



NEWSWAVE

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

In this issue: Addressing Coastal Resilience

Fall 2021

Throughout this issue we share articles and examples of how DOI brings together science and stewardship to create resilient coasts for the Nation.

Interior Puts Vision into Action with Quick Start to Harnessing Offshore Wind

Groundbreaking for Vineyard Wind 1 is the first of many projects that are fulfilling the United States' commitment to producing 30 GW from offshore wind by 2030, creating nearly 80,000 sustainable clean economy jobs focused on the ocean-climate nexus.

Read related stories on pages 4 and 6.



Secretary Haaland (center) participated in groundbreaking for Vineyard Wind 1, the first commercial scale offshore wind project in Federal waters. Photo credits: Tami Heilmann, DOI

America the Beautiful

The President's goal of conserving 30 percent of America's lands and waters by 2030 is more than a number—it is a challenge to build on the Nation's best conservation traditions, to be faithful to principles that reflect the country's values, and to improve the quality of Americans' lives—now and for decades to come.

Read the story on page 5.

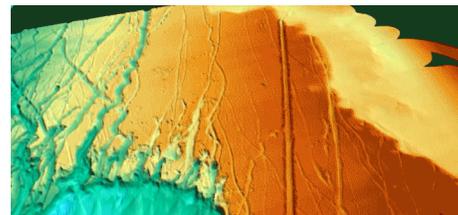


Dawn at Acadia National Park, ME. Photo credit: Vineesh Agrawal (<https://www.sharetheexperience.org/>)

Icebergs Tracks— Evidence of Traveling Icebergs in Seafloor Sediments has Climate Implications

30,000 years ago, giant icebergs drifted from Canada to as far south as Florida. Geologists unravel Earth's climate history in a new study.

Read the full story on page 5.



Watch the animated 3D perspective views of the seafloor bathymetry from multibeam sound navigation and ranging (sonar) offshore of South Carolina (<https://www.usgs.gov/media/images/iceberg-scours-seafloor-0>). The numerous grooves shown in the seafloor were carved by drifting icebergs. Image credit: USGS

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Contribute to NEWSWAVE!

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BOEM Scientist Shares with PBS Program “Curious About Careers”

Watch the two-minute video here: <https://www.pbs.org/video/marine-archaeologist-curious-about-careers-5enwu6/?fbclid=IwAR3nacZEV6dvvu9fYgHorr5B9iCoXU7UestCWs9Clmz1T6HvXuym8ul1aoA>

“The Curious Crew” is a local public television program presented by WKAR. Support for the program is provided by the Michigan State University Federal Credit Union (MSUFCU) and the Consumers Energy Foundation



BOEM Marine Archaeologist Melanie Damour (at right) recently sat down with Genesis, who is part of "The Curious Crew" of PBS to talk about the career of marine archaeologist. Melanie explained what kind of tools and science are needed for her job, describing what it's like to SCUBA dive on historic shipwrecks, study ancient artifacts, and bring history back to the surface. The program aired July 12, 2021. Rating: TV-G. Photo credit: DOI

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

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

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Gifts from the Ocean Floor to the Interior Museum

By the OIA

On March 11, 2021, Nicole Yamase made history as the first Pacific Islander to descend to the Challenger Deep (*see related story, page 36*). The Challenger Deep is the deepest point of the Mariana Trench, which straddles a large part of the western Pacific Ocean from the Commonwealth of the Northern Mariana Islands (CNMI), encompassing Guam and part of the exclusive economic zone of the Federated States of Micronesia. After her journey to a depth of nearly 11 kilometers, she donated items related to the historic dive to the Department of the Interior's (DOI's) Museum in honor of Asian American, Native Hawaiian, and Pacific Islander Heritage month last May.

These items include a compressed polystyrene cup with "Micronesia," "United We Stand," and the names of the Micronesian islands written on it. It is traditional to commemorate deep sea dives by compressing such cups to show the pressure experienced by the significantly deep water. Yamase also shared an autographed flag of the Federated States of Micronesia, which she carried with her inside the submersible, and badges from the mission. "May these items represent our strength, pride, resiliency, and the amazing accomplishments we will

continue to achieve as Pacific Islanders," said Nicole Yamase.

"We are pleased that the Interior Museum continues to update and strengthen its collection, including items that represent the island areas," said Acting Assistant Secretary for Insular and International Affairs Nikolao Pula. "This gift represents the unique achievement Ms. Yamase has made as the first Pacific Islander to descend to the Challenger Deep and will now continue to share her story for generations to come."

Yamase, a Ph.D. candidate in marine biology at the University of Hawaii at Manoa, hails from the Federated States of Micronesia. More people have voyaged to the moon than to the Challenger Deep, and she is the first Pacific Islander to do so!

OIA Conversation with Nicole Yamase

Yamase's expedition was culturally, historically, and scientifically significant and an important milestone in her own educational journey. Yamase shared more about her experience during this historic expedition through an online conversation with Office of Insular Affairs (OIA) Deputy Policy Director Tanya Harris Joshua that was recorded as part of

the "There's More to Islands" OIA Conversation podcast series. *See related stories on this page and page 36*



#WWDIslands #WhatWeDoIslands

An OIA Conversation - Nicole Yamase, the First Pacific Islander to Descend into the Challenger Deep

Image credit: OIA

OIA Podcast Series: "There's More to Islands"

OIA Conversations is a podcast about islands featuring the U.S. territories and the freely associated states with a focus on OIA-funded programs and people whose work is relevant to American Samoa, Guam, the Commonwealth of the CNMI, the U.S. Virgin Islands (USVI), the Federated States of Micronesia, the Marshall Islands, and the Republic of Palau.

The podcast is hosted by the DOI's OIA Deputy Policy Director Tanya Harris Joshua.

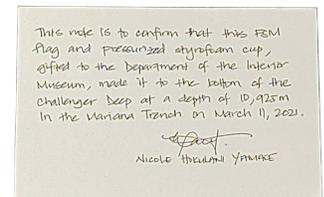
- A short highlight about Yamase's research: <https://www.youtube.com/watch?app=desktop&v=SBsr2PstXTo&feature=youtu.be>
- Listen to the full interview: <https://www.youtube.com/watch?app=desktop&v=TBJV1GgyZlk&feature=youtu.be>
- Tune into the OIA Conversations podcast: https://www.youtube.com/playlist?app=desktop&list=PLDHjK6yOPNkuv7H_7y6GG7VRbzhRSnrj6

Learn more about DOI's OIA:

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

Visit the Interior Museum online:

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



These items, including Yamase's mission badge and the polystyrene cup that was compressed during the dive, were part of Yamase's historic dive as the first Pacific Islander to visit the Challenger Deep. They were gifted to DOI by Nicole Yamase in remembrance of who we are and what we stand for. Photo credit: DOI

Interior's Quick Start to Harnessing Offshore Wind Vineyard Wind 1 Breaks Ground—BOEM Gives Go-Ahead to Second Commercial-Scale Project Offshore New England

By BOEM

DOI kicked its offshore renewable energy mission into high gear this fall, first by marking the ground-breaking on the first commercial-scale wind project approved in Federal waters and a week later by approving a second commercial-scale project.

Together the approvals marked crucial first milestones in delivering on the Biden-Harris Administration goal of delivering 30 gigawatts of clean renewable offshore wind energy by 2030.

Secretary of the Interior Deb Haaland joined Massachusetts Governor Charlie Baker, area Congressman Bill Keating and other officials on Covell's Beach in Barnstable for the November 18 ground breaking. When completed, Vineyard Wind 1 will feature up to 62 wind turbines approximately 15 miles south of Martha's Vineyard and Nantucket and 35 miles from mainland Massachusetts. The 800 megawatts of electricity it will generate is enough to power 400,000 homes and businesses.

"A clean energy future is within our grasp in the United States. Vineyard Wind 1 represents an historic milestone for advancing our nation's clean energy production. This project and others across the country will create robust and sustainable economies that lift up communities and support good-paying jobs, while also ensuring future generations have a livable planet," Secretary Haaland said.

One week later, DOI's Bureau of Ocean Energy Management (BOEM) issued a Record of Decision for South Fork Wind, which plans to build up to 12 wind turbines approximately 19 miles southeast of Block Island, RI, and 35 miles east of Montauk Point, NY, generating 130 megawatts of electricity for New York.

"We have no time to waste in cultivating and investing in a clean energy economy that can sustain us for generations," said Secretary Haaland. "Just one year ago, there were no large-scale offshore wind projects approved in the Federal waters of the United States. Today there are two,

with several more on the horizon. This is one of many actions we are taking in pursuit of the President's goal to open the doors of economic opportunity to more Americans."

Building infrastructure, such as offshore wind projects, and creating jobs to advance a clean energy future is a hallmark of the Biden-Harris administration and the Infrastructure Investment and Jobs law.

The Administration has catalyzed the offshore wind industry by announcing the first-ever national offshore wind energy mandate by setting a goal of reaching 30 gigawatts of offshore wind energy capacity by 2030 and by creating a roadmap for the future of this innovative industry.

While Vineyard Wind and South Fork were the first two construction and operations plans approved by BOEM for commercial-scale offshore wind projects, the agency has nine more plans in review, and expects to review an additional five by 2025, for a total of 16 projects.

In addition, DOI is preparing for lease sales in the New York Bight and offshore the Carolinas and California next year, and is actively working with states, Tribes, and other stakeholders to explore wind potential in the Gulf of Maine, Gulf of Mexico (GoM), and offshore Oregon and Hawaii.

For each of the two approved projects, the Records of Decision adopted a range of measures to help avoid, minimize, and mitigate potential impacts that could result from the construction and operation of the proposed project. These requirements were developed after consultation with Tribes; Federal, State, and local government agencies; as well as industry, ocean users, and other key partners and stakeholders.

Press release: <https://www.doi.gov/pressreleases/secretary-haaland-massachusetts-leaders-celebrate-groundbreaking-nations-first>

Please visit: <https://www.doi.gov/priorities/clean-energy-future>



Secretary Haaland (center) joined Virginia Governor Ralph Northam (to her left), Senator Tim Kaine (far left), Norfolk and local elected officials, and representatives of the offshore wind industry in Norfolk to discuss opportunities that will create jobs and strengthen the local economy. Secretary Haaland was joined by Principal Deputy Assistant Secretary for Land and Mineral Management Laura Daniel-Davis (to her right) and BOEM Director Amanda Lefton (far right) to announce the initiation of BOEM's environmental review for the Coastal Virginia Offshore Wind Commercial (CVOW-C) project. Photo credit: Tami Heilmann, DOI

Icebergs Tracks in Seafloor

Implications for Climate Change Studies

By Peter Pearsall and Jenna Hill (USGS)

Today, towering white objects floating off the Florida Keys are more likely to be cruise ships than anything else. But 30,000 years ago, giant icebergs drifted from Canada to as far south as Florida, a new study finds.

The study, published in the journal *Nature Communications* by



Researchers on the field crew extract a sediment core from iceberg scours on the seafloor. Photo credit: Jenna Hill, USGS

researchers from Woods Hole Oceanographic Institution and USGS, documents the drifting of enormous icebergs down the North Atlantic coast during glacial flooding events.

The researchers found that during the last glacial period 30,000 years ago, icebergs perhaps as tall as the Eiffel Tower drifted south along the Atlantic coast of North America, ferried along by cold-water currents created during periods of catastrophic glacial melting. These currents, likely caused by glacial ice dams bursting and releasing vast quantities of freshwater, would have been powerful enough to push the ice south against the prevailing Gulf Stream.

“We’ve long suspected that these melting events could bring icebergs this far south,” said Research Geologist Jenna Hill, co-author of the study. “Our work now provides strong

evidence for this and tells us when this happened.”

The ice left scour marks on the seafloor as it was pushed by the current. Scientists extracted sediment cores from the sea floor to determine the age of the scours.

The study demonstrates that when large volumes of ice melt from a glacier, they can create currents that hug the coast and bring cold, fresh water full of icebergs to far-off parts of the ocean.

This work provides the first age constraints for so-called Floridian icebergs and suggests a new way to think about how icebergs and meltwater moved in the North Atlantic. The transit of these ancient icebergs has implications for global ocean circulation and climate, the study argues, as glacial ice today is receding across much of the globe.

Learn more: <https://www.usgs.gov/news/timing-iceberg-scours-and-massive-ice-rafting-events-subtropical-north-atlantic>

America the Beautiful

Conserving at Least 30% of Lands and Waters by 2030

By DOI

Nature is essential to the health, well-being, and prosperity of every family and every community in America. From the bounty of the Great Plains and vast coastal forests to the high deserts of the Southwest and beyond, our lands and waters define who we are and who we, as a Nation, want to be.

Our communities deserve fresh air to breathe, clean water to drink, healthy and dependable economies, and a livable planet. “America the Beautiful” is a decade-long challenge to pursue a locally led and voluntary, nationwide effort to conserve, connect, and restore the lands, waters, and wildlife upon which we all depend. The President

has issued this call to action so that we work together to conserve, connect, and restore 30 percent of our lands and waters by 2030 for the sake of our economy, our health, and our well-being.

Key principles include:

- Pursuing a collaborative and inclusive approach to conservation;
- Conserving America’s lands and waters for the benefit of all people;
- Supporting locally led and locally designed conservation efforts;
- Honoring Tribal sovereignty and supporting the priorities of Tribal nations;

- Pursuing conservation and restoration approaches that create jobs and support healthy communities;
- Honoring private property rights and supporting the voluntary stewardship efforts of private landowners;
- Using science as a guide; and
- Building on existing tools and strategies with an emphasis on flexibility and adaptive approaches.

To learn more, read the report: <https://www.doi.gov/sites/doi.gov/files/report-conserving-and-restoring-america-the-beautiful-2021.pdf>

Press release: <https://www.doi.gov/pressreleases/biden-harris-administration-outlines-america-beautiful-initiative>

Read more: <https://www.usgs.gov/news/analysis-updated-usgs-database-finds-increase-america-s-lands-and-waters-managed-biodiversity>

Advancing Offshore Wind—Part of a Clean Energy Future

By DOI

From coastal towns and rural farms to urban centers and Tribal communities, climate change poses an existential threat—not only to our environment but also to our health, our communities, and our economic well-being.

“I believe that a clean energy future is within our grasp, but it will take all of us and the best available science to make it happen.” – Secretary Haaland

At DOI, we know that the time to act on climate is now. Renewable energy—including solar, onshore and offshore wind, geothermal, and wave and tidal energy projects—will help communities across the country be part of the climate solution while creating good-paying union jobs. As directed by the President’s Executive Order 14008, *“Tackling the Climate Crisis at Home and Abroad,”* DOI has partnered with other Federal agencies to increase renewable energy production on public lands and waters—including a commitment to deploy 30 gigawatts of offshore wind by 2030 and a target goal of permitting at least 25 gigawatts of onshore renewable energy by 2025.

DOI is moving quickly to meet these goals and will undertake them with broad engagement; including fishermen, outdoor enthusiasts, sovereign Tribal nations, States, territories, local officials, agricultural and forest landowners, and others to identify strategies and goals that reflect the priorities of all communities.

“Offshore wind is a critical component of this Administration’s commitment to confronting climate change, creating thousands of good-paying union jobs, and jump starting our country’s transition to a cleaner energy future,” said Secretary Haaland. “These States are stepping up and working together to lift up this growing



A view across the table of Secretary Haaland (center), joined by BOEM Director Amanda Lefton (to her left) and Principal Deputy Assistant Secretary for Land and Mineral Management Laura Daniel-Davis (to her right), who met in Norfolk, VA, with Virginia Senator Tim Kaine (left) and Governor Ralph Northam (right). Together, with Norfolk and local elected officials and representatives of the offshore wind industry, they discussed Virginia’s tremendous offshore wind opportunities that will create jobs and strengthen the local economy. Photo credit: Tami Heilmann, DOI

industry. At the Interior Department, we are doing our part to ensure all of these projects are done thoughtfully and with consideration of impacts to surrounding communities.”

