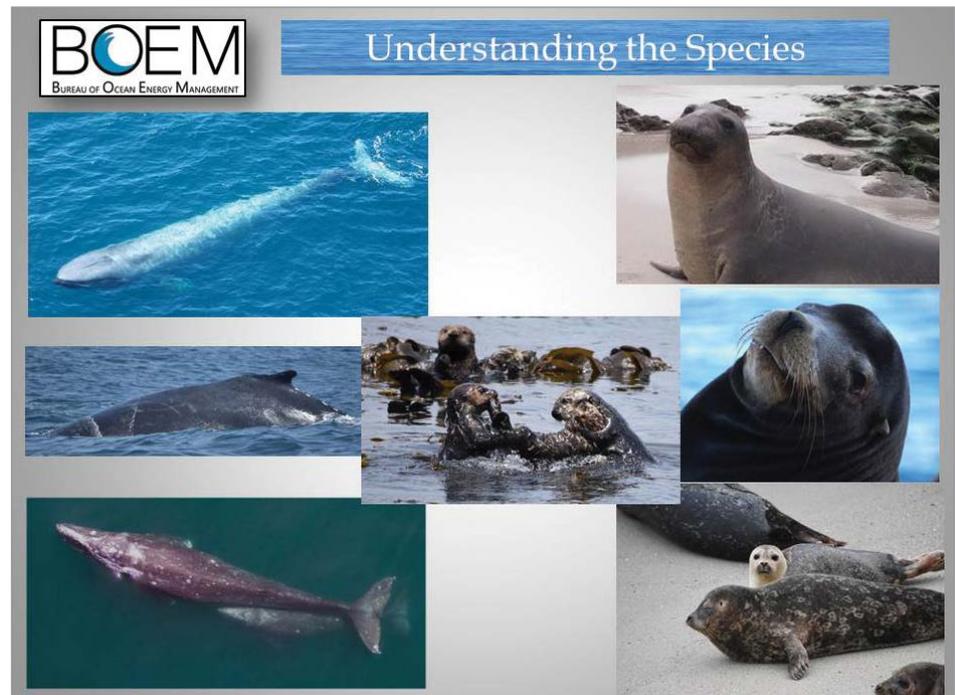
By Sara Guiltinan (BOEM)

On November 1–2, 2016, scientists, engineers, educators, interested members of the public, and representatives from Federal, State, and local governments gathered at the University of California (UC) Davis to share information about ocean renewable energy potential offshore California.

With California's ambitious goal to get 50 percent of its electricity from renewable sources by 2030 and recent commercial interest in developing wind energy offshore California's central coast, the California Ocean Renewable Energy (CORE) Conference was a timely event. Conference participants explored both offshore wind energy and wave energy development potential off the Golden State's shores. The CORE Conference was sponsored by the BOEM, and the UC Davis College of Engineering was a cooperating partner to

share information on all aspects of ocean renewable energy including permitting, technology and potential environmental, and economic effects.

All presentation materials from the conference, as well as additional information, are available at: [https://www.boem.gov/CORE\\_Conference/](https://www.boem.gov/CORE_Conference/)



BOEM Wildlife Biologist Greg Sanders shared a slide from his CORE conference presentation, "Potential Interactions Between Offshore Renewable Energy Activities, Marine Mammals and Sea Turtles." Image credit: Greg Sanders, BOEM

## First Meeting for West Coast Regional Planning Body

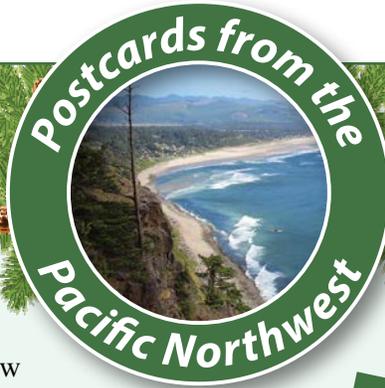
By Sara Guiltinan (BOEM)

The Tribal, State, and Federal representatives of the West Coast Regional Planning Body (RPB) convened for their first official in-person meeting on October 26–27, 2016, in Portland, Oregon. They discussed regional coordination and marine planning on the West Coast. The RPB members were able to look to at both the Northeast Ocean Plan and the Mid-Atlantic Regional Ocean Action Plan as examples while considering the best planning approach and tools to suit the West Coast. National Ocean Council Director Deerin Babb-Brott participated in the meeting and shared his insights and advice on effective regional planning strategies. RPB members discussed the many facets of marine planning, including the West Coast Ocean Data Portal, ocean assessment, communications and engagement with stakeholders, and a subregional approach for planning in the large and diverse West Coast region.

The meeting included opportunities for public comment, during which attendees offered their own valuable insights and recommendations. DOI representatives attending the meeting included Joan Barminski, Pacific Regional Director for the BOEM, along with staff from the Bureau of Indian Affairs (BIA), USFWS, and the Office of Environmental Policy and Compliance.



DOI attendees at the 2016 West Coast RPB meeting. From left to right: Keith Hatch (BIA), Yvonne Fish (BIA), Brian Milchak (DOI), Sara Guiltinan (BOEM), Chris Swenson (USFWS), Joan Barminski (BOEM), Allison O'Brien (DOI), and Doug Garcia (BIA). Photo credit: Sara Guiltinan, BOEM



## A Behind-the-Scenes Perspective of DOI Activities

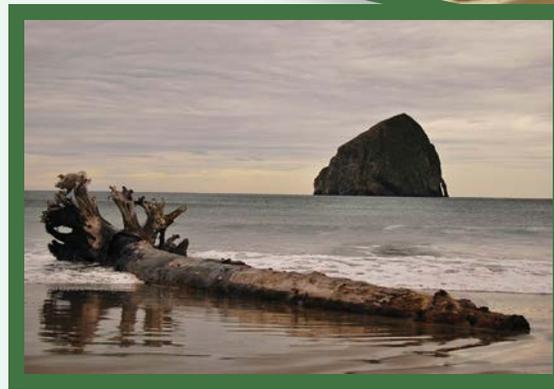
By Erica Wales (DOI)

I spent 2016 as a Sea Grant Knauss Fellow in the DOI Office of Policy Analysis (PPA), working with the Ocean, Great Lakes, and Coastal team. Working at the DOI in Washington, D.C., is a great way to see what DOI does at a high level when it comes to the ocean, Great Lakes, and coasts. To get a better sense of the scope of work the Bureaus carry out across the landscape, I toured in the Pacific Northwest to visit with several Bureau offices and facilities (which included driving nearly 2,000 miles across mountains, through snow, and on winding roads that hugged the coast). Through these behind-the-scenes visits, I gained a much better sense of how DOI Bureaus support the DOI mission of protecting and managing our public lands and resources.

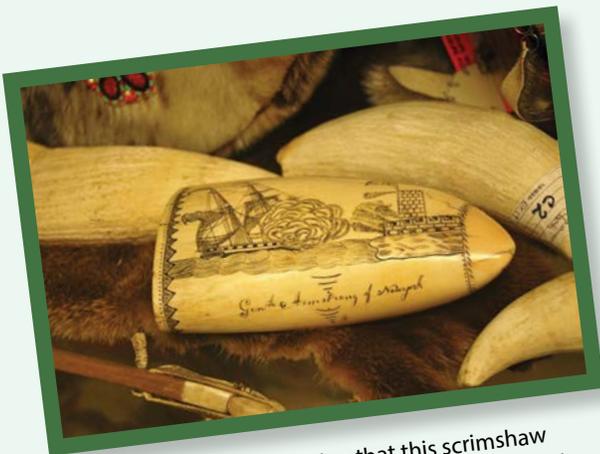
### Wildlife Forensics—USFWS in Oregon

The mission of the USFWS is to conserve, protect, and enhance species and habitats. For many people, this means restoration projects and refuges. But in Ashland, Oregon, the USFWS Forensics Laboratory is the world's only research facility dedicated to crimes against wildlife. Investigators here have pioneered innovative techniques in everything from grizzly bear autopsies to underwater fingerprinting, and today the lab is a linchpin in the fight to protect endangered species and solve wildlife crimes. While there

Reference animals, like the birds pictured below, are just one of the resources the lab has to help stop wildlife crime. Photo credit: Erica Wales, DOI



This haystack rock is one of 1,853 rocks and islands and two headlands in the Oregon Island National Wildlife Refuge. Photo credit: Erica Wales, DOI



The lab was able to determine that this scrimshaw originally had a carving of Lenin and was from Russia and was not a Tribal or Native Alaskan carving. Photo credit: Erica Wales, DOI

are only 17 scientists who work on these criminal cases, they analyze 8,000–10,000 items each year to help 200 USFWS special agents enforce 12 laws. They also deal with trade issues, helping to determine if a protected species is being traded illegally. For example, scrimshaw (whale bone carvings) are illegal to sell and trade, with some exceptions for items that pre-date 1972 and certain Tribal and Native Alaskan practices. The lab found that this carving, shown at left, had been imported illegally and made to look like a native carving so that it could be traded.

The lab uses science and evidence processing to respond to trends in wildlife crime. The lab has around 5,000 tree samples, the world's largest collection of frozen wildlife tissues, an immense collection of hairs, 60,000 genetic reference samples from all over the world, a large collection of reference animals, and works on a variety of cases ranging from tree oil to whole animals. Learn more: <https://www.fws.gov/lab/>

### Invasive Species Effects—USFWS in Oregon

At the Oregon Islands National Wildlife Refuge (one of six related refuges in the Oregon Coast National Wildlife Refuge Complex) invasive vegetation is an issue. Invasive species are replacing native grasses growing on rocky outcrops. Many birds, such as puffins and auklets, burrow and nest in these grasses, but the invasive species make it unsuitable for these nesting birds. Another issue is human disturbance. The Refuge complex hosts 1.2 million nesting seabirds—more than the coasts of California and Washington combined. Human disturbance can destroy habitat and cause nest abandonment. Although climbing on the rocks above the high tide line is not allowed, people are getting close to the islands with the increasing use of drones. Finding ways to reduce these aerial disturbances is a new challenge for the complex.

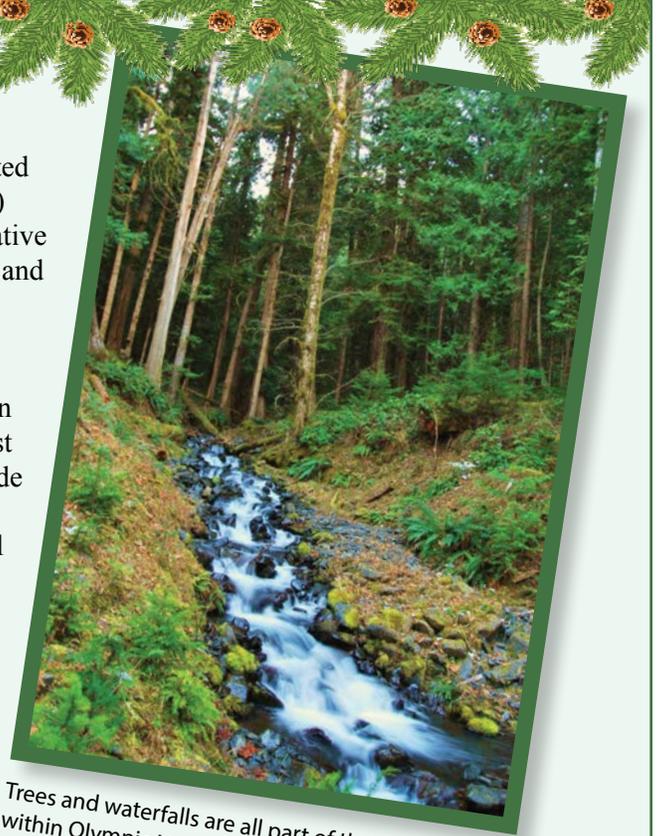
### Talking Science at Olympic National Park—NPS in Washington

Next, I headed up to the Olympic Peninsula in Washington to meet with Olympic National Park's (Olympic) coastal ecologist/limnologist and talk science. Olympic is a park for any kind of adventurer. The park has 1 million acres, 95 percent of it designated by Congress as wilderness. There are three different ecosystems within the park: lowland temperate rainforests, mountains, and coasts. There are 650 mountain lakes and 2 lowland lakes. Lake Crescent, more than 600 feet deep, used to be a river created by a retreating glacier. An earthquake collapsed two mountains, trapping fish in the newly formed lake.

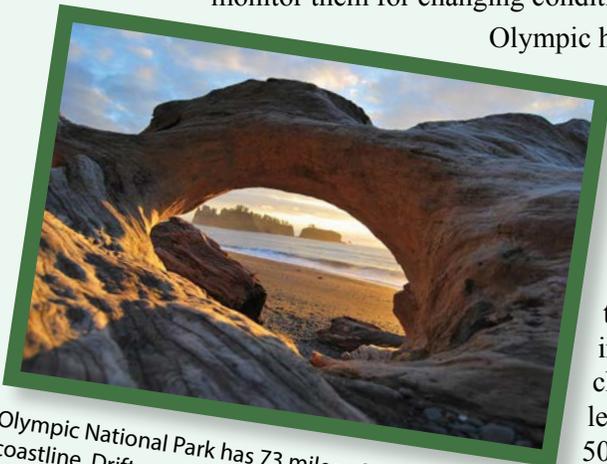
Olympic's science program became more robust with the Natural Resource Challenge (<https://www.nps.gov/nature/challenge.htm>), an NPS initiative to increase understanding of natural resources in national parks. NPS scientists completed research and monitoring, including stock and population assessments, to help inform management. The goal is to inventory NPS units to know what is in the units, as well as to monitor them for changing conditions and related effects on park resources.

Olympic has 73 miles of wilderness coastline, the most in the lower 48.

This coastline includes rocky beaches, headlands, sandy beaches, cliffs, and cobble beaches, all mixed together. There are 205 intertidal species of algae, 65 intertidal fish species, and 536 intertidal invertebrates. Scientists complete long-term monitoring of the rocky intertidal zone and sandy beach infaunal communities to track bands of species assemblages and numbers. They also monitor temperature, which is critical to track in the intertidal zone because species are experiencing changes in air and water temperature as the effects of climate change grow. The park is experiencing ocean acidification at levels other parts of the United States will experience in 30 to 50 years. To help the park adapt to these changes, Olympic is part of a network of parks that is monitoring intertidal ocean acidification on the West Coast (other parks in this network are Cabrillo, San Juan, and Channel Islands).



Trees and waterfalls are all part of the resources within Olympic National Park. Monitoring the three distinct ecosystems is a vital part of the science that informs management of the changing conditions of the park. Photo credit: Erica Wales, DOI



Olympic National Park has 73 miles of wilderness coastline. Driftwood and offshore rocks are part of the appeal of this rugged coastal park. Photo credit: Erica Wales, DOI

**Managing Multiple Land Use—BLM in Oregon**

Through my year at the DOI, I learned that the Bureau of Land Management (BLM) is a multiple use agency, meaning they must balance a lot of competing uses on the lands they manage. Donning a hard hat and boots, I met with BLM staff who took me into the field to see various projects BLM-Oregon was carrying out in the Coos Bay/North Bend area.

European beach grass is an invasive species on the dunes of Oregon. The grass was brought in because of its ability to hold the sand, which is good if you want to develop the area behind the dunes; however, the grass has drastically changed the dune ecosystem, which was adapted to changing shape with the wind. The ecosystem became less dynamic after the beach grass took over the dunes.

The North Spit Area of Critical Environmental Concern is a 725-acre area managed by BLM and the USACE, but one-third of Oregon’s snowy plover (*Charadrius nivosus*) population nests on 175 acres in that area. To help the plover population, BLM carries out a number of projects to remove the beach grass, spreading oyster shells for camouflage, and monitoring nests with a global positioning system (GPS). Unlike most plovers that nest on the fore dune, the plovers in Oregon nest on the back dune. To help newly hatched plovers over the dune, through the beach grass, and reach the ocean to feed, BLM has created chick migration corridors, small cut-outs in the dune where the plovers can more easily navigate their way to feed. BLM has to balance recreation on the spit (you can drive on the beach and the dunes during certain times of the year), the National Historic Preservation Act (an old railroad also runs through the area), restoring native plants like pink sand verbena (*Abronia umbellata*), as well as supporting the plover population...certainly a challenge.



Part of BLM’s habitat restoration work, chick migration corridors help newly hatched Western Snowy Plovers get from the back dune to the beach to feed. Photo credit: Erica Wales, DOI

Another land use that BLM manages is timber. I went to an active timber sale to learn about the process. At this site, no clear cutting was occurring, but specific trees were being marked and then cut. If a tree is cut that is not marked, the logging company will have to pay the value of the tree. It was pretty amazing to see the whole process. After a tree is cut, it is pulled up to the landing site by a yoder (a machine with cables and pulleys), a second machine cuts off branches and cleans up the tree, and then another places the trunks in a pile so they can be loaded on a truck. Although logging can be a contentious use of land, BLM is committed to following safe and proper procedures.

Finally, I visited a stream site where BLM was restoring fish habitat, vital for spawning fish, such as the Coho salmon, which is listed under the Endangered Species Act. BLM’s restoration activity included bringing in logs and gravel to restore the stream to a more natural state. The logs create eddies and pools in the bottom sediment where the fish can lay their eggs. The logs must be carefully selected for size and location relative to the stream, and carefully placed (often wedged into place) so that the proper habitat is created. Although putting logs and gravel in a stream may not sound like a particularly hard thing to do, one must be careful in how those logs are placed or a snow melt or storm could wash the logs downstream.

From solving wildlife crime mysteries to restoring fish habitat, DOI’s Bureaus carry out an incredibly diverse array of work to fulfill the DOI mission. The landscape of the Pacific Northwest is unforgettable, and I will certainly never forget the amazing work the DOI Bureaus do to preserve and protect our lands and resources.



**Top:** Erica Wales (in blue) at an active BLM timber site. Photo credit: Greta Krost, BLM. **Bottom:** Restoring a stream to a more natural state has helped spawning fish return to the Pacific Northwest. Photo credit: Erica Wales, DOI

## Healthy Groundwater for Shinnecock Nation Information for Resource Managers

By Michael Noll (USGS)

The Shinnecock Nation, an Algonquin tribe on the south fork of eastern Long Island near the town of Southampton, New York, relies on clean groundwater for drinking and healthy coastal fisheries. Oyster fisheries and other marine ecosystems in Shinnecock Bay are critical to the livelihood of many residents living on the Tribal Lands. In addition, about 6 percent of the households on the Tribal Lands use wells that tap the shallow freshwater aquifer (water table) for their primary source of drinkable water.

The quantity and quality of groundwater being discharged into coastal waters bodies may adversely affect the health and long-term sustainability of marine flora and fauna. Harmful algal blooms resulting from nutrient enrichment are a substantial threat to the fisheries on Long Island and may be responsible for the decline of oyster yield from the Shinnecock Bay. Rising sea level and saltwater intrusion, infiltration of storm overwash (surge) from intense coastal storms, nutrient loading from fertilizers, and septic effluent from wastewater disposal systems have been identified as potential sources of contamination to the surficial aquifer beneath the Tribal Lands. Defining the shape of the water table and the flow of shallow groundwater to Shinnecock Bay is crucial to identifying sources of potential contamination and evaluating the status of this water supply.

In December 2016, the USGS published the results of a study with the Shinnecock Nation and the Suffolk County Department of Health Services that was designed to provide information the tribe needs to manage their groundwater resources. The project began with drilling and



USGS scientist calibrates an electromagnetic induction borehole probe as part of the geophysical data collection at monitoring wells on Shinnecock Nation Tribal Lands. Photo credit: USGS

installing 17 new monitoring wells on and around the Tribal Lands. The freshwater lens in the aquifer beneath the south fork of Long Island resembles a bowl or wedge that floats on top of deeper salty water from the surrounding Atlantic Ocean and the Peconic Bay. USGS scientists used geophysical techniques to determine the position of the freshwater-saltwater transition zone beneath the Tribal Lands. Understanding where saltwater is present beneath the Shinnecock Nation, and the south fork of Long Island in general, is important for water suppliers that provide drinking water to residents of the south fork and Tribal Nation.