In May, Secretary Haaland and Secretary of Commerce Gina Raimondo announced approval of the first large-scale, offshore wind project in the United States, which broke ground on November 18.

See related story, page 4.

On October 13, Secretary Haaland outlined an ambitious offshore wind leasing strategy during a speech at

the American Clean Power’s Offshore WINDPOWER Conference & Exhibition in Boston, MA. The Secretary announced plans for the Bureau of Ocean Energy Management (BOEM) to potentially hold up to seven new offshore lease sales by 2025 in the Gulf of Maine, New York Bight, Central Atlantic, and Gulf of Mexico, as well as offshore the Carolinas, California, and Oregon.

Learn more: <https://www.doi.gov/pressreleases/secretary-haaland-outlines-ambitious-offshore-wind-leasing-strategy>

Developing a Robust and Sustainable Clean Energy Economy - A DOI Priority

The demand for renewable energy has never been greater. The technological advances, increased interest, cost effectiveness, and tremendous economic potential make these projects a promising path for diversifying our national energy portfolio while combating climate change and investing in communities.

Learn more: <https://www.doi.gov/priorities/clean-energy-future>

Offshore renewable energy development: <https://www.boem.gov/renewable-energy>

Tribal renewable energy development: <https://www.bia.gov/bia/ots/dem/renewable-energy>

Coordinating Renewable Energy on the Gulf Coast

By BOEM

The GoM, long the offshore oil and gas titan in the Nations energy portfolio, is taking a hard look at renewable energy development. BOEM is currently assessing industry interest in commercial renewable energy development in the GoM. It is working with the GoM Intergovernmental Renewable Energy Task Force, which held its first meeting June 15, 2021, and is scheduled to meet again in early 2022.

This task force is chartered to facilitate coordination and consultation related to renewable energy planning activities on the OCS in the GoM. The purpose of this task force meeting was to:

- Facilitate coordination among Federal, State, local, and Tribal governments regarding the wind energy leasing process on the OCS in the GoM.

- Share information about existing GoM activities and marine conditions.
- Provide updates on regional offshore wind goals and developer activities.

Meeting materials and more: <https://www.boem.gov/renewable-energy/state-activities/gulf-mexico-gom-intergovernmental-renewable-energy-task-force>

Press release: <https://www.boem.gov/youre-invited-boem-gulf-mexico-regional-task-force-meeting-renewable>

Restoring Lands to the Native Hawaiian Community

By DOI



View looking northwest of Makapu'u Beach Park (foreground) and Waimanalo Bay in the distance, southeast O'ahu, Hawaii. Photo credit: USGS

In June, Secretary Haaland and Deputy Secretary of Commerce Don Graves announced the transfer of an 80-acre parcel of surplus Federal property at the former NOAA Pacific Tsunami Warning Center on O'ahu for inclusion in the Hawaiian Home Lands Trust. The land has the potential to provide homesteads for 200 to 400 Native Hawaiian families.

The lands are being transferred to the State of Hawaii's Department of

Hawaiian Home Lands for inclusion in the Hawaiian Home Lands Trust as part of the Administration's commitment to honor relationships with indigenous communities and uphold trust responsibilities. The transfer will help fulfill the terms of a settlement agreement authorized by Congress in 1995 to compensate Native Hawaiians for the lost use of 1,500 acres of lands set aside as potential homelands but subsequently acquired and used by the U.S. Government for other purposes.

"The Native Hawaiian Community has waited more than 20 years for the Federal Government to address a \$16.9 million credit owed by the United States to the Hawaiian Home Lands Trust," said Secretary Haaland. "Today's action is an important step in our commitment to resolving the Hawaiian Home Lands Recovery Act settlement. We thank the Department of Commerce, General Services Administration, State of Hawai'i, and Native Hawaiian Community

members who provided their input during consultation on this transfer."

"We are pleased that Native Hawaiians will now have access to the 80 acres in Ewa Beach where the NOAA Pacific Tsunami Warning Center once resided," said Deputy Secretary of Commerce Don Graves. "With this overdue transfer, this parcel of land will soon be called home for hundreds of Native Hawaiians."

"Residential lots on O'ahu are of the highest demand from applicants on the waiting list. This land transfer is an opportunity for beneficiaries that is truly in line with the spirit of the Hawaiian Home Lands Recovery Act," said Chairman of the Hawaiian Homes Commission William J. Aila, Jr..

After an appraisal, environmental review, and consultation with the Native Hawaiian Community, DOI notified the General Services Administration that the site is suitable and approved the conveyance to the Hawaiian Home Lands Trust to satisfy \$10 million of the \$16.9 million credit.

Press release: <https://www.doi.gov/pressreleases/interior-and-commerce-departments-restore-lands-native-hawaiian-community>

Coastal Resilience Workshop: Feds Come Together

By the Subcommittee on Ocean Science and Technology (SOST) Coastal Resilience Workshop Planning Committee, Sandra Demberger (USFWS Knauss Fellow), and Ann Tihansky (USGS)

On June 15, 2021, the National Science and Technology Council (NSTC) Subcommittee on Ocean Science and Technology (SOST), convened over 400 Federal agency representatives across 27 agencies in a virtual Coastal Resilience Workshop to strengthen and build the Federal community required to address coastal resilience needs.

Leaders from across the Federal family shared keynote addresses and the state of current collaborations and needs. Leaders encouraged discussions among the participants working across a broad range of Federal coastal themes and responsibilities. Leadership and staff from across DOI bureau participated, representing diverse coastal responsibilities and important partnerships for managing our Nation's coastal resources.

SOST Co-Chairs—Amanda Netburn, White House Office of Science and Technology Policy (OSTP); Craig McLean, NOAA; Alexandra Isern, National Science Foundation (NSF); and Tom Drake, Office of Naval Research (ONR)—each gave remarks to welcome the virtual participants. The first keynote address by Deputy Director for Climate and Environment Dr. Jane Lubchenco, from the White House OSTP, kicked off the meeting calling for a science-based approach to coastal resilience rooted in partnerships across Federal agencies, sectors, and communities.

“Coasts offer powerful opportunities for adaptation and mitigation, and we urgently need both. We have a golden opportunity to jumpstart the recovery of coastal economies from the pandemic while also strengthening coastal resilience, using both built infrastructure and nature-based approaches. The Administration's plan to build back better seeks to create millions of new jobs and rebuild our country's

infrastructure in both sustainable and equitable ways,” said Lubchenco.

DOI's Senior Counselor to the Secretary Elizabeth Klein shared plenary remarks on coastal resilience and our Nation's responsibilities to Tribal communities. She reflected on actively including Tribal Governments in coastal resilience efforts and decision making.

“Consulting with Tribal Governments and building real, meaningful relationships with Tribal communities doesn't just benefit Tribes. It benefits all of us.” Klein said. “Each and every one of us has an obligation to engage in meaningful government-to-government consultation when our agencies are engaged in decision making that might affect Tribes.” Klein emphasized the responsibility of all agencies in working with Tribal Nations as true partners and in respecting Tribal sovereignty and self-governance.

Through a panel discussion that brought together leadership from NOAA, OSTP, NSF, the U.S. Geological Survey (USGS), and the U.S. Environmental Protection Agency (EPA), participants were introduced to the visions, the workshop planning committee's framework for action, and examples of what effective and successful coastal resilience can be. The workshop featured two breakout room discussions allowing participants to share agency capabilities, their dependencies on other agencies, and opportunities for improved collective engagement. Conversations included ideas on how apply

science and better inform basic science directions with what coastal communities need.

The workshop was an important step toward developing a coordinated and whole-of-government approach to achieving coastal resilience across the Nation. A new Coastal Resilience Interagency Working Group (IWG), co-led by the Council of Environmental Quality (CEQ) and NOAA will work to align Federal strengths, will coordinate major Federal involvement in coastal resilience activities and will support strategies with U.S. State, local, Tribal, and territorial governments for effective and equitable investments.

Future efforts will incorporate diverse participation, including government-to-government engagement with Tribal Nations, and input from industries, nongovernmental organization (NGOs), coastal communities, and other public stakeholders who are affected by changing coastal dynamics, to ensure that implementing activities that contribute to coastal resilience are inclusive and meet the needs of all.

A white paper and a detailed public summary are being developed.



The Capitola, CA beachfront has experienced high beach erosion rates that are exacerbated by storms and North Pacific swells combined with high tides. Coastal science can help waterfronts manage and plan so that they are more resilient to changes. Photo credit: Amy West, USGS

Collaborative Mechanisms for Resilient Coasts: NOPP and USCRP

By Sandra Demberger (USFWS Knauss Fellow) and Ann Tihansky (USGS)

There are many ways Federal agencies collaborate with each other and with nongovernmental partners, especially where the needs to advance capabilities, knowledge, or basic research are shared. During the recent SOST Workshop on Coastal Resilience (*see related story, page 8*), a session called “Interagency Coordination Mechanisms” highlighted ways that interagency programs coordinate and collaborate across multiple areas of government and research. Two notable programs that have a focus on harnessing interagency coordination to promote advancements in coastal resilience are: The National Oceanographic Partnership Program (NOPP) and the U.S. Coastal Research Program (USCRP).

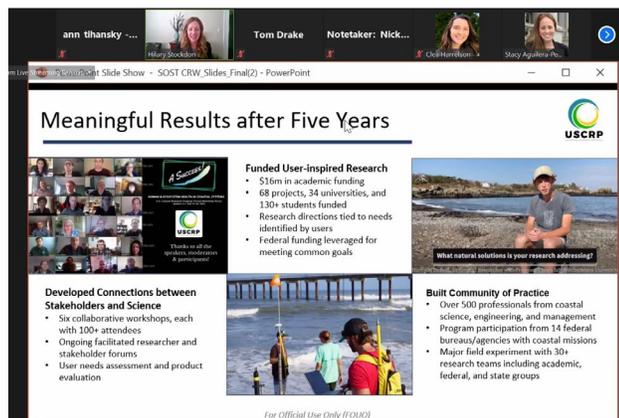
Tom Drake (ONR) gave an overview of the NOPP. He provided examples of programs the

NOPP supports and focus areas in which NOPP aligns with OSTP priorities that include: changing conditions in the Arctic, resilient coastal communities (through reducing risk and vulnerability, empowering local and regional capabilities, and preparing for disasters), advancing autonomous observing, and observations from space.

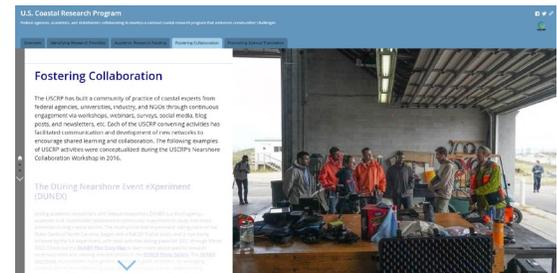
Hilary Stockdon (USGS) presented an overview of the USCRP on behalf of the other USCRP co-leads Julie Rosati (USACE) and Nicole Elko of the American Shore and Beach



Preservation Association (ASBPA). Created in 2014, the USCRP has focused on filling gaps in coastal research so coastal communities have the science they need to create resilient coasts. Examples of USCRP work includes enhancing funding opportunities for academics, developing societally relevant research for specific user communities like coastal planners, and translating science for users such as emergency managers and policymakers.



The USCRP highlighted several results from collaborative interagency efforts during the virtual SOST Coastal Resilience Workshop in June 2021. Photo credit: Ann Tihansky, USGS



Learn more about how the USCRP fosters collaboration among Federal agencies, academics, and stakeholders to develop a national coastal research program that addresses communities' challenges. Visit the storymap on-line: <https://www.arcgis.com/apps/MapSeries/index.html?appid=29657f365c4a4b74aae89dbe9535eac9> Photo credit: USCRP

U.S. Coastal Research Program (USCRP)

The goal of the USCRP is to build a community of practice to address societal needs along the coast. USCRP is a collaboration of Federal agencies, academics, and stakeholders that aims to identify research priorities, enhance funding for academic programs, foster collaboration, and promote science translation.

Learn more: <https://uscoastalresearch.org/>

Partner agencies: USACE, USGS, BOEM, ASBPA, the Federal Emergency Management Agency (FEMA), the U.S. Nuclear Regulatory Commission (USNRC), NASA, the National Park Service (NPS), NOAA, Coastal States Organization (CSO), the U.S. Naval Research Laboratory (USNRL), the Department of Energy (DOE), ONR, and the U.S. Fish and Wildlife Service (USFWS)

National Oceanographic Partnership Program

The NOPP facilitates partnerships among Federal agencies, academia, and industry to advance ocean science research and education. Through this collaboration, Federal agencies can leverage resources to invest in priorities that fall between agency missions or missions that are too large for any single agency to support.

Member agencies include: ONR, NSF, BOEM, the National Aeronautics and Space Administration (NASA), NOAA, the U.S. Coast Guard (USCG), and USGS

Learn more about NOPP: <https://www.nopp.org/>

Coastal Solutions Workshop for the Gulf Coast

Keynote Focused on Science for Stakeholders

By Kristen Kusek (USF CMS); and Davina Passeri, Meaghan Emory, and Ann Tihansky (USGS)

The USGS was a co-organizer with Ocean Visions for the virtual Coastal Solutions Workshop, “Coastal Flood Modeling, Prediction and Observations for the U.S. Gulf Coast” held in April 2021 held in St. Petersburg, FL. Hosted by the Ocean Visions Network, the workshop focused on resiliency challenges and opportunities facing the GoM.

In recent years, there has been significant progress in U.S. Gulf coast coastal flood observations, modeling, and forecasting efforts while coastal communities are facing more frequent and severe flooding, inundation, and sea-level rise. Many of these products and observations are now designed in active partnership with local and State partners and are intended to assist community stakeholders with addressing today’s coastal flood hazards and future flooding, inundation, coastal change, and sea-level rise.

“We need to do a better job of providing the science in a meaningful way. Understanding the people we serve is critical to the science we do,” said Dr. Hilary Stockdon, USGS Science Advisor for Coastal Change Hazards and Co-Executive Director of the USCRP, who was invited to present the keynote address.

The workshop was a forum for assembling the Gulf coast research community to help integrate and improve collaboration among these entities to better serve coastal stakeholders. Presentations at the workshop highlighted examples of how these products are evolving to meet a range of coastal stakeholder needs for addressing contemporary and future coastal flood hazards.

Dr. Gary Mitchum, sea-level rise expert and Associate Dean at the

University of South Florida College of Marine Science (USF CMS), led a session aimed at exploring ways to use regional models and data to inform local decision making. The two key speakers in this session were USGS Physical Scientist Kara Doran, a former student of Dr. Mitchum’s, and Dr. Frank Muller-Karger, another USF CMS scientist and professor.

Doran presented “USGS Forecasts of Total Water Level and Coastal Change Hazards along the U.S. Gulf Coast” and participated in a panel discussion on current challenges with observation, modeling, and stakeholder engagement. “We seem to have a tool overload, and there is a challenge to pulling together which tools are most useful to which audiences,” said Doran. She emphasized the challenge of connecting the wealth of information available in the portal in a meaningful way with practitioners. USGS Research Oceanographer Davina Passeri presented research on “Assessing Sustainable Restoration Measures to Increase Barrier Island

Resilience Through Data Collection, Integrated Modeling, and Decision Support – the Alabama Barrier Island Restoration Assessment.”

One of the goals for the workshop was to draft the terms of reference for a national task force for Coastal Solutions for Climate Adaptation and Resilience to provide a platform for ongoing collaboration, coordination, and synthesis activities. The workshop organizers also look forward to synthesizing the work and presenting it to Congress.

The Gulf coast workshop was co-sponsored and organized by Mississippi Sea Grant, NOAA’s Integrated Ocean Observing System, Mississippi State University, USGS, The Water Institute of the Gulf, the Southeast Coastal Ocean Observing Regional Association (SECOORA), the Gulf Coast Ocean Observing System (GCOOS), California SeaGrant, and Louisiana Universities Marine Consortium (LUMCON); and was one of three in the “Coastal Solutions Workshop” series.

See the full agenda and learn more: <https://oceanvisions.org/us-gulf-coast-coastal-solutions-2021/>

Ocean Visions, Coastal Solutions

There is a disconnect between research and ocean solutions that requires breaking down the silos that exist among research universities and institutions, professional ocean-focused societies, NGOs, intergovernmental organizations, nonprofit foundations, businesses, and financial institutions to link research, development, and deployment processes within a unified framework.

In 2019, a group of leading research and academic institutions joined together to create “Ocean Visions” as a network to co-create and deploy equitable, durable, and scalable science- and engineering-based ocean solutions to the growing crisis in our climate and ocean. Ocean Visions brings together leading oceanographic research and academic institutions with private sector and public-interest organizations to design

and advance solutions to the growing crisis in our ocean and climate.

The first Ocean Visions workshop, held in July 2020, focused on the U.S. east coast; the second one in March 2021 focused on the U.S. west coast. The third virtual “Coastal Solutions” workshop in April 2021 focused on resiliency challenges and opportunities facing the GoM. These workshops culminated in the Ocean Visions 2021 Summit, “Towards a Global Ecosystem for Ocean Solutions,” that was held virtually in May 2021 on the campus of Scripps Institution of Oceanography with linkages across the globe to satellite campuses. Learn more: <https://oceanvisions.org/oceanvisions-2021-summit/>



Image credit: oceanvisions.org

Managing Sediment on Barrier Islands

USGS and USFWS Share Expertise for Coastal Stewardship

By Jason Burton (USGS) and Brian Hires (USFWS)

In June, a report released by the USGS and the USFWS showed that coastal sediment management practices like dredging and beach nourishment can have beneficial and detrimental impacts to barrier island ecosystems. Developed jointly by DOI Bureaus, the report provides resource managers valuable information needed to evaluate sediment management and potential impacts of removing and placing sediment on barrier islands. The report also looked at how these practices can affect habitat resilience along U.S. coasts.

“The study identifies both beneficial and detrimental impacts from sediment management practices depending on where and how they are applied within barrier island systems,” said USGS Research Geologist Jennifer Miselis, the lead author on the report.

“Sometimes short-term benefits can have unforeseen impacts that may affect the health of barrier islands and their ecological stability beyond the life of the sediment management project itself,” said Miselis. Sediment

management actions such as beach nourishment—where sand is added to an area to expand beaches and dunes—are typically done for coastal hazard mitigation, erosion prevention, and flood control. Some of the key findings in the report illustrate how some barrier island sediment management practices can have negative impacts on seafloor habitats, fish and other marine species, beach habitats and dunes, and the coastal sediment supply that ensures barrier island resiliency. For instance, when sediment is removed from one barrier island system and deposited in a separate system, it may lead to coastal erosion near the removal location or cause longer-term impacts to the supply of sediments to neighboring barrier islands. Ultimately, these actions may alter the islands’ ability to withstand future storms and increases in sea level.

The process of removing sediments from an area, known as dredging, can also alter the quality of nearshore seafloor habitats, such as seagrass

beds and fish nurseries, that are critical for supporting economically and ecologically important species. Organisms that live in or on the seafloor, which often serve as food sources for many threatened and endangered coastal and marine species, may be directly excavated during dredging activities. Additional impacts to species that spend time in shallow coastal waters,

such as manatees (*Trichechus manatus*) and sea turtles, include direct entanglement in or physical strikes from dredging equipment.

The report also highlights some positive impacts of sediment management. For example, in addition to short-term protection from coastal hazards, beach nourishment can also increase nesting habitats for some coastal wildlife.

“By creating a wider beach, you create more foraging and nesting areas for several species, like shorebirds and turtles,” Miselis said. “However, the timing of beach nourishment activity is important so the addition of sediments to beaches, dunes and marshes does not interfere with wildlife breeding. This report will give decision-makers, resource managers and the public a better understanding of the pros and cons of moving sand within barrier island systems.”

For the study, USGS scientists reviewed existing information about barrier island response to changes in sediment supply via sand mining and removal and impacts to coastal resilience. USFWS scientists provided expertise in how changes in sediment supply impact wildlife habitats and species of concern. The report also identifies knowledge gaps that can help prioritize future USGS and USFWS research, modeling and monitoring efforts.

Press release:

<http://ow.ly/45nY50F1eTZ>

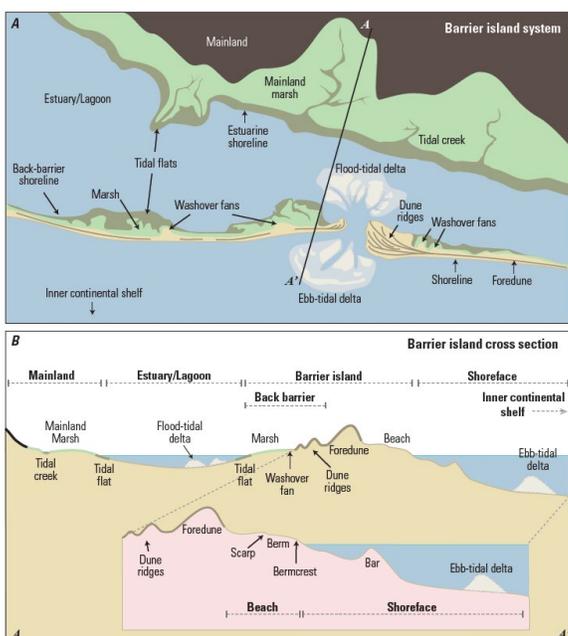
Read the report:

<https://doi.org/10.3133/ofr20211062>

Learn more: <https://www.fws.gov/cbra/>

Frequently asked questions:

<https://www.fws.gov/cbra/documents/FAQs-USGS-FWS-Coastal-Barrier-Report.pdf>



Barrier island geomorphic environments. A, plan view. B, profile view. Image credit: Noreen Buster, USGS

Barrier islands are narrow, low-lying, sandy landforms at the interface of land and sea that tend to move and respond to changes in sediment supply, winds, waves, tides and storms. They play a key role in storm protection for coastal communities and infrastructure and serve as critical habitats for many migratory birds and coastal and marine species.

Collaborate with Partners and Nature

Hurricane Sandy Funding Perpetuates Coastal Resilience

By James Miller (USFWS) and Sandra Demberger (USFWS Knauss Fellow)

Hurricane Sandy recovery funding continues to foster collaboration and yield success! Breakwaters and other shoreline protection techniques installed at Gandys Beach in the Delaware Bay are providing insight into how to mitigate erosion of valuable coastal habitat for the red knot (*Calidris canutus*), a threatened migratory shorebird, and bolstering wild oyster populations.

This innovative 8.5-acre project used interlocking Oyster Castle® blocks to create a series of 10-foot by 30-foot breakwaters intended to absorb wave energy and recruit wild oysters. These breakwaters were installed with gaps to allow for wildlife passage—particularly the movement of horseshoe crabs (*Limulidae* spp.) onto the beach to spawn. Engineering with nature is key to sustainable shoreline protection and habitat management.

A collaboration of the USFWS, The Nature Conservancy (TNC) in New Jersey, Partnership for the Delaware Estuary, Rutgers University’s Haskin Shellfish Research Laboratory, Stevens Institute of Technology, and others, this project has acted as a “living laboratory,” allowing partners to explore the benefits of various nature-based solutions and shoreline stabilization tactics.

Successes and lessons learned by the many partners involved in building and monitoring the Gandys Beach living shoreline will have even greater impacts as they radiate out to other projects, communities, regulators, nonprofit organizations, and public



Oyster Castles®—concrete blocks modified for this purpose—were used to build breakwaters along Gandys Beach. They serve multiple functions: reduce wave energy, promote sediment accumulation, and provide habitat for wild oysters. Photo credit: Danielle McCulloch Prosser, USFWS



Living shorelines, like the one seen here at Gandys Beach Preserve along the Delaware Bay, serve as “living laboratories” for increasing our understanding of nature-based approaches to coastal resilience. Photo credit: Steve Jacobus, USFWS

agencies seeking to do similar work. This project was recognized by the American Shore and Beach Preservation Association in fall 2020 as one of three best restored shores in the Nation.

Learn more: <https://medium.com/usfishandwildlifeservicenortheast/learning-from-a-living-shoreline-in-delaware-bay-bea8982b551>



Constructing these shorelines is hard work—Oyster Castle® blocks and shell bags weigh about 30 and 15 pounds, respectively. Importantly, though, the work can be done by hand (as seen here) rather than with heavy equipment—a consideration for project design. Photo credit: Patricia Doerr, TNC

The Coastal Barrier Resources System (CBRS)

In the early 1980s, Congress recognized that certain actions and programs of the Federal Government have historically subsidized and encouraged development on coastal barriers, resulting in the loss of natural resources; threats to human life, health, and property; and the expenditure of millions of tax dollars each year. To remove the Federal incentive to develop these areas, the Coastal Barrier Resources Act (CBRA) of 1982 (Public Law 97–348; 96 Stat. 1653; 16 U.S.C. 3501 et seq.) and subsequent amendments designated relatively undeveloped coastal barriers along the Atlantic, GoM, Great Lakes, USVI, and Puerto Rican coasts as part of the John H. Chafee Coastal Barrier Resources System (CBRS), and made these areas ineligible for most new Federal expenditures and financial assistance. The CBRA encourages the conservation of hurricane prone, biologically rich coastal barriers by restricting Federal expenditures that encourage development, such as Federal flood insurance.

The USFWS maintains a set of maps that depict the CBRS. Areas within the CBRS can be developed provided that private developers or other non-Federal parties bear the full cost. You can access the CBRS maps here: <https://www.fws.gov/CBRA/Maps/Mapper.html>

New Geospatial Tool Maps Potential Impacts from Rising Groundwater Levels

By Nathan Wood and Patrick Barnard (USGS)

Groundwater is a valuable natural resource and important source of freshwater around the world, but shallow groundwater tables can also pose significant hazards to infrastructure including flooding, reducing storm sewer capacity, liberating pollutants, and compromising foundations. Sea-level rise in coastal regions associated with climate change is expected to push groundwater levels up, making coastal water tables shallower. These are new hazards for communities to consider in their climate adaptation planning. Doing so requires an improved understanding of how groundwater levels respond to sea-level rise and tools to help project these conditions and identify what and where community assets may be affected.

In the HERA Coastal Groundwater Tool, users can look at hazard exposure in one community and compare multiple communities. Information is provided at the community and county level and is currently available for the California coastline. Maps and exposure estimates are planned to be available for the southeast Atlantic coast in 2022.

Groundwater “hazard zones” reflect long-term, average groundwater levels and are defined as an area that is estimated to have saturated soils below the ground or standing water on the land surface for a certain sea-level rise scenario, groundwater depth of interest, and assumed permeability of the underlying geology. Hazard zones are broken out by various depth bins to recognize the different ways that groundwater can affect communities.

The HERA Coastal Groundwater Tool was created by bringing together a wide range of expertise with key partners. USGS coastal geologists collaborated with USGS hydrologists and Kevin Befus, from the University of Arkansas. Together, they produced the

groundwater hazard zones to complement the overland flood projections and erosion hazard zones developed by the USGS *Coastal Storm Modeling System* (CoSMoS). USGS geographers created societal statistics to characterize community exposure and then developed the HERA web mapping application to view hazard maps and access the exposure metrics.

The tool allows users to see maps and hazard-exposure estimates in a community for a wide array of assets. Infrastructure exposure includes roads, rails, and water and wastewater management facilities. Exposure to critical facilities includes fire stations, hospitals, and other medical services, police stations, and schools. Estimates of residential exposure include total residents, as well as various demographic attributes within various land categories.

By using the HERA Coastal Groundwater Tool, a member of the public can use this platform to learn about

how their community, home, or business could be affected by changes in groundwater because of sea-level rise. Local or State planners could include groundwater hazard issues into long-term plans or projects such as hazard mitigation, capital improvements, land use, or economic development. Policymakers could use the tool to develop guidance documents, policies, or regulations to reduce potential impacts. Researchers may also want to use the data for more refined studies related to community exposure to sea-level rise, rising groundwater levels, and other impacts.

HERA web application:

<https://www.usgs.gov/apps/hera/>

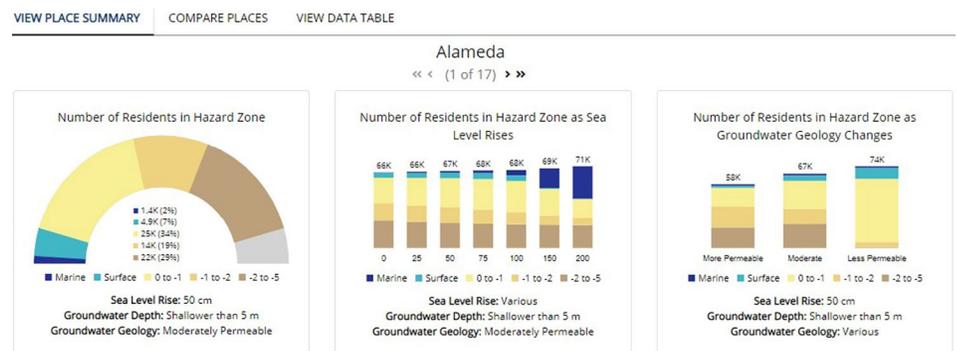
HERA Coastal Groundwater Tool:

<https://www.usgs.gov/apps/hera/groundwaterTool.php>

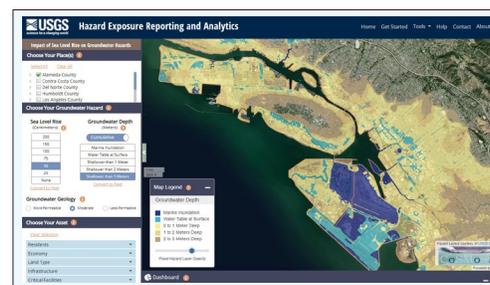
CoSMoS groundwater modeling:

<https://www.usgs.gov/centers/pcmsc/science/cosmos-groundwater>

Read more: <https://doi.org/10.1038/41558-020-0874-1>



HERA’s Data Dashboard provides multiple options for viewing hazard-exposure estimates. One tab shows hazard-exposure estimates for an individual community, including how values change based on different sea-level rise and underlying geology assumptions. A second tab compares multiple communities in terms of the amount and community percentage of a selected asset that may be in a hazard zone. A third tab allows the user to see and download hazard-exposure values. Image credits: USGS



HERA provides tools and data to help communities as they plan and prepare for natural hazards: <https://www.usgs.gov/apps/hera/>

The HERA website helps communities understand how natural hazards could impact their land, people, infrastructure, and livelihoods. Image credit: USGS

A Mapping Legacy

By Hillary McKey (BOEM)

William “Bill” Shedd closed out 24 years of Federal service during the summer of 2021. He left behind high-resolution maps of the seafloor in the GoM—the largest of their kind in the world.

Shedd was born in Manhattan, NY, and grew up in northern New Jersey. He attended the University of Rochester, focusing on marine geology, and he spent his senior year in St. Croix, USVI, studying marine geology. Shedd worked for Shell Oil Company and several independent oil companies, gaining 20 years of experience in geologic and geophysical data study before joining Minerals Management Service (MMS, now BOEM,) in 1997.