Because contaminants can move at the speed of groundwater, it is important to understand how fast groundwater moves from within the aquifer to the coastal waters of Shinnecock Bay. USGS scientists were able to estimate this travel time based on aquifer tests, along with the geophysical surveys and water-level data. In addition to these data and analyses, the monitoring wells will continue to provide critical information to the Shinnecock Nation so they have the information they need to make informed decisions about managing their water supply, fisheries, and other natural resources.

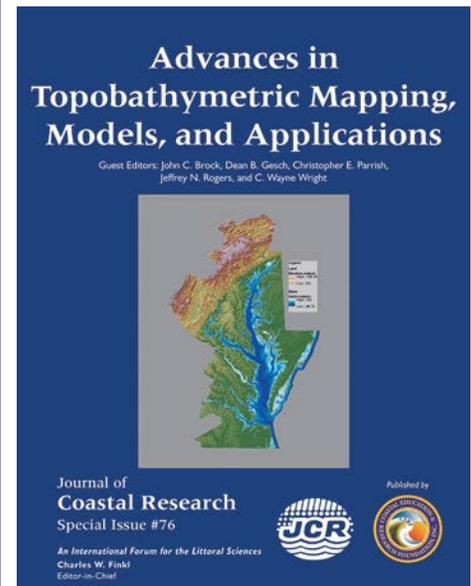
Read more: <https://doi.org/10.3133/sir20165110>

## Advances in Topobathymetric Mapping

By John Brock and Dean Gesch (USGS)

In coastal environments, elevation is perhaps the most fundamental and important variable that determines vulnerability to flooding and storm effects. Accurate high-resolution digital elevation models (DEMs) that show land and submerged topography (bathymetry) are key to coastal wetlands mapping and monitoring, storm surge and sea-level rise modeling, benthic habitat mapping, coral reef ecosystem mapping, and a host of related activities.

A special issue of the *Journal of Coastal Research* edited by USGS scientists, “Advances in Topobathymetric Mapping, Models, and Applications,” provides a broad array of recent



The image used on the cover of Special Issue 76 of the *Journal of Coastal Research* features a topographic-bathymetric DEM of a part of the Chesapeake Bay watershed and adjacent areas along the Atlantic coast in the eastern United States. The USGS Coastal National Elevation Database project developed the DEM as part of an ongoing effort to improve elevation information for U.S. coastal regions. Learn more: <https://topotools.cr.usgs.gov/coned/>  
Image credit: Dean Tyler, USGS

See *Topobathymetric* page 20

*Topobathymetric continued from page 19*

research findings on data, processing methods, applications, and physical processes that are critical for increased understanding of the dynamic coastal environment.

The special issue offers current information for coastal zone resource managers and provides the impetus for future research and advances in data, methods, models, and applications for the elevation mapping in a changing coastal environment. The issue is available at: <http://www.jcronline.org/toc/coas//76>

## Comprehensive Geologic Mapping of Delmarva’s Inner Continental Shelf— Now Available!

By Laura Brothers (USGS)

The USGS has collected about 10,000 kilometers of new geophysical data and 258 sea floor grab samples along with video footage at more than 200 bottom video stations to describe the geology and sea floor

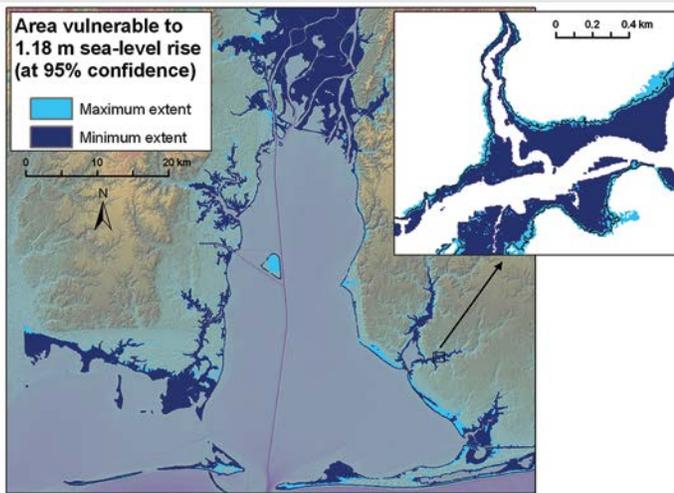
characteristics on the Delmarva Peninsula’s inner continental shelf.

Additionally, the USGS acquired and repurposed existing NOAA hydrographic data and BOEM Wind Energy Area geophysical data to optimize the design of this extensive survey to produce one of the most data-rich and areally extensive (about 5,100 square kilometers) inner continental shelf studies on the U.S. Atlantic coast.

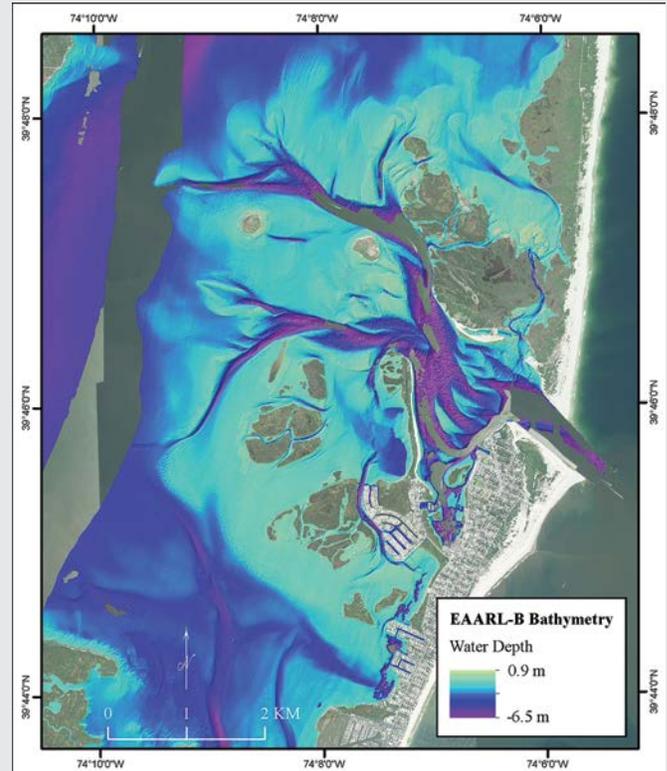
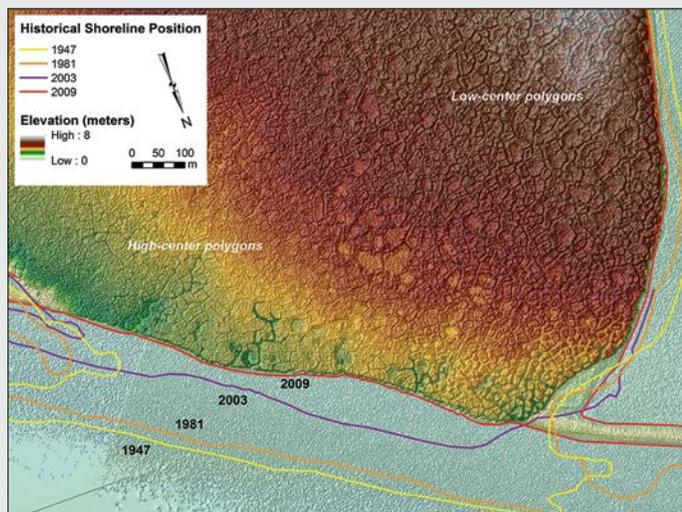
The Delmarva Peninsula is a 220-kilometer-long headland, spit, and barrier island complex on the coast

*See Geologic Mapping page 21*

### Examples of Topobathymetric Mapping Applications



Topobathymetric data were used to create a map of minimum and maximum extent of the area vulnerable to inundation after 1.18 meters of sea-level rise (at 95-percent confidence) in the Mobile Bay, Alabama, region. Image credit: Dean Gesch, USGS



Polygonal tundra features at Brownlow Point, along the North Slope of Alaska, are visible in a DEM derived from high-resolution airborne light detection and ranging (lidar). Shoreline positions between 1947 and 2009, digitized from historical maps and satellite imagery, are also shown on the map. Image credit: Ann Gibbs and Bruce Richmond, USGS

EAARL-B (second-generation Experimental Advanced Airborne Research Lidar) bathymetry acquired near Barnegat Bay Inlet, New Jersey, in late 2012, was compiled from data collected immediately before and after the landfall of Hurricane Sandy to reduce the number of data gaps in this area. Image credit: USGS

*Geologic Mapping continued from page 20*

of Delaware, Maryland, and Virginia that was substantially affected by Hurricane Sandy. In response to Hurricane Sandy, DOI funded an initiative to define the geologic framework of the Delmarva inner continental shelf and its role in coastal sediment flux and vulnerability through geophysical mapping of its offshore areas. The Delmarva Project provides baseline datasets and derivative interpretive maps that offer a geospatial framework for scientific research and provide critical information to planners and decision-makers who oversee the management of resources and

mitigation of hazards in the coastal ocean. Bathymetric data are critical for developing surge models, whereas sub-sea floor data inform structural and geologic understanding.