After working as a geophysicist in MMS Resource Evaluation in the GoM Regional Office, Shedd noticed anomalies in the three-dimensional (3D) seismic data that oil companies provide the Government. The anomalies, were an increase in 3D seismic amplitude response on the seafloor in data from the Garden Banks blocks during the permitting process.

The anomaly Shedd noticed in 1998 was an increase in 3D seismic amplitude response on the seafloor while evaluating the Garden Banks blocks during the permitting process. As Shedd investigated, he realized that

the seismic instrument was picking up authigenic carbonates formed by bacterial consumption of hydrocarbon. Hydrocarbon seeps are common on the GoM seafloor. Bacteria in the shallow subsurface sediments in the oceans consume hydrocarbon and convert it to calcium carbonate rock, which is readily visible on seismic data. These hardground areas are often sites where highly biodiverse deep-water biological communities exist. The anomalies allowed him to create a trove of bathymetry maps used for BOEM’s environmental research, leasing, and plans.

Arguably the most important byproduct of all this mapping was creating the highest resolution bathymetry map of an area this size anywhere on Earth. Shedd and his BOEM colleague, Kody Kramer, were tasked by NOAA’s disaster relief group, Natural Resource Damage Assessment (NRDA), with producing a high-resolution bathymetry map for biologists to use to model coral and other biological occurrences in the area around the 2010 Macondo (*Deepwater Horizon*) oil spill.

The map was so detailed and such a valuable contribution to GoM mapping that BOEM continued mapping across the GoM to cover everywhere they could decipher the data. The expanded map was first published online in the American Geophysical Union’s 2017 edition of *Eos*. Within hours, National Geographic,



William “Bill” Shedd, BOEM senior geophysicist, at sea in the ship’s laboratory inspecting rocks collected from the seafloor. Photo credit: NOAA

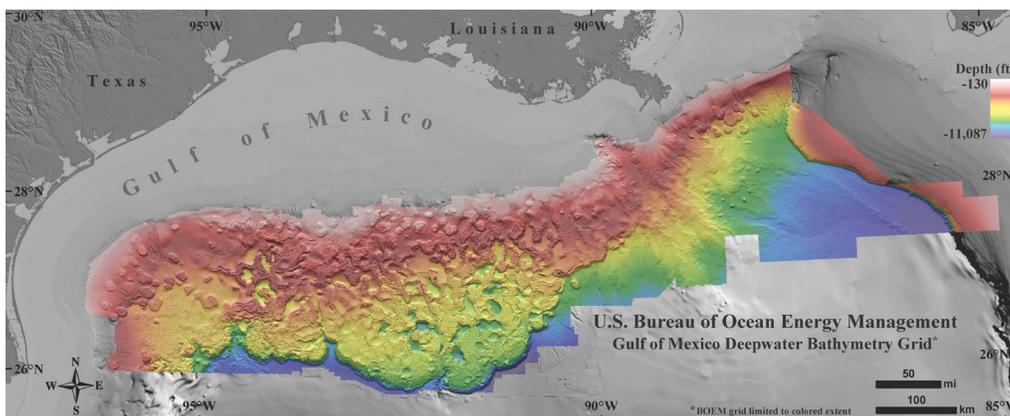
Esri, Forbes, Smithsonian, Oil and Gas Journal, and several other online journals shared it. It was the second most-viewed article in the history of *Eos*, with 71,000 hits in six months.

Besides finding the anomalies and creating detailed mapping products from seismic data, Shedd helped shape BOEM’s resource evaluation process, by ensuring that geoscientists were included in the bid evaluation process to protect deep-sea biodiversity. BOEM uses the designations of these anomalies on the bathymetry map as probable hardground sites to restrict the oil and gas industry from operating too close to potential biodiversity sites.

The presence of seafloor anomalies led to the discovery of natural gas hydrates on the seafloor and in the subsurface of the GoM. BOEM’s Resource Evaluation team has undertaken a study to estimate how much technically recoverable gas hydrate is in the OCS.

In honor of his colleague, Shedd formally dedicated the bathymetry map to Kramer, who passed away in 2018. He also named a seafloor mound and BOEM’s wave glider after him.

Learn more about BOEM’s High-Resolution Geophysical Survey Application: <https://www.boem.gov/oil-gas-energy/mapping-and-data/map-gallery/high-resolution-geophysical-survey-application>



Northern GoM deepwater bathymetry grid created from 3D seismic surveys. See the map: <https://www.boem.gov/oil-gas-energy/mapping-and-data/map-gallery/boem-northern-gulf-mexico-deepwater-bathymetry-grid-3d>. Image credit: BOEM

Restoring Reefs Can Reduce Coastal Risks

By Peter Pearsall and Curt Storlazzi (USGS), and Michael Beck (University of California, Santa Cruz)

The increasing risk of flooding along our coasts is driven by climate change, development, and habitat loss. Powerful climate-fueled hurricanes such as Irma and Maria in 2017 caused significant damage to coastal communities in Florida and Puerto Rico, not just to infrastructure but to natural barriers such as coral reefs, which help to dissipate wave energy before they flood coastlines.

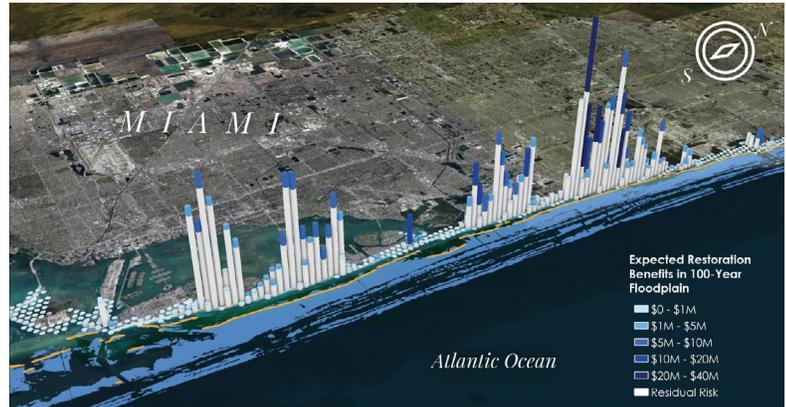
Three new reports from the USGS, the University of California and NOAA quantitatively assess how coral reefs damaged by those hurricanes increased flood risk significantly, to the tune of hundreds of millions of dollars. The reports also assess how, in the absence of restoration, coral reefs in Florida and Puerto Rico will

continue to decline, further increasing the risk of flooding. But the reports find reason for hope: coral reef restoration across Florida and Puerto Rico could prevent the loss of more than \$270 million annually from flooding. By working with nature, the reports conclude that we can reduce present and future risks to coastal

communities and save coral reef ecosystems at the same time.

Watch the video: <https://www.youtube.com/watch?v=uEFIYhqtasak>

Learn more: <https://www.usgs.gov/news/reducing-flood-risks-restoring-coral-reefs>



An oblique view of the Atlantic coastline along Miami, FL, overlain by analytical data. Learn more: <https://www.usgs.gov/media/images/risk-reduction-benefits-reef-restoration>

Image credit: USGS

Environmental Studies Planning From 2022–2023

By Jonathan Lilley (BOEM)

In June, BOEM released the fiscal year (FY) 2022–23 Studies Development Plan (SDP).

The plan includes proposed environmental research needed to assess and manage impacts of offshore energy and marine mineral development on human, marine, and coastal environments. These studies are designed to collect the information necessary to

meet the needs of the users, including BOEM scientists, rule writers, modelers, and decision makers.

Proposed studies are evaluated for program relevance, programmatic timeliness, and scientific merit.

In July, the National Academies of Sciences, Engineering, and Medicine's Committee on Offshore Science and

Assessment (COSA) held its annual SDP meeting. BOEM subject-matter experts presented 12 profiles and received valuable feedback on study development from the committee. BOEM consults with COSA as a source of independent, scientifically credible, and objective information on topics of interest for the environmental studies and assessment activities and to support discussions on relevant issues.

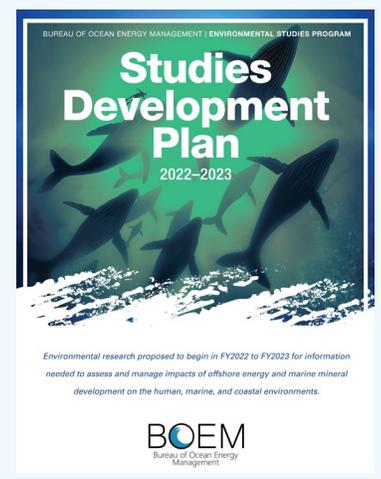
Science for Informed Decisions

BOEM must follow numerous environmental statutes, regulations, and executive orders to carry out its mission. BOEM is dedicated to acquiring and using the highest quality scientific information in support of Bureau decisions. To that end, the Environmental Studies Program (ESP) uses a rigorous planning, review and procurement process to meet the Nation's environmental research needs for OCS resource assessments.

The FY 2022–23 SDP covers all BOEM energy and minerals activities. It includes a total of 72 studies proposed for the Alaska (18), Atlantic (19), GoM (13), and Pacific (9) OCS regions, as well as 10 National and 3 Marine Minerals studies.

Read the plan: https://www.boem.gov/sites/default/files/documents/environmental-studies/SDP_2022-2023.pdf

Learn more: <https://www.boem.gov/environmental-studies-planning>



Support for Fisheries and Aquatic Species

USGS Science, Tools, and Information

By USGS Fish and Aquatic Species Program, adapted by Sandra Demberger (USFWS, Knauss Fellow)

The USGS Fish and Aquatic Species (FAS) Program delivers cutting-edge science to help conserve and restore our Nation’s at-risk aquatic species and manage healthy fisheries for the American people and economy. The USGS is a key player in protecting, restoring, and enhancing our Nation’s fisheries and their habitats.

USGS scientists study the interactions of an array of aquatic species—from native and non-native fish to plants and algae—within aquatic ecosystems, focusing on species diversity and fisheries health.

USGS provides scientific information to natural resource managers and decision makers in areas such as species management, ecohydrology, aquatic organism passage, land use impacts, and changing climate effects on aquatic resources through aquatic systems research, collecting data, and developing tools and technologies.

The FAS Program works with aquatic systems across the United States. Here, we highlight some USGS fisheries projects in and along the Great Lakes, oceans, and coasts—the place where all waterways eventually connect.

Downlisting the Okaloosa Darter

The USGS offers scientific expertise when it comes to informing listing decisions under the Endangered Species Act (16 U.S.C. ch. 35 § 1531 et seq.). In Florida, the recovery of the Okaloosa darter (*Etheostoma*

okaloosae) is rooted in essential partnerships, innovative monitoring techniques, and an unwavering commitment to conservation of the species. The species’ limited geographic range, habitat degradation, and competition from an introduced darter species resulted in listing the Okaloosa darter as endangered. Stream habitat restoration and improvement projects have increased population estimates of the species, and new, innovative visual sampling and monitoring techniques implemented by USGS and Loyola University New Orleans have increased species observation an average of three times the number of darters than were captured using more traditional seine nets. Data collected from this project were used in the decision to downlist the Okaloosa darter from endangered to threatened in 2011 and complete a species status assessment for delisting (see news in link below). With an estimated total number of darters around 500,000, and the continuation of habitat restoration efforts, the outlook looks positive for the Okaloosa darter.

<https://www.fws.gov/southeast/news/2021/11/service-joins-partners-to-announce-the-proposed-delisting-the-okaloosa-darter/>

Managing Gulf Sturgeon

Management of federally protected species requires an understanding of population abundance and ecology. USGS fish biologists have devoted more than three decades to studying the anadromous Gulf sturgeon (*Acipenser oxyrinchus*), which spends part of the year in the GoM and the rest of the year in rivers like Florida’s Suwannee River.

This species tends to jump out of the water causing potential risk to people who recreate in and along the Suwannee River. The potential for

human-wild-life contact raises a critical need for effective management of Gulf sturgeon and its habitat. USGS tagging and tracking programs

have revealed the size, where and when the fish spawn, what river conditions lead to successful recruitment, and where juveniles and adults feed during the winter. Information collected by USGS may allow managers to develop a predictive risk warning system during Gulf sturgeon jumping activity. Despite declines in water quality and quantity, analyses indicate the Suwannee River Gulf sturgeon population has increased. The USGS continues to work with Florida Fish and Wildlife Conservation Commission, USFWS, and NOAA.

Understanding Native Freshwater Mussel Response to Lampricides

Sea lamprey (*Petromyzon marinus*), an invasive species in the Great Lakes, have caused billions of dollars in economic damage. The Great Lakes Fishery Commission selectively treats tributary streams with lampricides to reduce sea lamprey populations—an extremely effective program. However, there is growing concern over the risk of lampricide applications to native mussels due to their sedentary nature along the

See Fisheries page 17

This mussel’s protruding foot is a behavioral response to lampricide. Photo credit: Teresa Newton, USGS



Gulf sturgeon jumping out of the water. Photo credit: Oscar Sosa, NY Times, used with permission.



Okaloosa darter. Photo credit: Howard L. Jelks, USGS



Fisheries continued from page 16

lake bottom and imperiled status. USGS scientists, along with partners at the Great Lakes Fishery Commission, explored behavioral and reproductive responses of mussels to increasing lampricide concentrations. Preliminary data indicates short-term behavioral (that is, foot protrusion, gaped valves) changes in mussels after exposure to lampricides, but most mussels returned to pre-exposure behaviors after 10 days in clean water.

Thermal Stress in Cold-Water Salmonids Species

Understanding how individual cold-water salmonids species will respond to increasing temperature is critical to understanding and predicting the effects of climate change. Brook trout (*Salvelinus fontinalis*), are keystone species in their ecosystems and constitute important commercial and recreational fisheries. The USGS validated the use of heat shock proteins, proteins that indicate environment-related stress, as a tool to indicate temperatures that will control the geographical distribution of these fish. Scientists have demonstrated that heat shock proteins increase (that is, fish are more stressed) in wild populations of brook trout in the northeast at 23 degrees Celsius and in wild populations of Chinook salmon at 18 degrees Celsius in the Pacific northwest. This approach provides important “ground truthing” for establishing thermal stress thresholds for these fish. Fisheries



Nonlethal gill and muscle biopsies are used as markers of thermal stress in studies. Photo credit: Stephen D. McCormick, USGS

managers may use these temperature thresholds to predict and mitigate the impact of climate change.

New Airlift Technology Helps Eels Migrate Past Dams



Eel airlift passage device. Photo credit: Alex Haro, USGS

Adult American eels (*Anguilla rostrata*) migrating from freshwater to the ocean to spawn are often prevented from emigrating by hydroelectric, agricultural, or water-supply dams. Siphons or sluices are sometimes constructed to provide eels a downstream route to bypass dams; however, these are expensive to build and operate and use significant amounts of water that otherwise could be used for power generation, irrigation, or drinking water. The USGS has designed a low-cost, low-maintenance bypass system using airlift technology to induce flow and pass eels around dams. The airlift works by injecting air into a vertical pipe below the surface. As air rises in the pipe, it draws water with it, inducing a flow in the pipe that attracts downstream migratory eels. Eels enter the pipe and are lifted vertically, transported out of the pipe and into a conveyance structure that moves eels around the dam. In field tests, the airlifts passed several hundred migrating eels without causing harm or losing water to the utility. USGS is focused on designing safe and effective passage options for American eels when they encounter barriers to movement. Several other

airlifts are proposed for agricultural withdrawals and hydroelectric stations in the northeast United States, the United Kingdom, and New Zealand.