These data and mapping products are needed for:

- Identifying sand and cultural resources;
- Delineating benthic habitat;
- Identifying shallow geohazards, such as natural gas and structurally weak sediment units;
- Evaluating and selecting optimal sites for offshore infrastructure placement; and

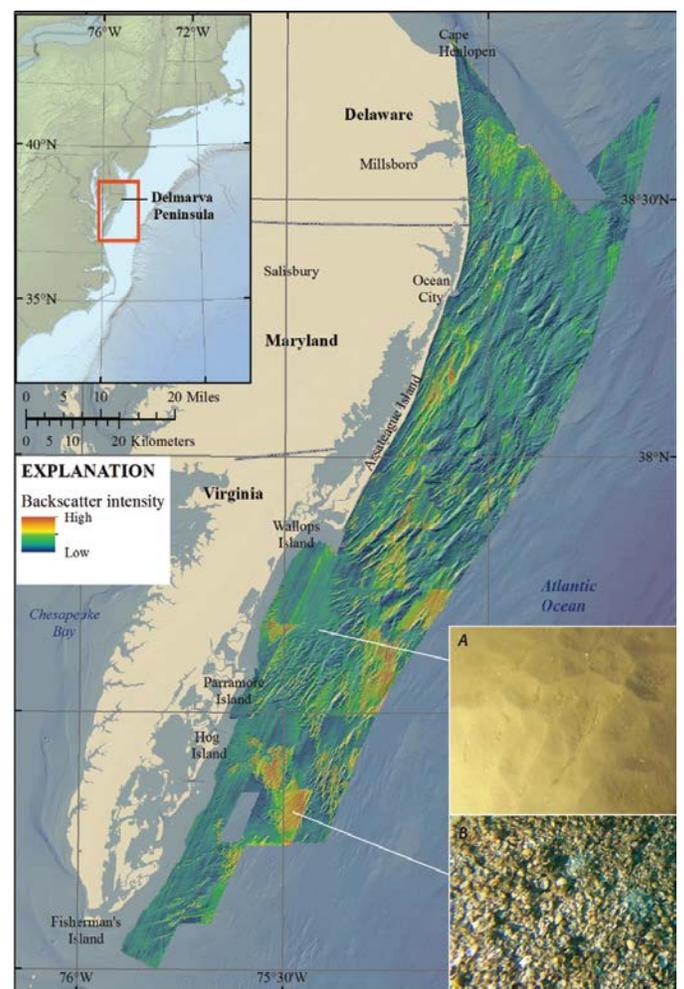
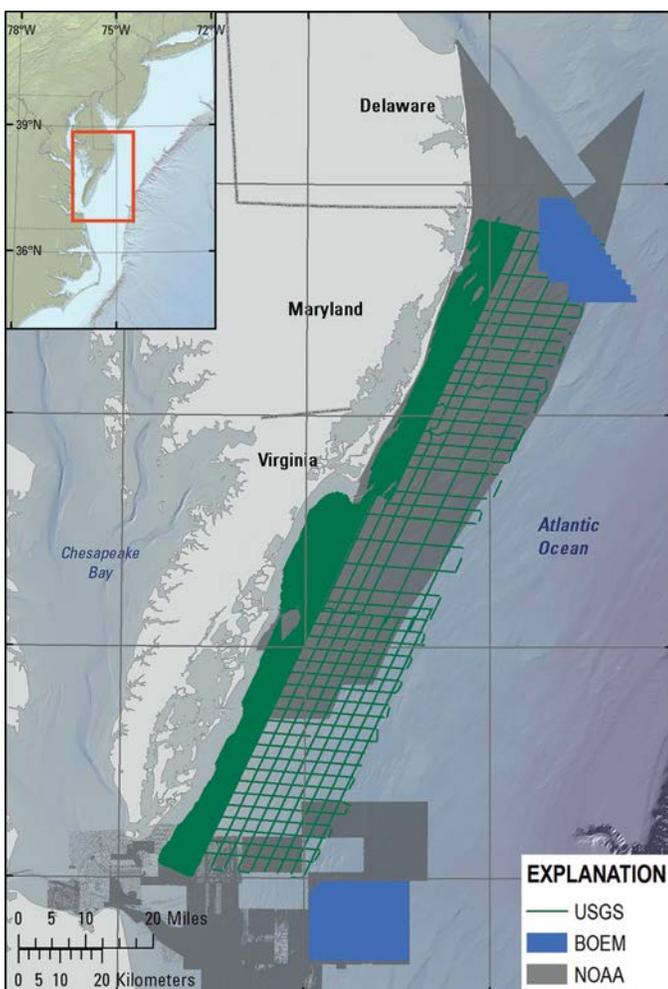
- Informing siting for offshore development and general marine planning.

These datasets will also contribute to improving our ability to identify coastal areas in the region that are most susceptible to effects of large storms and sea-level rise.

High-resolution geophysical data releases:

<https://doi.org/10.5066/F7MW2F60>  
<https://doi.org/10.5066/F7P55KK3>  
<https://doi.org/10.3133/ofr20141262>

Read more: <https://woodshole.er.usgs.gov/project-pages/delmarva/>



**Left:** The USGS conducted surveys on the inner continental shelf of the Delmarva Peninsula (shown in green) in order to complement related datasets previously collected in the area by partners NOAA and BOEM. The inset map shows location of study area. Image credit: USGS.

**Right:** Hill-shaded bathymetric, backscatter and photographic data collected by NOAA and the USGS on the inner continental shelf of the Delmarva Peninsula. Backscatter data give indications of sea floor character. In general, low-backscatter intensity (blue) corresponds to finer grained material, whereas high-backscatter intensity (orange) corresponds to coarser substrate. Off the coast of Virginia zones of low backscatter indicate a smoother, sandy sea floor (inset A), whereas zones of high backscatter often indicate a sea floor with abundant carbonate (shell hash) (inset B). Image credit: Laura Brothers, USGS

## Regional Planning Bodies Recognized with Peter Benchley Award

By Ann Tihansky (USGS)

The Mid Atlantic and the Northeast RPBs have been recognized along with the Rhode Island Ocean Special Area Management Planning Team with the 2017 Peter Benchley “Excellence in Solutions” award.

This award recognizes those who help find or create practical solutions to the environmental challenges confronting our seas.

Bob LaBelle of BOEM and the Federal co-lead of the Mid-Atlantic RPB, received the award on behalf of the RPB along with the State and Tribal co-leads, and the Northeast RPB co-leads, on May 11 at the Smithsonian’s Sant Ocean Hall in the National Museum of Natural History in Washington, D.C.

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

### From the award citation:

“To fully utilize and protect the ocean requires good planning which is why this year’s Solutions Award is going to three model programs that engage a wide range of ocean stakeholders including state, federal and tribal ocean resource managers to better understand, map and make use of our public seas for all citizens... Awardees include three widely-admired planning bodies: the ocean SAMP team in Rhode Island and two ocean policy planning bodies in the Northeast and Mid-Atlantic that were established under the U.S. National Ocean Policy of 2010. Each of these three groups has produced landmark ocean plans that will benefit all users and provide excellent models for other states and regions to engage in smart ocean planning. Ultimately, they are proving that securing our ocean future in a collaborative way is not only possible, but the best way forward.”

## STEMSEAS

STEMSEAS is designed to

- (1) increase the number of meaningful shipboard experiences for under-graduate students;
- (2) introduce students to essential skills and competencies for geoscience careers; and
- (3) expose both STEM and non-STEM students to STEM issues and careers through transformative experiences.

The program leverages scheduled ship transits to provide 6–10 day on-board exploratory experiences for undergraduates from diverse backgrounds aboard National Science Foundation-funded research vessels.

Read more about the activities during the R/V *Sikuliaq* transit.

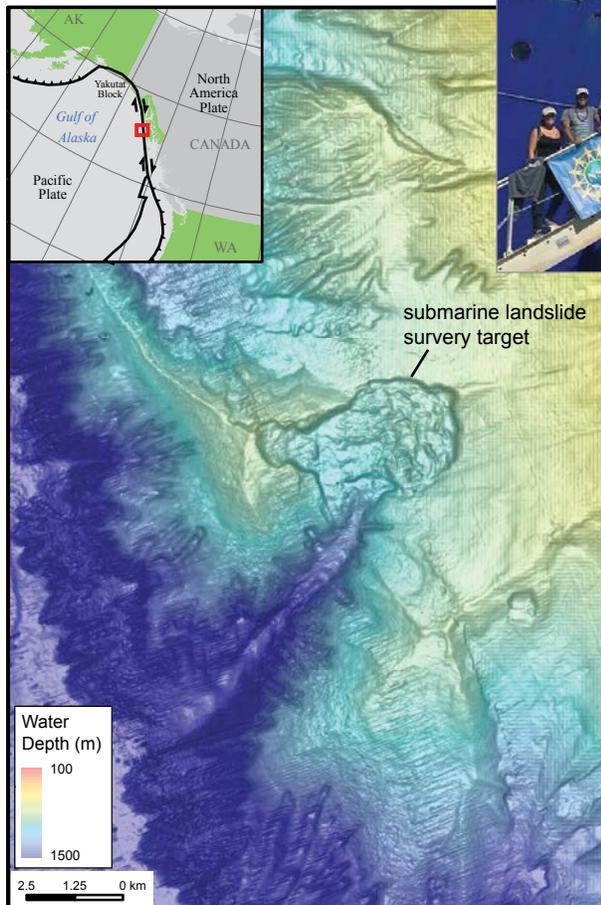
Visit the STEMSEAS blog at <https://stemseas.wordpress.com/> or Facebook page at <https://www.facebook.com/stemseas/>

## Students Explore Geoscience Hazards in the Gulf of Alaska

By Kris Ludwig and Danny Brothers (USGS)

In August 2016, USGS scientists collaborated with a new National Science Foundation-funded geoscience education program to share hazards science with 10 undergraduates while at the same time filling in a critical research data gap in sea floor bathymetry on the Queen Charlotte Fairweather Fault (QCFF) in the Gulf of Alaska.

Onboard the research vessel (R/V) *Sikuliaq*, 10 students and 4 mentors sailed from Seattle, Washington, to Seward, Alaska, from August 17 to 23, 2016, as part of the Science, Technology, Engineering and Math (STEM) Student Experiences Aboard Ships (STEMSEAS) program to engage in geoscience, oceanography, and career exploration activities.