Developing a Diet Analysis Protocol for Invasive Catfish

In 2017, the USGS conducted a pilot study in Maryland waters focused on establishing a diet analysis protocol for the invasive blue catfish (*Ictalurus furcatus*). The study developed two new genetic testing protocols that allow scientists to identify the composition of fish and invertebrates that are commonly found in catfish stomachs. This is like being able to identify all the different toppings (and proportions) you had on your pizza last night from a sample of your stomach content. The new methods, multilocus metabarcoding genetics and TaqMan® qPCR assay, are improving species monitoring and management. The project has been expanded to include blue catfish in Maryland, Delaware, and Virginia where the USGS is also focusing on reproductive assessments to help inform fisheries managers on spawning. Comparative health and disease evaluations will help understand relative risks of invasive catfish to other aquatic species.



Invasive blue catfish. Photo credit: Joseph Love, Maryland Department of Natural Resources

Learn more:

<https://www.usgs.gov/programs/fisheries-program/science>

Exploring the Deep North Atlantic Ocean

By Ann Tihansky and Peter Pearsall (USGS), Brittany Petersen (USFWS), and Sandra Demberger (USFWS Knauss Fellow)

What do you know about the Northeast Canyons and Seamounts Marine National Monument?

The USGS and the USFWS are important partners with NOAA's Office of Ocean Exploration (OE) "2021 Stepping Stones" Expedition Number 2104 to the depths of the North Atlantic. From June 30 to July 29, OE and partners conducted a telepresence-enabled ocean exploration expedition on NOAA Ship *Okeanos Explorer* to collect critical information and improve knowledge about unexplored and poorly understood deepwater areas of the New England Seamounts and the Corner Rise Seamounts in the high seas of the North Atlantic.

This expedition is expanding on previous expeditions in the New England Seamounts in 2013 and 2014. Additionally, because only 20 percent of the global seafloor has been mapped with modern high-resolution technology, data collected during this expedition will help fill mapping gaps in the high seas in support of Seabed 2030 and in U.S. waters in support of the National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone (NOMEZ). It also supports NOAA's Atlantic Seafloor Partnership for Integrated Research and Exploration (ASPIRE) campaign and leverages international partnerships to support the Galway Statement on Atlantic Ocean Cooperation and the Sargasso Sea Commission.

An important aspect of the expedition is exploring and mapping the "high seas," which in maritime law include all parts of the saltwater oceans that are not part of the territorial sea or internal waters of a state. The high seas and associated resources cover roughly two-thirds of the ocean and 50 percent of the planet and according to the United Nations Convention on the Law of the Sea, they belong to all humankind. They are ecologically vital and among the least understood environments on Earth. Learning more about the high seas through exploration is critical to ensuring they are collectively and sustainably managed for the good of the planet.

The 2021 "North Atlantic Stepping Stones: New England and Corner Rise Seamounts" expedition involved at-sea and shore-based science teams who collaborated on dives focused on studying these deep ocean areas. Researchers used remotely operated vehicles to explore seamounts (steep underwater mountains) and shared much of the work through livestream video.

Tune in to "Must Sea" Multimedia Programming!

The team held two "Live Dive" events on July 14 and 28 where scientists and staff talked about the expedition's mission and deep-sea features observed throughout the research cruise. They also answered questions from a live viewing audience. The events were also recorded and are available online. In addition, several other short video interview of USGS scientist helped capture the mission and science that is guiding the expedition's activities.

July 14 Live Dive: Rachel Gulbraa (OE) hosted a live event introducing the 2021 North Atlantic Stepping Stones: New England and Corner Rise Seamounts expeditions. Expedition Coordinator Kasey Cantwell joined biology Science Lead Rhian Waller of the University of Maine, geology Science Co-Lead Jason Chaytor of the USGS, and onshore scientist Chris Mah of the Smithsonian National Museum of Natural History who discussed the research aspects related to the expedition and held a question-and-answer session with the live streaming audience. In case you missed it, the event was recorded and you can see and listen here: <https://www.facebook.com/USGSCOASTALANDOCEANSCIENCE/videos/539996970774278>

See Deep Sea page 19

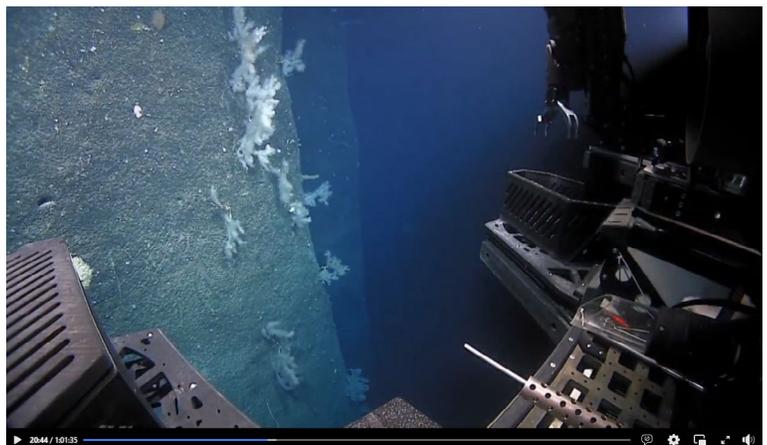


Image credits: NOAA/USGS video screen captures

Deep Sea continued from page 18

July 28 Live Dive: Staff from OE explored the Northeast Canyons and Seamounts Marine National Monument with Brittany Petersen, USFWS Monument's superintendent through an interactive live event that was streamed at the Mystic Aquarium, in Mystic, CT, with the visiting public so they could learn about the wildlife and features of their own marine backyard. The team discussed the geologic formations, history, and the unique and newly discovered biology of these areas with remote scientists and viewers. This recorded program is available here: <http://ow.ly/c9Sy50FEWXe> (Note: Sound begins about 30 seconds into the video.)



Image credits: NOAA/USGS video screen captures

Additional Videos

Meet USGS Ocean Exploration Researchers Jason Chaytor and Kira Mizell: USGS scientists Jason Chaytor and Kira Mizell are the expedition's geology science leads for Expedition 2104. From land, they worked with a team to develop the dive plans, and they led and narrated the dives for a worldwide audience. They will continue to coordinate science outcomes. This video highlights their roles and the collaboration between USGS and NOAA scientists as they explore the largely unmapped seafloor. Watch the video: <https://www.usgs.gov/media/videos/noaa-usgs-stepping-stones-2021-expedition>



Image credits: NOAA/USGS video screen captures

Learn about Manganese Nodules: During a recent dive on the New England Seamount chain off the North Atlantic coast, researchers aboard the NOAA Ocean Exploration Expedition, North Atlantic Stepping Stones, discovered a marine geological feature known as a ferromanganese (Fe-Mn) nodule field in the saddle between two peaks of Gosnold Seamount. These seamount-hosted nodules were an exciting find because Fe-Mn crusts are more common in seamount settings. Marine Fe-Mn minerals are unique among marine rocks in that they grow slowly over millions of years, building layers and accumulating metals as they precipitate from seawater and/or sediment pore waters. The study of Fe-Mn deposits can yield clues about past climatic conditions and geologic history, shedding light on how the world's oceans have changed over time. Watch the video here: <https://www.usgs.gov/media/videos/ferromanganese-nodules-2021-north-atlantic-stepping-stones-expedition>



Image credits: NOAA/USGS video screen captures

Learn more:

USGS science: https://www.usgs.gov/center-news/2021-north-atlantic-stepping-stones-expedition?qt-news_science_products=1#qt-news_science_products

Northeast Canyons and Seamounts Marine National Monument: <https://www.fws.gov/northeast/northeast-canyons-and-seamounts/index.html>

Learn more about Expedition 2104: <https://oceanexplorer.noaa.gov/oceanos/explorations/ex2104/welcome.html>

Our Nation's Maritime Heritage

BSEE's Marine Archaeological Stewardship Mission

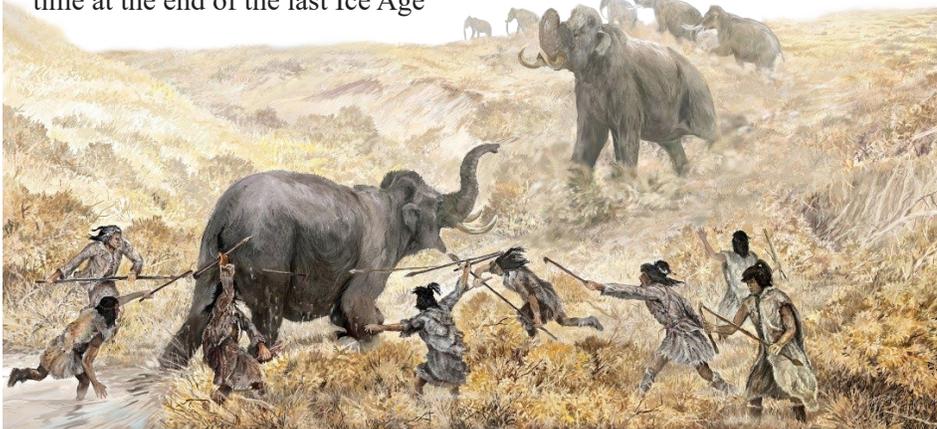
By Chris Horrell and Irina Sorset (BSEE)

One means of protecting the future is by understanding the past. Archaeology is the study of past human behavior through the investigation of sites and the analysis of artifacts and other physical remains. Underwater archaeology is a subdiscipline that focuses on archaeological sites in submerged environments. Through an array of collaborative efforts, DOI's Bureau of Safety and Environmental Enforcement (BSEE) leads the way in understanding and protecting archaeological sites on America's submerged lands.

Indigenous sites dating to the conclusion of the Last Glacial Maximum (LGM) are present on the Federal OCS. Over 10,000 years ago, sea levels were about 200 feet lower than they are today. These former dry land sites may contain information about how precontact indigenous peoples once lived. Many of these sites are now under the Federal OCS seafloor.

Clues to understanding our rich maritime heritage lie entombed in thousands of shipwrecks resting on the ocean floor.

The archaeological sites on the OCS are most likely to be either precontact Native American sites dating from the time at the end of the last Ice Age



Artist Velizar Simeonovski recreated the scene of Clovis hunters cutting off the escape of a woolly mammoth near the end of the last ice age. Archaeological site of these indigenous people dating to the conclusion of the LGM are present on the Federal OCS. Image credit: Field Museum Library/Getty Images

when sea levels were about 200 feet lower than they are today, or are historic shipwrecks. Historic shipwrecks dating from as early as the 16th century A.D. and as recent as World War II have been discovered, largely through industry surveys, in all parts and in all water depths of the GoM.

For several millennia, ships were the most sophisticated machines on earth. They have shaped history by expanding trade and waging war, spreading ideas (and sometimes plague), and discovering and colonizing new lands. At the same time, the crews of these ships lived in closed societies, with traditions, beliefs, vocabularies, and hierarchies that set them apart from those on shore. When archaeologists scientifically excavate a shipwreck underwater, they read these clues to form a picture of what it was like to live on a ship that sank hundreds of years ago. In that sense, shipwrecks are special archaeological sites because, unlike



The 1802 painting titled, "Cap. Cook Cast A Way on Cape Cod" attributed to Michele Felice Cornè, portrays the 163-ton sailing vessel, *The ULYSSES*, foundering in violent seas. The ship was built in 1794 in Amesbury, MA. Historic shipwrecks dating from as early as the 16th century have been identified on the Federal OCS. Image credit: Maritime Art and History Collection, Peabody Essex Museum, MA

sites on land, everything on board was in use during a single moment in time. Because of this, the study of shipwreck sites has contributed to the understanding of broader issues of human history and helps us to understand better who we are by telling us where we have been.

These shipwrecks include vessels associated with the colonial period, coastal commerce, pirates and privateering, trafficking of enslaved people, steamships, military operations, tankers, the fishing industry, and energy development projects. Each of these sites has a story to tell about our Nation's maritime culture and history, and many preserve underwater war graves.

Only a handful of these have been scientifically excavated by archaeologists for the benefit of generations to come. By studying shipwrecks and the technology that fostered the growth of the United States, the work conducted by BSEE, BOEM, and other scientists in the GoM contributes to our understanding of how our Nation developed. Bureaus at DOI have long taken part in the study of some of the most historically significant shipwrecks in the GoM.

See Heritage page 21

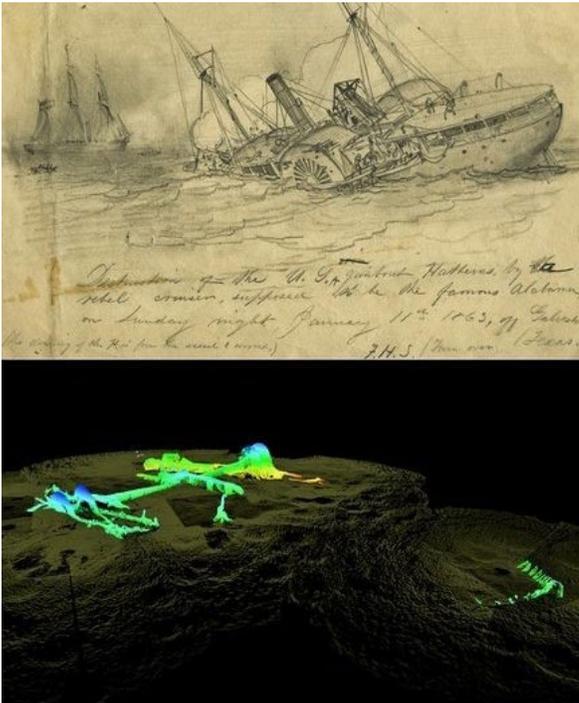
National Historic Preservation Act of 1966

The Federal OCS consists of over 1.7 billion acres of seafloor. Under Federal law, BSEE is responsible for the management of underwater archaeological sites that may exist in and around energy development projects.

BSEE is required by the National Historic Preservation Act of 1966 (16 U.S.C. ch. 1A, subch. II § 470 et seq.) to institute procedures to ensure that Federal plans and programs contribute to the preservation and enhancement of nonfederally owned sites, structures, and objects of historical, architectural, or archaeological significance.

To determine if there is a potential to affect an archaeological site or historic property on the OCS by a proposed energy development or decommissioning activity, BSEE Historic Preservation Program reviews BOEM's assessments of all the potential archaeological sites that have been identified and that have the potential to be impacted during proposed energy development projects. BSEE ensures that the appropriate information and mitigations are applied to the permit. And once those operations are complete, BSEE archaeologists review all postactivity documentation to determine if the operator has complied with the various conditions, mitigations, and stipulations required in the permit. A major part of BSEE's mission is ensuring compliance with environmental regulations that aid in protecting the environment offshore, including archaeological and cultural resources. BSEE does this by developing project-specific mitigation measures in consultation with the operator before conducting seafloor-disturbing activities. Through coordination and science-based compliance, BSEE protects not only our natural resources but also our Nation's submerged cultural heritage.

Visit BSEE's Archaeological and Cultural Resources website to learn more: <https://www.bsee.gov/what-we-do/environmental-compliance/environmental-programs/archaeological-cultural-resources-program>



Using the latest technology available, BSEE archaeologists working in partnership with the U.S. Navy, NOAA, and the State of Texas conducted research and documented the remains of the U.S. Naval vessel *Hatteras*. *Hatteras*, an iron-clad sidewheel steam vessel, participated in the blockade of Galveston during the Civil War and was lost during an engagement with the infamous Confederate naval vessel, *CSS Alabama*, in 1863. The illustration (top) depicts the *USS Hatteras* sinking during the engagement. Illustration credit: courtesy of Becker Collection, Boston College. The image (bottom) was created using Blueview technology and shows the stern (solid green feature to the right) and the vessel's two sidewheels (blue-green feature to the left) that remain today. Image credit: Courtesy of Teledyne Blueview and James Glaeser, Northwest Hydro

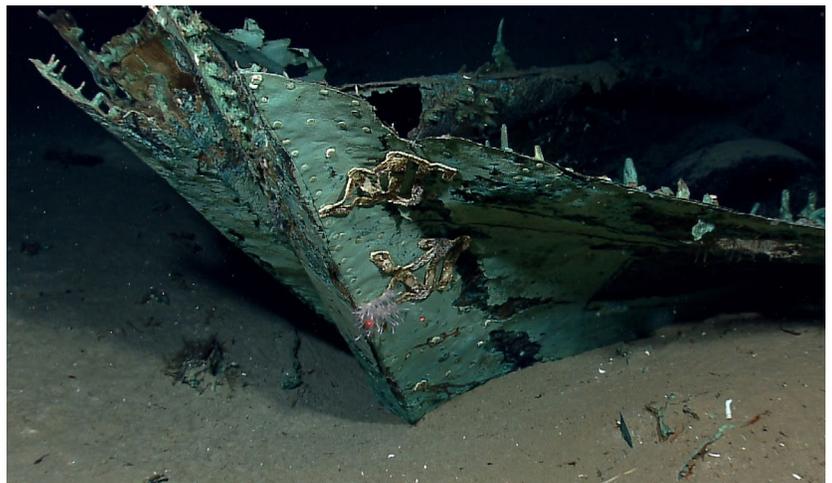
Heritage continued from page 20

A major component of BSEE's mission is ensuring compliance with environmental regulations that aid in protecting the environment offshore, including archaeological and cultural resources. BSEE does this by developing project-specific mitigation measures in consultation with the operator before conducting

seafloor disturbing activities. Through coordination and science-based compliance, BSEE protects not only our natural resources but also our Nation's submerged cultural heritage.

Learn more: <https://www.bsee.gov/what-we-do/environmental-compliance/environmental-programs/archaeological-cultural-resources-program>

Historic Shipwrecks: <https://www.boem.gov/environment/historic-shipwrecks-gulf-mexico>



This shipwreck in 4,000 feet of seawater is the vessel identified as Monterrey Wreck A, named after the lease prospect in which it was found. This is an example of an early 19th century sailing vessel. This incredible archaeological site was identified in an industry survey and is an example of the types of archaeological sites that BSEE helps to protect. Photo credit: NOAA

BIA Tribal Climate Resilience Program Provides Funding to Tribes

Funds Aim to Enhance Climate Preparedness, Resilience, and Ocean and Coastal Management and Planning

This article is dedicated to Morris Nakarak, Jr. (pictured) who passed away in July 2021. Nakarak, affectionately known as “Bemo,” was a great friend to many and a key contributor to environmental projects within his community.

By Rachael Novak (BIA) and Sandra Demberger (USFWS Knauss Fellow)

Since 2011, the DOI’s Bureau of Indian Affairs’ (BIA) Tribal Climate Resilience Program (TCRP) has awarded over \$74.67 million to federally recognized Tribal Nations and Alaskan Native villages through its Annual Awards Program.

Tribal communities and Alaskan Native villages are facing an array of threats from melting sea ice, permafrost, exacerbated coastal and riverine erosion, extreme precipitation events leading to flooding, and other impacts. Grant funding from DOI’s BIA includes nine categories of support ranging from planning, trainings, travel, and capacity-building to youth engagement. With this support, the Tribal and Alaskan Native communities are able to conduct adaptation planning, ocean and coastal management planning, capacity building, relocation, managed retreat, and protect-in-place to better cope with current and imminent climate challenges.

On September 9, 2021, the program awarded \$13.84 million to Tribal Nations and organizations. This year, 18 awards were made to support ocean and coastal management and planning (\$2.1 million). The program also provided eight awards to support the next generation of Tribal leaders, scientists, and land and water stewards through Tribal internships and Tribal youth engagement. In addition, 15 Alaska Native villages and two Tribal Nations in the lower 48 received funding to support relocation, managed retreat, and protect-in-place decisions benefiting over 13,000 Indian people facing threats related to melting sea ice, degrading permafrost, extreme precipitation and flooding and other related impacts.

In 2020, over 159 awards were granted totaling over \$14 million. Here are some examples of projects that were funded:

Adaptation Planning Funding: Native Village of Elim, AK

The Alaska Native village of Elim, AK, was awarded \$149,022 to work with partners to develop a water-quality streamflow risk assessment for temperature and dissolved oxygen (DO) designed to protect aquatic habitat and subsistence resources in the Tubutulik River Watershed of Alaska. This work, which will incorporate traditional ecological knowledge, will allow the Tribe to predict salmon die-offs and identify and protect critical fish habitat.

Ocean and Coastal Management: Klawock Cooperative Association, AK

The Klawock Cooperative Association is facing challenges with harmful algal bloom species, paralytic shellfish toxins, and threats related to changing ocean chemistry. The \$149,821 award will help fund research to fill data gaps to understand these emerging toxins. This project will help protect traditional and subsistence resources and the health of Tribal citizens by improving management decisions related to water quality.



Two tribal members Morris Nakarak, Jr and Leigh Takak measure the water quality on a cool summer day at the Vulcan Creek gage site about 40 miles from the Elim, AK within the Tubutulik River Watershed. Photo credit: Water Policy Consulting, LLC

Relocation, Managed Retreat, and Protect-in-Place Planning: Lower Sioux, MN

The Lower Sioux received \$150,000 to develop a comprehensive flooding and erosion assessment for a mitigation strategy of the Tribe’s flood- and erosion-prone lands along the Minnesota River. This project also supplied funds to support science, technology, engineering, and math (STEM) mentorship to Lower Sioux community youth.

Learn more:

Press release: <https://www.bia.gov/news/bia-announces-tribal-climate-resilience-grants-totaling-1384-million-awarded-fy-2021>

Climate Resilience Program: <https://www.bia.gov/bia/ots/tribal-climate-resilience-program>

Annual Awards Program: <https://www.bia.gov/bia/ots/annual-awards-program>

User Pays, We All Benefit

The Dingell-Johnson Act Puts Big Dollars Toward Conservation

By Amanda Lawrence (NOAA SeaGrant, Knauss Alumni) and Sandra Demberger (USFWS Knauss Fellow)

User Pays, All Benefit

Every time you gas up the boat to head off to a favorite fishing spot, or you experience the excitement of pulling in that fish you have been waiting all season to catch, think about this. By way of newly purchased sinkers, lures, reels, and other recreational gear, a fraction of the purchase money has gone toward enhancing your surroundings and experience.

The Dingell-Johnson Act (also known as the Sport Fish Restoration Act of 1950; 16 U.S.C. §§ 777–777I) was a bill that Congressman John Dingell (Michigan) and State Senator Edwin Johnson (Colorado) created to fund and sustain recreational fishing activities. The Dingell-Johnson Act uses monies generated by the purchase of recreational gear for habitat acquisition, restoration, fish stocking, and research to promote continued fisheries, the habitat that supports them, and public access to all of it.

For instance, user-collected funds may be used to enhance bird and fish habitat by replanting native vegetation, or to construct a new pier and boat ramp to enhance user access. Collecting a user fee to enhance habitat that ensures wildlife populations remain plentiful for hunting and fishing, is a concept referred to as “user pays, user benefits.” In reality, we all benefit from this type of management.



Two young anglers in the Great Lakes region enjoy the thrill of catching a fish. Photo credit: Minnesota Department of Natural Resources

From Rods and Reels to Ramps and Piers

The Dingell-Johnson Act allows a 10 percent excise tax on sport fishing, boating equipment, and gear to support the continued use of the land and its resources responsibly. The act supports activities that range from fish stocking and land acquisition; and, in 1984, was expanded to include certain boat motors, fish finders, education, and construction of recreational facilities including boat ramps and piers.

The evolution of the Dingell-Johnson Act has taken various forms over the years but always with a user responsibility mentality at the forefront. The program brings in substantial funds that directly support conservation. In the FY 2021, the Dingell-Johnson Act brought in more than \$500 million to the USFWS.

Reaping the Benefits

The National Coastal Wetlands Conservation Grant Program (NCWCGP), administered by the USFWS, is one of the few programs that works under the authority of the Dingell-Johnson Act. Established in 1992, this program was designed to acquire, restore, enhance, and/or manage coastal wetland habitat to support wildlife—especially declining wetland types. This past year (2021), the USFWS awarded \$27 million to support roughly 28,000 acres of coastal wetland and adjacent upland habitat conservation, with projects reaching coastlines across the Nation.

Funding for the Future

The practice of “user pays, user benefits” reaches far beyond the individual and out into all corners of the country and ecosystems entwined. The concept has shaped conservation in the United States with its power and impact like no other. Next time



The 309-acre stretch of newly acquired protected habitat along the Kasilof River in Alaska provides contiguous habitat for the 165 species of migratory, nesting, and overwintering birds. Read the report: https://kenaiwatershed.org/wp-content/uploads/2019/03/Kenai-Mountains-to-Sea-Strategic-Plan_5nov2016_compressed.pdf Photo credit: Kachemak Heritage Land Trust

there’s a tug on that fishing line, you will know that you and others are contributing toward a conservation legacy. You will know that with each recreational purchase you make, you are supporting the conservation work essential to preserving and protecting these sacred and wild places.

One of the 33 projects that were funded through the NCWCGP this year (2021) is the 309-acre acquisition of a pristine stretch of habitat along the Kasilof River, AK. The addition of this land to an existing southcentral Alaskan state park unit (already functional for public recreation and wetland habitat management) will seamlessly provide contiguous habitat for the 165 species of migratory, nesting, and overwintering birds. Other species that benefit from this project are the salmon: Chinook (*Oncorhynchus tshawytscha*), sockeye (*O. nerka*), coho (*O. kisutch*), and pink salmon (*O. gorbuscha*). They are culturally, economically, and ecologically important; and healthy salmon populations further benefit the federally endangered Cook Inlet beluga (*Delphinapterus leucas*) whale, who rely on the salmon for food.

Learn more: <https://www.fws.gov/coastal/coastalgrants/>

Facing our Climate’s “New Normal” with Solutions for People and Wildlife

By Wendi Weber (USFWS)

In times of crisis, our actions need to be informed by our past and guided by our vision for the future. When life-altering circumstances like the pandemic and climate change test our resilience, we must follow the science and choose adaptable solutions. *See related story, page 14.*

We are in the midst of hurricane season, a challenging time for coastal communities, especially in an era of higher sea levels and more-frequent intense storms. This year, there’s a new yardstick for comparing year-to-year hurricane activity, as NOAA recently updated its climate normal based on data from the previous 30 years.

The new normal reflect increased Atlantic storm activity, along with warmer, wetter conditions on the east coast. The average Atlantic hurricane season has two more named storms and one more hurricane than it did using older data. Beyond that, researchers at Colorado State University have predicted an “above average” Atlantic hurricane season this year.

In the face of rising seas and more-formidable weather, we need a resilient coast that can absorb storm surge and wave energy and recover quickly, with little need for repair. Using natural infrastructure, we can create such a coast.

What does natural infrastructure look like?



See related stories throughout this issue about creating resilient coasts for our nation.



A young alewife next to a penny. Photo credit: Katie Conrad, USFWS

It looks like healthy salt marshes that soak up rising water like sponges and provide habitat for species like the saltmarsh sparrow (*Ammodramus caudacutus*), whose numbers are declining rapidly. It looks like free-flowing rivers that reduce flooding of nearby communities and let fish swim from the ocean to historical spawning grounds. And it looks like oyster reefs and other living shorelines that buffer coastal zones from wave erosion and create new habitat for marine life. In short, natural infrastructure provides solutions that benefit people and wildlife, improve with time, and have a high return on investment.

The USFWS and partners—including Tribes, towns, States, universities, industry, landowners, and nonprofits—are well on their way to making natural infrastructure the new normal across the Atlantic coast. Nearly a decade after Hurricane Sandy devastated communities and wildlife habitat from Florida to Maine, incredible work has been done—beaches, dunes, and marshes restored; dams removed; and living shorelines built.

This is what success looks like:

In Maryland, the removal in 2018 of Bloede Dam on the Patapsco River—a collaboration of American Rivers, the State of Maryland, NOAA, USFWS and others—restored access to more than 65 miles of river habitat for migratory fish, including alewives (*Alosa pseudoharengus*) and blueback herring (*A. aestivalis*), collectively known as river herring.

This spring, the Maryland Department of Natural Resources, which owned the dam and was a partner in its removal, found both species of river



The Bloede Dam on the Patapsco River in Maryland before it was removed in 2018. Photo credit: Rick Bennett, USFWS

herring above the dam’s former site. They were the first known to make it that far upriver since Bloede was built more than a century ago.

These economically and ecologically important fish experienced significant population declines throughout the region, in part because of limited access to spawning habitat. Findings like this confirm what we’ve seen in so many locations: Dam removals can help migratory fish populations recover.

Removing dams also provides multiple benefits to people and communities. Studies have shown that each mile of river opened so fish can move freely can contribute more than \$500,000 in social and economic benefits, such as recreational fishing and tourism. Removing Bloede eliminated a serious public safety hazard; there had been at least nine dam-related deaths since the 1980s. It also put an end to the environmental risks associated with a sewer pipe that carried millions of gallons of sewage through part of the structure.

In Delaware, with partners including the USACE and the State of Delaware, the USFWS completed a \$38 million project to restore 4,000 acres of tidal marsh at Prime Hook National Wildlife Refuge.

See Solutions page 25



Wendi Weber, North Atlantic-Appalachian Regional Director for the USFWS. Photo credit: USFWS

*Solutions continued
from page 24*

By stabilizing marshes and beaches, restoring wetlands, and improving the resilience of coastal areas, the Prime Hook restoration exemplifies how strengthening natural defenses can help protect local communities during intense storms while improving habitat for vulnerable species. Residents of the local residential and agricultural communities have benefited from reduced flooding. The road previously had been subject to flooding from storms and high tides but since the project's completion, there's been no flood-related

closure of Prime Hook Road. In 2020, 16 nesting pairs of federally threatened piping plovers (*Charadrius melodus*) were counted at Prime Hook's restored Fowler Beach. These pairs were part of a new record number for Delaware. Fowler Beach is also providing breeding habitat for least terns (*Sternula antillarum*), listed as endangered by the State of Delaware.

Additionally, with water flow restored, many areas of open water have also returned to marsh with grasses and other vegetation. These plants absorb and retain carbon and provide habitat for wildlife, including the at-risk salt-marsh sparrow.

These projects are among more than 70 supported by \$167 million in Federal funding the USFWS received for Hurricane Sandy recovery and resilience. Each is making a difference in its own way to create more resilient

and healthy natural environments that help wildlife and people thrive. Increasing climate challenges call for smart, adaptive, and innovative solutions. In warmer, wetter, stormier parts of the world, strengthening natural infrastructure is the new normal we need to rise to these challenges.

Climate reference resources:

- <https://www.ncei.noaa.gov/news/noaa-delivers-new-us-climate-normals#:~:text=The%201981%E2%80%932010%20average%20temperature,on%20record%20for%20the%20country.>
- <https://www.noaa.gov/media-release/average-atlantic-hurricane-season-to-reflect-more-storms#:~:text=The%20average%20for%20major%20hurricanes,hurricanes%2C%20and%203%20major%20hurricanes.>

Assessing and Addressing Marine Debris Impacts on Birds in the Gulf of Maine

By the Atlantic Marine Bird Cooperative

Shorebirds are in trouble. Nearly 70 percent of the world's marine birds have declined since the 1950s, as a direct result of human activity, with several species going extinct within the last 150 years. Marine debris is widely recognized as a threat to coastal and marine wildlife. In the northeastern United States, however, the severity and magnitude of the impacts of marine debris on birds has not been well evaluated. In recent years, the NOAA Marine Debris Program (MDP) has coordinated the development of the Gulf of Maine Marine Debris Action Plan in its Northeast region, in partnership with the USFWS and dozens of other agencies and organizations.