Students on board for science and adventure aboard the R/V *Sikuliaq*. Photo credit: Karen B. Thomson, STEMSEAS Instructor

Map of complete bathymetry data showing one of the submarine landslide scars along the continental shelf margin near the 2012 M7.5 Craig earthquake. Image credit: Danny Brothers, USGS

See *Geoscience Hazards* page 23

*Geoscience Hazards continued from page 22*

USGS shipboard mentors included QCFF researcher Danny Brothers and scientist Kris Ludwig, who joined the program to share expertise in hazards science and facilitate the collection of “datasets of opportunity” for ongoing USGS research on the QCFF.

The 10 undergraduate students—most at sea for their first time—tested their sea legs and stamina as they learned about the deep sea geology of the Northeast Pacific Ocean. As they studied, the ship’s multibeam bathymetry sound navigation and ranging (sonar) mapped the sea floor trace of the QCFF nearly 1,000 meters below.

The QCFF is a major structural feature that extends more than 1,200 kilometers from northern Vancouver Island, Canada to the Fairweather Range of southern Alaska. Recent seismic activity along the QCFF, as well as potential secondary hazards including submarine landslides and tsunamis, have sparked an increased interest in understanding the fault’s behavior. Ludwig and Brothers worked with STEMSEAS organizers and the ship’s crew to shift the planned cruise track to fill in the missing data.

The new bathymetry data collected onboard the R/V *Sikuliaq* show the full extent of a submarine landslide. Future research may help improve our knowledge of potential hazards posed by the QCFF.



Illustration by Cole Goco.

## Sailing for Science Education on R/V *Tiglax*

By Steve Delehanty and Marianne Aplin (USFWS)

Can you imagine a teenager at the helm of a 500-ton research vessel in the Bering Sea? Or visiting visible remnants of an abandoned village that was last occupied by your great-great grandparents? These education activities are offered to local youth through the Alaska Maritime National Wildlife Refuge’s R/V *Tiglax*.

While the R/V *Tiglax* has been “sailing for science” for 30 years, 2016 was the first year the ship sailed to Camp Qungaayux along the Alaska Maritime National Wildlife Refuge and hosted camp participants on board. The Refuge’s Youth Conservation Corps enrollees stood at the helm with the captain, learned to navigate and control the ship, and worked in skiffs to complete bird surveys. Teenagers from the village of Atka embarked on the ship to visit their ancestral home on Amlia Island, now part of the vast wildlife refuge. In addition to the science lessons, Refuge staff introduced the students to the work of the Refuge biologists and mariners, and shared cold water safety lessons that are very relevant to the community.

At Camp Qungaayux, tribal members of the Qawalangin Tribe of Unalaska set up weatherports and tents in a sheltered cove in Unalaska in the Aleutian Islands on the edge of the Bering Sea. The camp is an annual week-long summer camp for community students in grades 4–12. The students learn cultural traditions such as Aleut language, seal hunting, fishing, weaving, bentwood hat making, traditional dance, and cooking. The Refuge provides funding and a staff member to teach science lessons in partnership with the traditional knowledge lessons taught by Alaska Native elders of the Qawalangin Tribe.

**The Alaska Maritime National Wildlife Refuge** was established to conserve marine mammals, seabirds and other migratory birds, and the marine resources upon which they rely. The Refuge’s 3.4 million acres include the spectacular volcanic islands of the Aleutian chain, the seabird cliffs of the remote Pribilofs, the rich forested soils of the Inside Passage, and icebound lands washed by the Chukchi Sea, providing essential habitat for some 40 million seabirds representing more than 30 species. Managing these far-flung lands is a challenge that calls for a ship, and the 120 foot R/V *Tiglax* is a vital platform for science and now increasingly plays a key role in education.



Pictured on the back deck of the R/V *Tiglax*, these students just raced to don the orange immersion suits that they’re wearing. They had fun with the activity, but for kids who make their home on the North Pacific and Bering Sea, cold water survival is serious business. Photo credit: Marianne Aplin, USFWS



R/V *Tiglax* Captain John Faris takes the skiff out on a mission. Photo credit: Steve Hillebrand, USFWS

## NPS Engages Youth in Science, Stewardship and Maritime Culture

For the past 2 years, Biscayne National Park has been spearheading an effort to more fully integrate national parks into marine science education efforts nationwide.

### Youth Ocean Conservation Summit

By Gary Bremen (NPS)

In December, more than 200 people gathered to celebrate ocean conservation and 100 years of the NPS at the Fifth Annual Youth Ocean Conservation Summit (YOCS) held at Mote Marine Laboratory in Sarasota, Florida. The event showcased student-led ocean conservation projects (including nine sponsored by the NPS) and ocean conservation films produced by young people. The participants networked and shared their ocean conservation projects. Local youth projects included Sophie Meloro, a senior at St. Thomas Aquinas High, who shared information about lionfish effects at Biscayne National Park, and 7-year old Ryan Moralevitz, who founded the “Fishes Wishes Mangrove Garden” program to supply mangrove seedlings to restore shoreline areas near his home.

The event began with the Community Ocean Conservation Film Festival with a variety of short films featuring ocean conservation themes and award-winning youth ocean conservation films. Biscayne National Park Ranger Gary Bremen and South Florida troubadour Grant Livingston blended music and storytelling with “Songs and Stories of Our National Parks” as a salute to the NPS Centennial.

Chris Fischer, founder of OCEARCH, shared the story of how and why he founded the organization that tags and tracks keystone marine species including great white sharks (*Carcharodon carcharias*). OCEARCH uses research

tags on these animals in conjunction with conservation outreach and education. In 2016, OCEARCH open sourced the data on the Global Shark Tracker to 2.3 million users and achieved an annual global reach of more than 6 billion media (including Facebook and Twitter) impressions.

The NPS also partnered with the YOCS Expedition at Biscayne National Park March 17–19 with a camping/education/networking event on Elliott Key, sponsored by the South Florida National Parks Trust. Read more: <http://youthoceanconservationssummit.weebly.com/expeditions.html>

Sign-up for the Youth Ocean Conservation Team e-newsletter: <http://youthoceanconservationssummit.weebly.com/youth-ocean-conservation-team.html>



Seven-year old Ryan Moralevitz presents information about his “Fishes Wishes Mangrove Garden” program, designed to restore mangrove vegetation near his home. Photo credit: NPS



**Above:** Fourth graders visiting the San Francisco Maritime National Historical Park got to visit and tour the historic floating vessels. Photo credit: National Park Trust

**At left:** Sophie Meloro shares work she is doing to help address effects from the invasive lionfish with participants at the 2016 YOCS. Photo credit: NPS

## Maritime Culture

In February, fourth grade students learned a little maritime history and took tours of the historic ships that are preserved at the NPS San Francisco Maritime National Historical Park (<https://www.nps.gov/safr/index.htm>). The visit was part of the “Every Kid in a Park” initiative sponsored by the National Park Trust, North Face, and the Outdoors Alliance for Kids. As part of the event, the students and their families were given year-long passes to Federally managed lands and waters.

For more information, visit: <https://www.everykidinapark.gov/>



## The 37th U.S Coral Reef Task Force Meeting

By Gina Digiantonio (DOI) and Miguel G. Figuerola-Hernández (NOAA)

New U.S. Coral Reef Task Force (USCRTF) co-chairs Shawn Buckner (DOI) and Russell Callender (NOAA) convened the 37th USCRTF meeting in Washington, D.C., from February 21 to 23. More than 125 coral enthusiasts including Governor David Ige from Hawai'i, Governor Eddie Calvo from Guam, Attorney General Ale from American Samoa, Federal Members, Federal and local government agencies, research/academic institutions, and NGOs reported and discussed ongoing interdisciplinary and interagency efforts to protect and preserve corals.

The Injury and Mitigation Working Group released a comprehensive handbook for avoiding coral impacts and planning mitigation efforts. *See related story, page 26.* The Watershed Partnership Initiative Working Group is creating programmatic, ecological, and societal metrics to assess the effectiveness of individual watershed initiatives. The Education and Outreach Working Group discussed their plan to generate materials for the International Year of the Reef in 2018, update the USCRTF website, and create briefing materials for new USCRTF members.

The All Islands Committee (AIC) reported on their leadership with on-the-ground efforts through the Coral Management Fellowship, water-quality monitoring and watershed management in Hawai'i, research assistance during Florida's coral disease event, and a symposium in the Marshall Islands. The AIC hosted a moment of silence in honor of Carey Morishige Martinez who will be missed, but whose legacy will continue to inspire dedication and commitment to the USCRTF mission.



Principal members of the 37th USCRTF meeting. Photo credit: Gina Digiantonio, DOI

Dr. Mark Eakin (NOAA Coral Reef Watch) summarized present bleaching observations and expectations for the future. After the 2014–16 global bleaching event, the longest and most intensive on record, bleaching is still occurring in the South Pacific (American Samoa, Niue, Fiji, and some parts of the Great Barrier Reef) despite neutral El Niño atmospheric conditions. As temperatures remain warmer than usual, a National Adaptation Forum and Caribbean Workshops are being coordinated to tackle this issue.

The USCRTF meeting hosted several presenters whose work was focused on actions to build coral reef resilience. Presenters identified scientific techniques, effective restoration strategies, and interdisciplinary efforts that are giving hope to coral conservationists. NGOs are becoming an important collaborative asset to scale-up NOAA's lead on restoration efforts with The Nature Conservancy and Mote Marine Laboratory's goal to plant 1 million corals by 2025. The Hawai'i Institute of Marine Biology is working on coral adaptation and assisted evolution as a means for facilitating natural evolutionary processes for better adapted corals.

Many speakers throughout the meeting highlighted the importance of corals reefs for their economic, cultural, and environmental services such as

the socioeconomic value of coral reefs and the benefits of conservation actions. Dr. Mike Beck (The Nature Conservancy) discussed the role corals play in flood protection by reducing storm wave energy by as much as 97 percent with a 1-meter reduction in coral reef height possibly leading to doubled flood costs in the United States. *See related story, page 26.*

Dr. Beck's presentation highlighted the importance of green infrastructure in maintaining coastal ecosystems while ensuring national safety.

This winter meeting highlighted several ongoing projects designed to have a positive effect on coral reef conservation and facilitated communication among members and partners.