Learn more: <https://blog.marinedebris.noaa.gov/addressing-and-combating-impacts-marine-debris-birds-gulf-maine>

Watch the webinars to learn what the shorebird community is doing to better understand impacts to shorebirds in the Gulf of Maine.

Webinars About Impacts of Marine Debris on Birds in the Gulf of Maine Region:

1. <https://atlanticmarinebirds.org/webinar-impacts-of-marine-debris-on-birds-in-the-gulf-of-maine-region/>
2. <https://atlanticmarinebirds.org/webinar-impacts-of-marine-debris-on-birds-in-the-gulf-of-maine-region-webinar-2-filling-information-gaps/>
3. <https://atlanticmarinebirds.org/impacts-of-marine-debris-on-birds-in-the-gulf-of-maine-region-webinar-3-impact-reduction-strategies/>

Atlantic Marine Bird Cooperative: The Atlantic Marine Bird Cooperative is an open, collaborative forum for



A common tern (*Sterna hirundo*) is entangled in plastic strapping material. Photo credit: Atlantic Marine Bird Cooperative

resource managers, research scientists, and other professionals working to conserve marine birds in coastal and offshore ecosystems of eastern North America. We apply scientific principles to identify and address research needs and management issues in an effort to promote long-term viability of our unique avian community, and we partner with other stakeholders to minimize threats to critical coastal and marine habitats on which marine birds depend. Learn more: <https://atlanticmarinebirds.org/about/>

Tools to Empower Resilience to Storms: COAWST Modeling System Training

By Sara Ernst (USGS)

Understanding the processes responsible for coastal change is important for managing our natural and economic coastal resources. Storms are one of the primary driving forces causing coastal change. To better understand storm impacts and their effects on coastlines, there is a global need to better predict storm paths and intensities. To fill this gap, the USGS has been leading the development of a Coupled Ocean-Atmosphere-Waves-Sediment Transport (COAWST) modeling system. The integrated COAWST models improve understanding of coastal change hazards and impacts so that coastal communities can determine how best to reduce risk and vulnerability to storms in coastal areas.

See related story, page 28.

The USGS has provided and developed varying aspects of all the COAWST's individual systems and provided enhanced capabilities to allow these components to feed back to one another. For example, a typical hurricane modeling simulation may include great details for

the atmosphere component but with limited connectivity to the ocean. With the COAWST system, these simulations can combine the modeling components to allow the ocean temperature, and wave heights and directions, to interact with the atmosphere and provide dynamic feedback to the complete simulation. This will modify the storm development and provide a more-realistic suite of interacting physical storm processes.

“We developed the system because there are no other capabilities like this openly available to the scientific community. In the beginning it was limited to specialized modelers and applications, but as it has evolved, the advantages of using a coupled system has become apparent because the earth is controlled by interconnected systems. Forecast modelers have realized that hurricane predictions were more accurate by including feedback from the ocean and waves. Coastal zone predictions of surge and erosion will be improved by using full ocean simulations rather than simplified physics. The disadvantage is that these simulations take more computational time, but advances in computer systems

will allow more complicated simulations,” said USGS oceanographer and COAWST project lead John Warner.

Currently, COAWST has 800 registered users from around the world. As the community and capabilities grow, more users are developing coastal forecasting systems for local- and national-scale applications. Many international users are establishing applications in their countries that have never been available previously. Since 2012, the USGS, through the Woods Hole Coastal and Marine Science Center (WHCMSC), has led face-to-face in person COAWST modeling system trainings every two years. These trainings provide a great deal of value to COAWST users of all experience levels and advance the user community by providing a tutorial of the system and fundamental information about the modeling components.

Because of the pandemic, the latest COAWST modeling system training took place virtually on May 24–27, 2021. Each of the four days of the first virtual COAWST training consisted of lectures to describe a model component, a tutorial to demonstrate development of a coupled application, and an opportunity for user support in breakout rooms. In addition to daily overviews and use-case tutorials, a different expert in each of the modeling components presented each day:

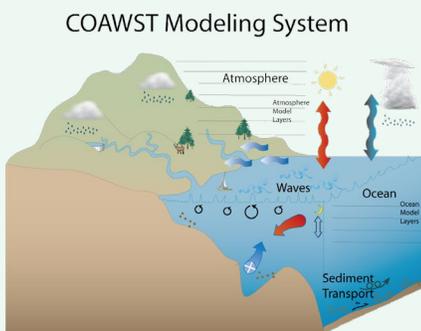
- Kelly Werner (National Center for Atmospheric Research, University Corporation for Atmospheric Research) discussed the atmospheric component of COAWST (WRF);
- Hernan Arango (Rutgers) discussed the ocean component (ROMS);
- Ali Abdolali (NOAA) discussed one of the wave components (WAVEWATCHIII);
- Alfredo Aretxabaleta (USGS) discussed the USGS Community Sediment Models;

The COAWST modeling system is an open-source tool that combines many sophisticated models that each provide earth-system components necessary to investigate the dynamics of coastal storm impacts. Specifically, it includes:

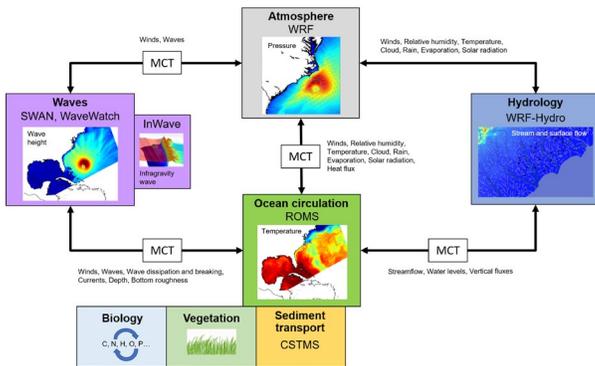
- An ocean component—Regional Ocean Modeling System (ROMS);
- An atmosphere component—Weather Research and Forecast Model (WRF);
- A hydrology component—WRF_Hydro;
- Wave components—Simulating Waves Nearshore (SWAN), WAVEWATCHIII, and InWave;
- A sediment component—the USGS Community Sediment Models; and
- A sea ice model.

Access the COAWST tool here:
<https://woodhole.er.usgs.gov/project-pages/cccp/public/COAWST.htm>

The COAWST modeling system joins several models for studies of coastal change. Image credit: Zafer Defne, USGS



See Tools page 27



A diagram overview of the COAWST modeling system components that couples many Earth-system models. The Model Coupling Toolkit (MCT) exchanges data fields between the ocean model ROMS, the atmosphere model WRF, and the wave model SWAN. This graphic shows the data fields that are exchanged between each model. Image credit: Zafer Defne, USGS

Tools continued from page 26

- Tarandeep Kalra (USGS) discussed the wave-current-vegetation module;
- Julia Moriarty (University of Colorado, Boulder) discussed the biogeochemistry coupling and biology modules;
- Christie Hegermiller (USGS) discussed an infragravity wave component (InWave); and
- Rich Signell (USGS) discussed tools for working remotely with data.

Over 200 people from around the world were interested in attending

the training, although the invite list was capped at 125 to ensure breakout rooms remained small enough to elicit valuable discussion and breakout room leads were able to answer every question. Recordings of the trainings were provided to the attendees along with all the presentation materials.

Post-training feedback indicated that the virtual COAWST training was successful. An overwhelming 92 percent of attendees

said they would be interested in attending another training and indicated which topics they would like to learn more about. Post-training surveys shared by the attendees showed that most attendees were very satisfied with the training and that the information presented was very helpful. One attendee wrote, “I would like to congratulate the team that organized the event and all the presenters for the incredible work that you have done. It is not easy to hold an event online and you made this one very engaging and gave lots of opportunities to the participants to ask questions and solve

any issues or discuss any topic that we wanted. The content was vast and the practical examples provided helped a lot to understand the functionalities and potentialities of each model and how they work coupled. For me, the training was a very positive experience and I thank you all for that! You do a fantastic job! Thank you very much!”

As valuable as the training itself proved to be for COAWST users, the feedback has been equally valuable to the COAWST team and meeting organizers who plan to use it to better serve the user community in the future. The USGS plans to continue these trainings to enhance the user community and the modeling system. By supporting COAWST users, helping them navigate the intricacies of this modeling system and improving their capabilities in exploring the dynamics of coastal storm impacts, USGS is contributing to creating more sustainable and resilient coastal resources and communities at the global scale.

COAWST modeling system:

<https://www.usgs.gov/centers/whcm/science/coawst-coupled-ocean-atmosphere-wave-sediment-transport-modeling-system>

Science for Coastal Resilience

By Meaghan Emory (USGS)

The Coastal Change Hazards (CCH) team launched a video to describe how USGS integrates robust research, state-of-the-art capabilities, and stakeholder input to achieve coastal resilience goals.

The USGS CCH team works to identify and address the risks and consequences of coastal change hazards throughout the Nation. Coastal resilience is under threat from extreme storms, loss of protective coastal ecosystems, coastal erosion, and sea-level rise. Understanding these processes and forecasting their impacts provides

crucial information for preserving coastal habitats and communities. By integrating research, technical capabilities and applications, and stakeholder engagement and communications, CCH develops thorough and accessible coastal change assessments, forecasts, and tools that help protect lives, property, and economic prosperity along our Nation’s coasts.

The team created an introductory video to demonstrate the significance of this work and describe how USGS integrates research, innovative capabilities, and stakeholder input to achieve coastal resilience goals. The USGS CCH video debuted at the



Watch the video: <https://www.usgs.gov/media/videos/usgs-coastal-change-hazards>

White House SOST Coastal Resilience Workshop in June 2021 to communicate USGS CCH work to partners across the Federal family. Watch the video to learn how the CCH team encourages innovative collaboration to identify and address the Nation’s coastal change hazards challenges.

Forecasting Coastal Storm Impacts

USGS Scientific Team Applies COAWST Modeling System to Hurricane Florence (2018) to Better Predict Compound Impacts of Ocean Surge and Rainfall

By Zafer Defne, John Warner, and Christie Hegermiller (USGS); George Xue, Daoyang Bao, and Dongxiao Yin (Louisiana State University, Baton Rouge); Joe Zambon and Ruoying He (North Carolina State University); and Melissa Moulton (National Center for Atmospheric Research)

Hurricanes are becoming stronger and have significantly more intense rainfall, creating greater impacts in coastal areas. The ability to forecast the effects of these storms will allow for more advanced warning, making it easier and more reliable to evacuate hazardous zones and allow for better coastal protection measures. The USGS, in partnership with Louisiana State University, North Carolina State University, and the National Center for Atmospheric Research, are leading an effort to create a more robust and accurate approach to predict the impacts during extreme coastal storms by developing a numerical modeling system that combines several other specialized models.

The team of scientists is using the COAWST modeling system, which allows different models of the ocean, surface waves, atmosphere, hydrology, and sediment transport to be combined, allowing feedback from one model directly to another.

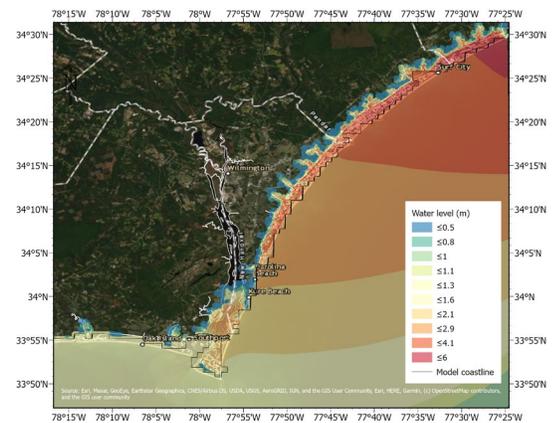
See related story, page 26.

“This collaboration and the COAWST modeling capabilities are allowing scientists to dive in more deeply to understanding storms and being able to forecast their impacts more

accurately than ever before,” said USGS Coastal and Marine Hazards and Resources Program Coordinator John Haines. “Supplemental funds and the data we were able to obtain during Hurricane Florence have truly accelerated our scientific capabilities.”

The scientists are applying the models to study the characteristics of Hurricane Florence that made landfall on the southeastern coast of North Carolina on September 14, 2018. The COAWST simulations correctly predicted the path of the hurricane, but the intensity of the storm as well as the magnitudes of the winds and rainfall depend on various physics options in the models. By using the COAWST modeling system, the scientists can obtain a more comprehensive understanding of the storm. Feedback between the models can lead to results that are sensitive to the way the models are set up (model parameterizations). Hurricane Florence was interesting in that while it caused strong waves and coastal erosion, the predominant impact was the severe rainfall that occurred immediately after landfall.

The amount of precipitation predicted by the model can vary depending on the way the atmospheric model represents the cloud formation. These differences can yield different results. Differences in where and how much precipitation

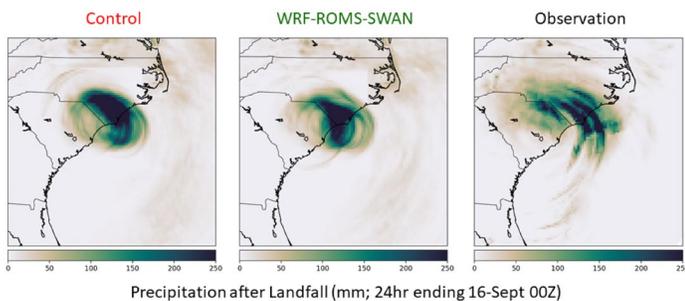


Map showing water levels at the coast during Hurricane Florence. Coastal compound flooding is caused by the combined effects of ocean surge and increased river flows from rainfall. Image credit: Zafer Defne, USGS

occurs will then modify the river flows and the predicted flooding at the coast.

The team is using the data from Hurricane Florence to help better understand how the model parameterizations affect the forecast capabilities. Currently they are studying the timing of the combined effects of ocean surge and river flooding at the coast and how the COAWST modeling system can improve analysis of conditions that cause compound flooding. In addition, they are also continuing modeling efforts focused on how characteristics of the watershed alter the routing of river flows and flooding. This can take further advantage of the COAWST coupling capabilities by providing data and information that can help describe how land-sourced contaminants disperse in the ocean during coastal storms.

This work is funded in part by congressional appropriations through the Additional Supplemental Appropriations for Disaster Relief Act, 2019 (Public Law 116–20; 133 Stat. 871).



The prediction of rainfall can vary depending on the physics options in the models. Using a coupled system allows studies to investigate how model choices can help predict rainfall more accurately. Image credit: Joe Zambon, North Carolina State University

Bristol Bay, Sockeye Salmon, and the Portfolio Effect

By Katrina Liebich (USFWS)

Nine major rivers pour into Bristol Bay, AK, creating a unique geologic setting where diverse sockeye salmon populations thrive and support the world's most notable and sustainable wild salmon fishery.

As part of the podcast series, "Fish of the Week," Katrina Liebich and Guy Eroh, a self-professed "fish enthusiast," explored stories, science, and culture surrounding a variety of fish topics, species, and related issues. The USFWS' "Fish of the Week" podcast with Liebich and Guy is

full of fascinating information. The series explores Kenai River Kings, Sticklebacks, the "Salvation Fish" (Eulachon), and more with guest experts like the "Gar Guy," Sport Fish managers, university professors, and fisherfolk.