The USCRTF meeting concluded with goals and action items to support local capacity building through fellowships and internships, continuing to fulfill the current USCRTF work plan priorities: enforcement needs in the jurisdictions, and developing products or trainings to support the States, Territories, and Commonwealths in addressing local issues.

The 38th USCRTF meeting, hosted by the State of Florida, is scheduled for August 7–11, 2017, in Ft. Lauderdale, Florida.

Visit <http://coralreef.gov> for more information on the USCRTF.

## New Handbook for Coral Managers

By Gina Digiantonio (DOI)

The long-awaited handbook for guidance on coral reef impacts and mitigation was released by the USCRTF in February 2017 during their 37th Meeting in Washington, D.C. *See related story, page 25.*

“The Handbook on Coral Reef Impacts: Avoidance, Minimization, Compensatory Mitigation and Restoration” provides resources for coral reef managers, responsible parties, and others with interest in coral reef communities. The handbook contains resources and guidelines for avoiding, minimizing, and mitigating planned activities that can affect corals such as harbor improvements, shoreline hardening, and unplanned injuries such as ship groundings or exposure to oil. By addressing physical effects on corals, reef communities can be more resilient to other stressors such as increasing ocean temperatures, invasive species, and ocean acidification.

The handbook offers a general model for planned and unplanned events that walks users through the process of planning the project or responding to an incident, analyzing alternatives and project designs or recovery action to minimize impacts, implementing appropriate compensatory mitigation, and postproject monitoring. Throughout the process, the first goal is to avoid coral damage whenever possible, minimize new or additional effects, and resort to compensatory

mitigation only when natural resource damage is unavoidable.

The USCRTF strongly emphasizes avoiding or minimizing impacts to corals as the best practice, but when corals are affected, the handbook is a valuable tool for addressing damage in an efficient and effective manner. For example, the handbook recognizes the importance of coordinating early and often with all appropriate agencies and includes a compilation of coral authorities. It also includes a continuum of best management practice options for coral reef mitigation and restoration, and a section that shares lessons learned. To measure the effectiveness of mitigation efforts, the handbook provides evaluation frameworks, performance standards, and monitoring techniques.

The handbook is an important milestone that involved many stakeholders and interagency communications to address numerous technical and scientific challenges facing coral reef management. The interagency Coral Reef Injury and Mitigation Working Group began crafting the handbook in 2002. It addresses specific policies related to conserving and protecting coral reefs: USCRTF Resolutions 16.7 and 25.1 and the National Ocean Policy Implementation Plan.

The handbook is being shared within and across USCRTF agencies, as well as with NGOs, interested parties, and other stakeholders. It is envisioned to be a living document with regular updates being made as needed. Find the handbook here: <http://www.coralreef.gov>

Gerry Davis (NOAA), Cindy Barger (Army, Civil Works), and Paige Rothenberger (Contractor), presented the final handbook at the 37th USCRTF meeting. Jennifer Koss with NOAA's Coral Program (far right) joined the team after the presentation. Photo credit: Ann Tihansky, USGS



## Coral Reefs Struggle to Keep up With Rising Seas

### Coastal Communities Lose Protection

In the first ecosystem-wide study of changing sea depths at five large coral reef tracts in Florida, the Caribbean, and Hawai'i, USGS researchers found the sea floor is eroding in all five places, and the reefs cannot keep pace with sea-level rise.

The combined effect of sea-level rise and erosion means water depths have already increased to levels near to what most scientists expected to occur by the year 2100. As a result, coastal communities protected by the reefs are facing increased risks from storms, waves, and erosion and are losing other valuable benefits that healthy coral reefs provide. The USGS-led study was published in *Biogeosciences*. *See related story, page 25.*

Read more at: <https://www.usgs.gov/news/sea-floor-erosion-coral-reef-ecosystems-leaves-coastal-communities-risk>



A healthy elkhorn coral reef (inset) compared to one that has died and collapsed, both at Buck Island, the U.S. Virgin Islands. Photo credit: Curt Storlazzi, USGS

## OWLS—Visualize Sea-Level Rise

### Viewers Use Augmented Reality

By Rex Sanders (USGS)

Visitors to the Santa Monica Pier in southern California in late 2016 were able to see what the beach might look like when future storms and sea-level rise raise coastal water levels. Two virtual-reality viewers, named “Owls” in reference to their appearance of having two large “eyes,” show the projected extent of flooding by a big storm at high tide, by sea-level rise, and by both together. The viewers show projected flooding based on forecasts by the USGS Coastal Storm Modeling System (CoSMoS): [https://walrus.wr.usgs.gov/coastal\\_processes/cosmos/](https://walrus.wr.usgs.gov/coastal_processes/cosmos/)

In addition to highlighting coastal flooding risks, the viewers show how communities can adapt to sea-level rise through nature-based coastal-planning projects such as enhanced dunes. The City of Santa Monica developed the Owls (one ADA-accessible) in partnership with the USGS, Owlized, and the University of South California (USC) Sea Grant program. The Owls operated from November 7, 2016, to January 7, 2017, and a public event was held November 16 to coincide with “king” high tides, the highest tides of the year.

In January 2017, USGS scientist Juliette Finzi Hart showed images of the prior “king tides,” along with a discussion about the coastal flooding projected by the CoSMoS model at a public forum at the Aquarium of the Pacific.

Read an interview with Finzi Hart: [http://www.gazettes.com/news/long-beach-aquarium-to-provide-forum-for-climate-sea-level/article\\_9b89d38c-ddb4-11e6-b346-0f55bab96a05.html](http://www.gazettes.com/news/long-beach-aquarium-to-provide-forum-for-climate-sea-level/article_9b89d38c-ddb4-11e6-b346-0f55bab96a05.html)

## Storms Have Silver Lining

By Patrick Barnard (USGS)



On January 12–13, just days after “atmospheric river” storms dropped heavy rain on Santa Cruz, California, scientists from the USGS Pacific Coastal and Marine Science Center surveyed local beaches to compile a three-dimensional map of storm-related changes. Dan Hoover was part of a team of USGS scientists that used a laser scanner, GPS-equipped backpacks, and a sonar-equipped boat and personal watercraft to measure the beaches and sea floor around the mouths of the San Lorenzo River and Soquel Creek. Early results show the storms washed about 100,000 cubic meters (about 10,000 dump-truck loads) of sand to each river mouth and onto local beaches in Santa Cruz, California. The additional sediment enhanced local surfing spots by creating temporary bars, and the sand should help protect beaches and developed bluffs and shorelines in the future. The fieldwork complements twice-a-year surveys from Santa Cruz to Moss Landing. The research results should assist communities planning for sea-level rise and other coastal hazards. Photo credit: USGS. *See related story, page 19.*



Members of the public using Owl viewers see “augmented” images of the coastline to get a sense of how coastal flooding could affect the beach. Photo credit: USC Sea Grant

**Video:** View her 360° video of January 12 king tide in Long Beach:

<https://www.youtube.com/watch?v=FQI93W469vI>



Juliette Finzi Hart, USGS, shows how much flooding a large storm combined with future sea-level rise would likely cause in the ports of Los Angeles and Long Beach. Photo credit: USGS

**Video:** Watch Finzi Hart’s presentation on CoSMoS (begins around the 40-minute mark): <https://www.youtube.com/watch?v=Xtw-GwSV4Z4&feature=youtu.be>

## Disappearing Beaches Alarming News for Southern California Beaches

By Leslie Gordon (USGS)

The USGS CoSMoS—Coastal One-line Assimilation Tool (COAST) model was used to predict shoreline change caused by sea-level rise and changing storm patterns driven by climate change. Although 72 percent of beaches in Southern California show historical trends of accretion or getting larger (because of large artificial beach nourishments since the 1930s), future predictions indicate that nearly all the beaches will erode (will get smaller) because of accelerated sea-level rise.

“Beaches in Southern California are a crucial feature of the economy, and the first line of defense against coastal storm impacts for the 18 million residents in the region. This study indicates that we will have to perform massive and costly interventions to preserve these beaches in the future under the erosive pressures of anticipated sea level rise, or risk losing many of the economic and protective benefits beaches provide,” said USGS geologist and coauthor Patrick Barnard.

USGS science makes these coastal hazard assessments possible. These tools are designed to inform management strategies and plans.

Read more: <https://www.usgs.gov/news/disappearing-beaches-modeling-shoreline-change-southern-california>



Exposed bedrock on the beach, below the campus of University of California, Santa Barbara. Photo credit: Daniel Hoover, USGS

## Interconnected Submarine Faults Pose Risk in Coastal California

### Discovery Prompts Preparation

By Helen Gibbons, Janet Watt, and Rex Sanders (USGS)

Using a small boat and seismic equipment called a “chirp,” USGS scientist Janet Watt led a group of scientists in discovering a previously unrecognized connection between the Hayward and the Rodgers Creek faults off the coast of San Francisco, California. Chirp systems use high frequency sounds that bounce off the layers beneath the sea floor, creating a detailed view of the layers from which researchers generate three-dimensional fault models.

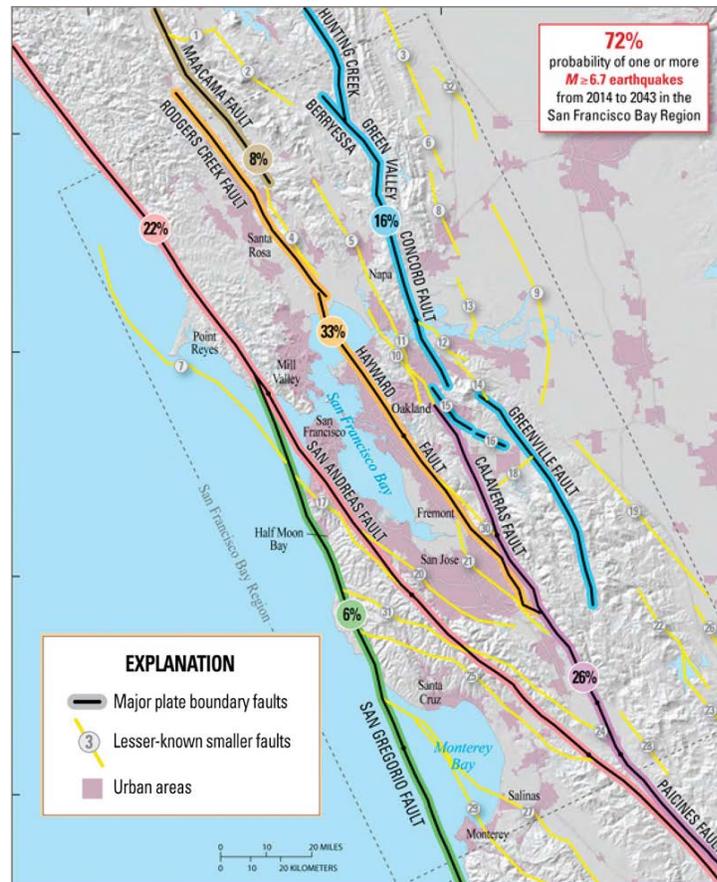
Previously, USGS researchers determined that the Hayward, Calaveras, and San Andreas faults were more

interconnected than initially thought. Now, the connection between Hayward and Rodgers Creek faults poses increased risk of large earthquakes in the San Francisco Bay area, home to nearly 7 million people.

The Hayward and Rodgers Creek faults are two of the most hazardous fault lines in the Bay area, and the direct connection makes it easier for an earthquake to rupture along both fault lines at once, with the potential to generate a greater magnitude earthquake than the 6.9 magnitude Loma Prieta earthquake in 1989. The discovery prompted 1,200 emergency responders; and scientists, engineers, and politicians to meet in Los Angeles in November 2016 to talk about earthquake preparation and participate in a coordinated earthquake drill.

Read more: <https://soundwaves.usgs.gov/2017/02/research.html>

<https://walrus.wr.usgs.gov/geohazards/cenorcal.html>



Map of known active faults and earthquake probabilities in the San Francisco Bay area. When this map was published, the connection between the Hayward and Rodgers Creek faults was not known. The 72-percent chance of a large earthquake before 2043 includes both known and unknown faults. Read more: <https://doi.org/10.3133/fs20163020> Image credit: USGS

## Trawling for Sea Turtles

### New Partnership Boosts Turtle Research in the Gulf of Mexico

By Kristen Hart (USGS), Margaret Lamont (USGS), Autumn Iverson (USGS), Jessica Mallindine (BOEM), Michael Cherkiss (USGS), and Michael Miner (BOEM)

The BOEM and the USGS Wetland and Aquatic Research Center started a new 5-year collaboration that furthers sea turtle research and compliance with Endangered Species Act regulations and recovery goals.

Managers of development projects are required to comply with the Endangered Species Act. Activities like oil and gas extraction, renewable energy installation, and even coastal restoration in the GoM are required to produce information for decision documents. When specific types of dredging occur, BOEM contracts a trawler to capture and relocate live

sea turtles away from the dredging location. These actions help minimize the risk of entrainment to threatened and endangered turtles. During recent construction as part of the Caminada Headland Beach and Dune Restoration project in southern Louisiana, BOEM contracted the use of hopper dredges to excavate and transport sediment to shore. An unexpectedly high number of sea turtles, more than 150 individuals by the end of the first phase of activity, had to be relocated after being captured by the trawler.

These trawling efforts provide unique access to sea turtles that allow scientists opportunistic sampling and tagging that is a first of its kind in the United States.

“We’re getting males and subadults, animals other than those we get on nesting beaches,” said Kristen Hart, USGS scientist who is leading the study along with USGS scientist Margaret Lamont. Sea turtles spend most



Above and at left: Andrew Crowder releasing a Kemp's ridley. Photo credit: USGS

of their lives at sea, but adult females come ashore to nest each year, which makes them readily available for capture. Because of this, research has been biased toward the adult female life stage; little is known about adult

*See Trawling for Sea Turtles page 30*

## National MPA Center News

By National MPA Center

The Marine Protected Area (MPA) Federal Advisory Committee (FAC), a committee of non-Federal experts that advises NOAA and the DOI on MPA issues, completed recommendations options for external financing for U.S. MPA programs.

Recognizing that MPA programs need additional resources beyond those provided by their home institutions, the MPA FAC reviewed potential options for external sources and mechanisms for accessing external funds. The MPA FAC also made recommendations regarding future steps NOAA and the DOI can use these funds to support the MPA mission.

In a separate report, the MPA FAC provided guidance on incorporating ecological spatial connectivity into the design and management of MPAs. Recent research increasingly highlights the

importance of ecological connectivity for populations, ecological communities, and ecosystems in the marine environment. Connectivity is also recommended as a key design element of MPA networks. The MPA FAC recommendations include design principles for enhancing connectivity as a component of MPA networks and the report includes recommended actions for NOAA and the DOI to incorporate connectivity principles and connectivity guidelines for all MPA programs.

Two new reports highlight recommended options for external financing and enhanced connectivity for U.S. MPA programs. <http://marineprotectedareas.noaa.gov/>

- <http://marineprotectedareas.noaa.gov/fac/products/mpa-fac-external-finance-report-jan-2017.pdf>
- <http://marineprotectedareas.noaa.gov/fac/products/connectivity-report-combined.pdf>

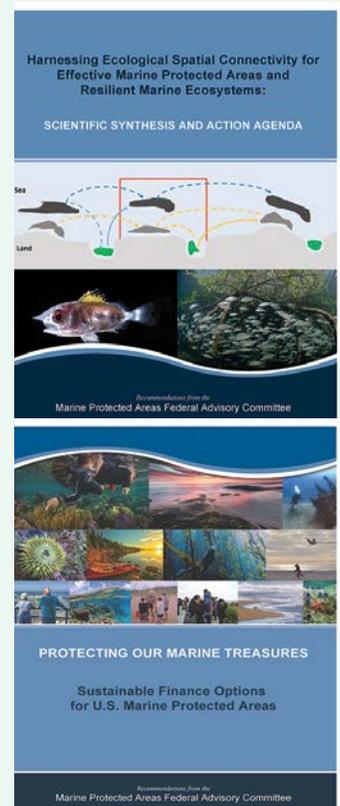


Image credit: National MPA Center

*Trawling for Sea Turtles continued from page 29*

males and juveniles because catching them in water can be difficult. “Working with actively permitted dredge and trawl operations gives us access to turtles captured in the water, a sample that includes males and subadults of both sexes,” said Hart.

For 32 days in May–July 2016, the USGS team made the most of the opportunity by joining the trawlers’ crews and tagging 26 turtles with depth-logging satellite tags at two sites: Ship Shoal (Louisiana) and an area about 4 miles offshore of Pensacola Beach (Florida). The team captured 10 Kemp’s ridleys (*Lepidochelys kempii*; listed as threatened) and 2 loggerheads (*Caretta caretta*; listed as endangered) at the Ship Shoal site, and 14 loggerheads at the Pensacola site. Turtles were also tagged with internal passive integrated transponder (PIT) tags, and blood and tissue samples (for genetic and isotope analyses) were collected from all individuals. Both subadult and adult turtles were captured, including seven males.

Through the use of biologging PIT tags, USGS researchers are obtaining data on turtle dive profiles and movement patterns. While captured, the team gathers additional data to assess available diet and benthic composition of bottom habitat for habitat modeling efforts. “Gathering fine-scale information on dive profiles can provide key data on turtle use of preferred thermal zones of the water column and time spent on the bottom within the vicinity of dredging activities, which will aide BOEM in evaluating mortality and entrainment risk at project sites,” said Jessica Mallindine, who co-leads the BOEM project with Michael Miner.

Currently, tracking data is still transmitting, and so far every turtle has stayed near to where it was captured. Dive results show that tagged loggerheads are diving slightly deeper and longer than tagged Kemp’s ridleys. These results help the team to predict

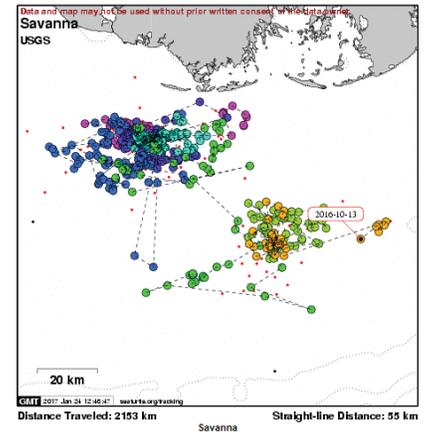
the likelihood of future turtle captures in other dredge operations. “Once we determine where turtle high-use areas overlap with dredging sites, we can assess risk to turtles and characterize habitat preferences. By tracking the turtles, we can inform decisions about how far it may be prudent to move them to be a ‘safe’ distance away from active dredge/trawl operations” said Hart. In addition to providing information related to turtle movements

and dive patterns, the researchers can determine how much time turtles spend within the first 2 meters of the surface, which can help inform population estimates gathered from aerial and visual surveys.

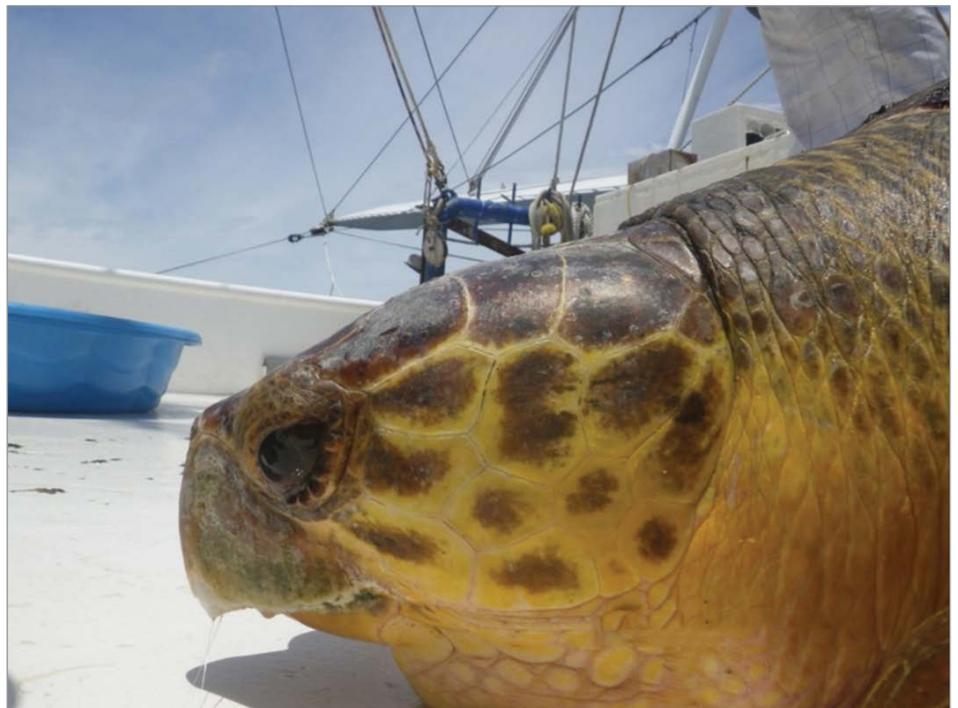
You can follow the turtle tracks here: [http://www.seaturtle.org/tracking/index.shtml?project\\_id=1205](http://www.seaturtle.org/tracking/index.shtml?project_id=1205)



Sea turtle with depth-logging satellite tag. Photo credit: USGS



The map shows her location over 133 days of tagging. You can follow her movements at the project site ([http://www.seaturtle.org/tracking/index.shtml?project\\_id=1205&dyn=1470255546](http://www.seaturtle.org/tracking/index.shtml?project_id=1205&dyn=1470255546)). Map credit: USGS



An adult female loggerhead turtle, nicknamed Savanna, was captured during BOEM trawling operations and satellite tagged. Photo credit: USGS

## What is the Difference Between Kemp's Ridley and Loggerhead Sea Turtles?

Although Kemp's ridleys and loggerheads both use similar habitat in the northern GoM, there are differences between the two species. Kemp's ridleys are considered the smallest sea turtle in the world, with adults reaching about 2 feet long and weighing as much as 100 pounds. They nest exclusively on GoM beaches in northern Mexico and southern Texas and forage in the GoM and the Atlantic seaboard, primarily on crab species living on the sea floor in shallow waters. Kemp's ridley sea turtles are listed in the United States and internationally as endangered throughout their range because of dramatic population declines in the 20th century.

Loggerheads nest throughout the world. In the U.S. waters of the GoM, nesting beaches extend primarily from southern Florida to Alabama with limited nesting in the western GoM. Loggerhead sea turtles are primarily carnivorous and feed mostly on shellfish that live on the bottom of the ocean, such as horseshoe crabs, clams, mussels, and other invertebrates. Mean average adult mass is 250 pounds, and once they reach sexual maturity, females nest every 2 to 5 years, depositing 2 to 6 clutches of 75 to 120 eggs about every 2 weeks during the nesting season. After nesting, they migrate back to distinct foraging sites. Loggerheads nesting in the United States are listed as a threatened species.

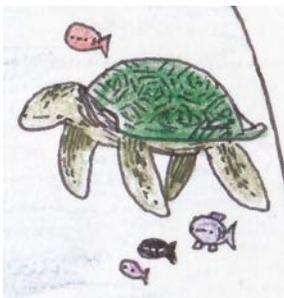


Illustration by Cole Goco.

## New Handbook for Coastal Park Managers

By Courtney Schupp, Rebecca Beavers, Amanda Babson, and Jeffrey Olson (NPS)

A new NPS publication supports management of park sites that are affected by sea-level rise and climate change, including 88 ocean, coastal and Great Lakes parks, and an additional 35 parks subject to coastal influence.

The Coastal Adaptation Strategies Handbook (<https://www.nps.gov/subjects/climatechange/coastalhandbook.htm>) was released in October 2016. This web-based guidance document is a compilation of experience and best management practices for parks in the coastal zone. Though written primarily for NPS managers, it can be a useful resource for DOI partners and other practitioners in exploring and implementing climate change adaptation and learning from park examples. It summarizes existing strategies for climate adaptation in coastal areas, and highlights processes and tools that parks can use for storm response, hurricane recovery, and development of NPS management plans.

The handbook chapters focus on policy, planning, cultural resources, natural resources, facility management, communication, and education. One chapter includes a case study of Hurricane Sandy response and recovery strategies, such as changes to infrastructure. Another chapter features practical coastal infrastructure information including cost per

unit length of constructed features (such as seawalls, beach nourishment, and nature-based features). One key message is that managing for change may require working at a larger landscape scale than a single park, such as working with adjacent refuges and with partners such as the Landscape Conservation Cooperatives.

Rebecca Beavers and co-editors Courtney Schupp and Dr. Amanda Babson compiled contributions from more than a dozen NPS authors and partners with expertise in natural and cultural resources management and science, infrastructure, planning, communication, and policy. "Those authors have decades of experience in managing park resources and providing context for addressing current park challenges with new strategies from the field of climate change adaptation," said Schupp.

The handbook also outlines decision-making processes that NPS managers can use in protecting parks threatened by diverse coastal climate change challenges. Babson said, "we are moving forward with strategies and taking action in parks so, as the climate changes and affects parks, we can continue to serve visitors and provide stewardship and protection of natural and cultural resources."

The Coastal Adaptation Strategies Handbook complements an earlier compilation of 24 case studies (<https://www.nps.gov/subjects/climatechange/coastaladaptationstrategies.htm>) of coastal parks affected by climate change.



Infrastructure, natural resources, and cultural resources are all vulnerable to climate change effects at Point Reyes Historic Lighthouse, Point Reyes National Seashore, California. Photo credit: Don Weeks, NPS



Photo credit: BLM



Photo credit: Bob Wick, BLM



Photo credit: Bob Wick, BLM



Photo credit: Bob Wick, BLM

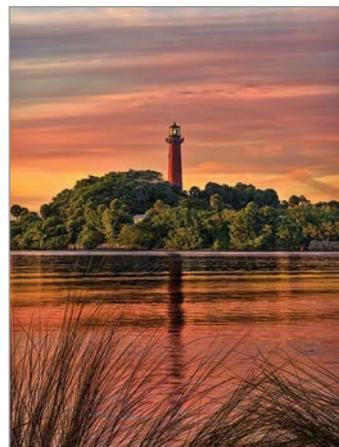


Photo credit: Kenneth Henke, BLM

Photos from top to bottom: San Juan Islands National Monument, King Range NCA, California Coastal National Monument, Yaquina Head ONA, and Jupiter Inlet Lighthouse ONA.

## Explore BLM's Coastal Units

<https://www.blm.gov/programs/national-conservation-lands>

By Erica Wales (DOI)

## The Surfing Bison



Did you know that the BLM does more than manage grazing, timber harvesting, energy development, and mining on public lands? They also manage millions of acres of national monuments, outstanding natural areas (ONAs), historic trails, wild and scenic rivers, national conservation areas (NCAs), wilderness areas, and fish habitat. BLM manages many of these public lands so that you can hike, bike, fish, camp, and enjoy the great outdoors. *See related story, page 16.*

Here are a few coastal examples of BLM coastal lands: <https://www.blm.gov/programs/national-conservation-lands>

### California

*Piedras Blancas Light Station ONA*—Since 2008, the 476 acres of public land at this ONA has provided visitors with lighthouse tours and views of the rugged, rocky shoreline filled with seabirds, sea lions, and elephant seals. In just the 19 acres around the lighthouse, 70 native plant species can be found. Read more: [https://www.blm.gov/nlcs\\_web/sites/ca/st/en/prog/nlcs/PBLS.html](https://www.blm.gov/nlcs_web/sites/ca/st/en/prog/nlcs/PBLS.html)

*King Range NCA*—Created in 1970, this 68,000 acre conservation area allows hiking, camping, biking, fishing, surfing, hunting, and more. From mountains to seascapes, King Range offers coastal wilderness in an area too rugged for highways: [https://www.blm.gov/nlcs\\_web/sites/ca/st/en/prog/nlcs/King\\_Range\\_NCA.html](https://www.blm.gov/nlcs_web/sites/ca/st/en/prog/nlcs/King_Range_NCA.html)

*California Coastal National Monument*—In January 2017, the existing California Coastal National Monument was expanded by 6,230 acres to include six new coastal areas. Read more: [https://www.blm.gov/nlcs\\_web/sites/ca/st/en/prog/nlcs/California\\_Coastal\\_NM.html](https://www.blm.gov/nlcs_web/sites/ca/st/en/prog/nlcs/California_Coastal_NM.html)

### Florida

*Jupiter Inlet Lighthouse ONA*—Established in 2008, this ONA is 120 acres and the only National Conservation Lands unit east of the Mississippi River. Visitors can tour the lighthouse, watch for manatees, or explore coastal and upland habitats. Read more: <https://www.blm.gov/programs/national-conservation-lands/eastern-states/jupiter-inlet-lighthouse>

### Oregon

*Yaquina Head ONA*—This 100-acre ONA was established in 1980. The rocky cliffs are home to nesting seabirds, and waters around the headland are home to gray whales and harbor seals. Find colorful sea life in the tide pools like orange sea stars, purple urchins, and green anemones. Read more: [https://www.blm.gov/nlcs\\_web/sites/or/nlcs/yaquina.html](https://www.blm.gov/nlcs_web/sites/or/nlcs/yaquina.html)

### Washington

*San Juan Islands National Monument*—Established in 2013, more than 450 islands, rocks, and pinnacles make up the 1,000 acre national monument. Landscapes range from forests to sandy beaches, and snow-capped peaks in the distance provide the backdrop. In the islands, you can fish, crab, shrimp, hike, kayak, and camp. Read more: [https://www.blm.gov/nlcs\\_web/sites/or/nlcs/sanjuan.html](https://www.blm.gov/nlcs_web/sites/or/nlcs/sanjuan.html)