In a recent two-part episode about the sockeye salmon of Bristol Bay, the team spoke with retired commercial fisherman/USFWS Native Liaison Orville Lind and Dr. Daniel Schindler from the University of Washington. Orville, who hails from Chignik, AK,

gave insight into fishing and the cultural importance of Bristol Bay sockeyes. Dr. Daniel Schindler did a deep dive into their biology, the Bristol Bay geographic environment, the "portfolio effect," and how long-term monitoring and related science



Satellite imagery of the Bristol Bay area of Alaska, showing the lakes, rivers, and drainage of the region. Image credit: USGS

can inform the sustainable management of wild fisheries.

Learn more about how this "investment portfolio" of intact habitat and distinct salmon populations creates a diverse and stable wild fish metapopulation and fishery.

While hatcheries are used to help manage fish in many impaired habitats, research shows they are no substitute for intact habitats and healthy watersheds. Intact and richly diverse habitats are the foundation for sustainable, resilient fisheries.

Listen and learn more here:

<https://usfwalaska.libsyn.com/bristol-bay-sockeye-salmon-part-1>



Birds-eye view of sockeye salmon amassing in Upper Ugashik Lake in the Bristol Bay region of Alaska. Photo credit: Jeff Jones

Fish of the Week!

Join us every Monday for Fish of the Week! Where we get to know all the fish—how they make a living, what habitats they use, what they eat, and where they go and why. Everything you need to know to appreciate and conserve these fish and be a successful angler. We've got lots of fish stories below! Katrina Liebich and Guy Eroh are your hosts.



Guy is a fan of fishes. A man on a mission, dedicated to conserving and fostering appreciation for all aquatic critters finned and gilled. He studied ecology and fisheries and the University of Georgia and has shared his enthusiasm for fish with colleagues from Alaska to Washington, D.C. Photo credit: USFWS



Katrina is a fish nerd and piscivore working for the USFWS. She has a Master's and Ph.D. degrees from Michigan State University's Department of Fisheries and Wildlife and has lived in Anchorage since 2010. She loves fishing and helping others develop a connection with fish. Photo credit: USFWS



Visit online: <https://www.fws.gov/alaska/pages/fish-of-the-week>

New Animated Videos

Help Raise Awareness to Address Human Disturbance to Beach Birds

By Debra Reynolds (USFWS/AFSI)

People love going to the beach. The sun, the surf, and the memories we create with our friends and families make the beach a special place. We fish, play, fly kites, walk our dogs, and relax while some of our most imperiled wildlife attempt to feed, rest, and raise their young nearby. All along the Atlantic coast, the beach is “home sweet home” for shorebirds like piping plover and Red Knot (*Calidris canutus*), and seabirds like the Roseate Tern (*Sterna dougallii*). Every year, as we flock to our favorite beach destination for sun and fun, shorebirds and seabirds return from their wintering areas in the Caribbean and South America to eat, rest, mate, and raise their young on the beach. These birds face many threats during migration

including loss of habitat, hunting, predation, climate change, and human disturbance that keeps them from the food they need to survive.

To help address these threats, the Atlantic Flyway Shorebird Initiative (AFSI), Florida Shorebird Alliance, Florida Fish and Wildlife Conservation (FWC) Commission, and BiodiversityWorks developed three animated videos to address general human disturbance, disturbance to migrating species, and disturbance by dogs to beach birds. The videos feature a multicultural family and are currently available in English and Spanish. They are for YOU, your friends, and YOUR partners to use to help raise awareness to beachgoers and dog walkers in your communities so that they better understand what they can do to reduce the threats to shorebirds. You can share

the videos via web pages, email, and social media.

Access the videos here:

Share the Shore in English:

<https://atlanticflywayshorebirds.org/share-the-shore/>

Share the Shore in Spanish:

<https://atlanticflywayshorebirds.org/es/compartir-la-costa/>

Collaborators on this project include Debra Reynolds, USFWS; Shea Armstrong, FWC Florida Shorebird Alliance; Luanne Johnson, BiodiversityWorks; and Joseph Marchionno, FWC, Florida Wildlife Research Institute. Special thanks to Vianey Ramirez, Manomet; and Miguel Garcia-Bermudez, USFWS, for their help with Spanish translation; and to Danielle Belleny, BlackAFinSTEM Collective, for ensuring cultural representation. For questions, please contact: Debra_Reynolds@fws.gov



Three animated videos feature how common human activities and their pets can disturb beach birds and threaten their survival. The videos are currently available in English and Spanish. They are intended to educate coastal communities so that they better understand what they can do to reduce the threats to shorebirds. Photo credits: A, AFSI; B, Florida Fish and Wildlife Commission; C, Virginia State Parks; D, Ray Hennessy (used with permission, <http://rayhennessy.com/>)

New Flyway Website!

A Resource to Support Shorebird Conservationists

By Debra Reynolds (USFWS/AFSI)

Shorebirds can be found in nearly every habitat across the Western Hemisphere. These habitats have been altered dramatically in the last century. Habitat loss combined with so many obstacles throughout their life cycle has resulted in significant declines to shorebirds in the Americas.

Effective conservation requires a wide-ranging approach to identify and reduce threats throughout each flyway. To be truly effective, such an approach must coordinate research, conservation, and management efforts of many groups across multiple political boundaries and consolidate resources. Thankfully, shorebirds have amazing partners helping to conserve and protect them as well as educating people who share the habitats that shorebirds call home. This is happening across the hemisphere through the Atlantic, Pacific, and Midcontinent Flyway

While our initiatives are unique, we share a common goal of working to reverse the downward trend of shorebirds throughout the flyways.



Adult American Oystercatcher (*Haematopus palliatus*) is teaching its chick to search for food. Photo credit: Doris Rafaeli

Shorebird Conservation Initiatives.

A new shorebird flyway website, <https://shorebirdflyways.org/> puts conservation resources and information all together in one place. The Shorebird Conservation Initiatives of the Americas website showcases our collective goals, threats, and hopes. These initiatives support strategies for sustaining and recovering shorebirds integrate conservation actions across geographic, ecological, and cultural landscapes and are focused on reducing threats and implementing actions to reverse shorebird declines and recover vulnerable populations. Through this website, you can easily find your way to each flyway's website for more detailed information (Midcontinent coming soon!) and find shared resources, such as the Shorebird Management Manual, conservation plans, outreach resource directory, and a forum that can be used across this broad community.

See related story, page 30.

We invite you to become a partner in your flyway initiative and please share broadly with your networks. For feedback or to provide additional



The Shorebird Conservation Initiatives of the Americas website <https://shorebirdflyways.org/> provides users with access to "their" flyway initiative, communication resources, and a way to connect with partners throughout the Western Hemisphere. Image credit: AFSI

resources we can include that are relevant to shorebird conservation and science in the entire Western Hemisphere, please contact:

Debra Reynolds
(debra_reynolds@fws.gov) or
River Gates
(river.gates@audubon.org).

We are also very grateful to the following translators: Jean-François Lamarre (Polar Knowledge Canada), Arne Lesterhuis (WHSRN Executive office, Manomet), Roberta Rodrigues (SAVE Brasil) and Verónica Anadón.



This Rufous-chested plover (*Charadrius modestus*) breeds on southern moorland and steppe and migrates north to winter on beaches and coastal flats of the Pacific coast. Photo credit: Ricardo Matus

Male Buff-breasted Sandpipers (*Tryngites subruficollis*) try to attract a mate raising their wings over their head, bill pointed to the sky, and breast puffed out. Unlike most shorebirds, Buff-breasted Sandpipers forage in dry, grassy habitats, not wetlands. Photo credit: Shiloh Schulte



Science Strategy for Chesapeake Bay

By the USGS

The Chesapeake Bay is our Nation's largest estuary. Tourism, fishing, boating, agricultural production, shipping, and other commerce contribute almost \$100 billion annually to the economy. As a partner within the Chesapeake Bay Program, a partnership of Federal and State agencies, USGS science contributes to sound conservation, restoration, and management decisions.

For decades, the USGS has provided critical science used to understand and improve the health of the Chesapeake Bay ecosystem.

The Chesapeake Bay Program is working to improve water-quality conditions and habitat for numerous fish and wildlife species, to conserve lands, and to improve recreational opportunities for about 18 million people in the watershed. As the ecosystem is faced with new and evolving pressures from climate change, human development, and changes in land use, the USGS is updating its science priorities to help address these growing threats.

The USGS is looking at how multiple stressors, including increased

temperatures, poor water quality, contamination, harmful algal blooms, diseases, and invasive species, are affecting fish populations and their habitats. In addition, scientists are looking at the effectiveness of management actions and polices.

The USGS is also helping understand how habitat along the coast, which is important to migratory waterbirds, is vulnerable to sea-level rise. This includes measuring land subsidence and elevation changes to determine resiliency. The development of high-resolution maps of the watershed are essential to understanding where changes in land use and land cover such as forest loss

are occurring. Together, this research will help inform land conservation decisions.
Learn more: <https://www.usgs.gov/centers/cba>



USGS Chesapeake Science Strategy 2021-2025

The Chesapeake Bay ecosystem is a national treasure that provides almost \$100 billion annually of goods and services. The Chesapeake Bay Program (CBP), is one of the largest federal-state restoration partnerships in the United States and is underpinned by rigorous science. The U.S. Geological Survey (USGS) has a pivotal role as a science provider for assessing ecosystem condition and response in the Chesapeake watershed. Despite significant CBP accomplishments, the pressures of climate change and competing demands on land use and change require an acceleration of progress towards the 10 goals in the Chesapeake Bay Watershed Agreement. USGS Chesapeake studies are increasing efforts to provide integrated science and are engaging stakeholders to inform the multi-faceted restoration and conservation decisions to improve habitat for fish and waterfowl, and socio-economic benefits to the 18 million people living in the watershed.

The USGS is implementing four integrated science themes (fig. 1):

- Theme 1: Provide science for environmental management of stream health, fish habitat, and water quality.
- Theme 2: Assess the risks to coastal habitats and migratory waterbirds.
- Theme 3: Enhance landscape data and forecasting to inform watershed management.
- Theme 4: Integrate science and inform stakeholders.

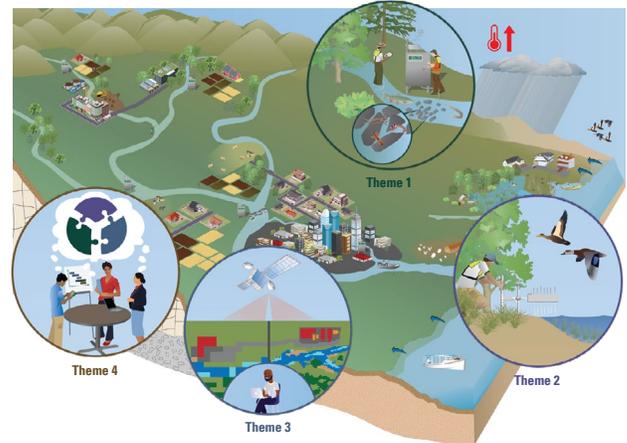


Figure 1. Conceptual diagram of the Chesapeake watershed depicting the four USGS science themes (see insets), as well as major environmental drivers, like climate change, land-use activities, and urban development.

U.S. Department of the Interior
U.S. Geological Survey
Printed on recycled paper
Fact Sheet 2021-2027
June 2021

The USGS Chesapeake Science Strategy Fact Sheet provides an overview of science priorities, themes, and environmental drivers such as climate change, land-use activities, and urban development: <http://ow.ly/HO5d50FpStC>

VIDEO: The State of the Arctic Terrestrial Biodiversity, 2021

The new report identifies circumpolar trends and knowledge gaps in vegetation, arthropods, birds, and mammals. It provides advice for ecosystem-based monitoring and reporting, better coordination, standardization of methods, improved use of indigenous knowledge, local knowledge citizen science, and addressing knowledge gaps so that Arctic countries can improve the ability to detect and report on significant changes in the terrestrial Arctic for Arctic residents, for future generations.



See related story page 35

Watch the video: https://www.youtube.com/watch?v=N_OH1EdznZc&t=2s

Learn more: <https://www.caff.is/>

For more information about START, including the full START report, a key findings report, data, and videos, see: <https://www.arcticbiodiversity.is/terrestrial>

Read the *Ambio* special issue: <https://link.springer.com/journal/13280/volumes-and-issues/49-3>



How Hurricanes Gain Strength—Scientific Serendipity from Hurricane Maria

New Information Could Aid Forecasting, Save Lives, and Protect Infrastructure

By Camille Collett, Paul Laustsen, Olivia Cheriton, and Curt Storlazzi, (USGS); and Clark Sherman (UPR-M)

Researchers from the USGS and the University of Puerto Rico-Mayagüez (UPR-M) did not set out to make observations during a hurricane. In the summer of 2017, they deployed a large suite of subsurface oceanographic instruments off the southwest coast of Puerto Rico to study the area's coral reefs. Those plans changed when Hurricane María, the strongest weather system to hit Puerto Rico since 1928, made landfall on September 20, 2017.

“We had originally planned to recover the instruments in October 2017, but that all changed after Hurricane María,” said Clark Sherman, UPR-M professor of marine science. “It was not until January 2018 that we were able to get back in the water, and we weren't sure what, if anything, would still be there.”

The instruments not only survived the passage of Hurricane María but also collected a rare, high-resolution set of underwater ocean observations not detectable by more-common surface observation platforms, such as buoys or satellites. In addition, this type of

The unique observations collected by USGS scientists during Hurricane María in 2017 revealed previously unknown ocean processes that may aid in more-accurate hurricane forecasting and impact predictions.

subsurface information is not currently incorporated into ocean hurricane model simulations. Doing so may improve forecasts.

Understanding how the underlying ocean temperature changes in response to hurricane forces is critical to accurately forecasting the tracks and intensities of extreme storms. Hurricane María caused thousands of deaths, more than \$90 billion in damage, and the largest electrical blackout in U.S. history.

Such forecasting is critical in preparing communities in the storm's path to help minimize the loss of life and the long-term repercussions of damage to critical infrastructure such as airports,

communications networks, roads, and power grids.

“We were surprised to find that the direction of the approaching hurricane winds relative to the coastline kept the ocean surface layer distinctly warmer compared to the colder waters below,” said USGS oceanographer Olivia Cheriton, lead author of the paper. “This is important because warmer sea surface temperatures provided more energy for the storm.”

The research, published in *Science Advances*, is applicable to the thousands of islands in the world's tropical oceans subject to these types of weather systems and is intended for use by a wide variety of scientists and emergency managers working on hurricane forecasts and impacts to coastal communities.

Read the report: <https://advances.sciencemag.org/content/7/20/eabf1552>

Learn more: <https://www.usgs.gov/news/usgs-scientists-add-another-piece-puzzle-how-hurricanes-can-gain-strength>

USGS Launches New One-Stop Shop for Hurricane Information

By Meaghan Emory, USGS

Hurricanes pose numerous hazards to coastal communities and ecosystems. The USGS has gathered a broad range of expertise on storm-related hazards and research and compiled them into a handy hub of hurricane information.

USGS brings together diverse expertise to study hurricanes and tropical storms, develop models and tools to forecast storm impacts, and deliver this knowledge to inform preparedness, response, and recovery. USGS scientists and staff coordinate across Water Resources, Ecosystems, and Natural Hazards Mission Areas and collaborate with Federal, State, and local partners to understand and prepare for hurricane hazards.

When hurricanes threaten our coasts, the USGS provides comprehensive science and information that decision makers, emergency responders, resource managers, and communities can use to help them prepare for, cope with, and recover from a storm. With so much information available, the USGS developed an information hub where coastal communities can learn about the scope of USGS science, storm response, and the data and tools available to improve preparedness, reduce risk and enhance our resilience: <https://www.usgs.gov/special-topic/hurricanes>



Image credit: Ricky Arnold, NASA

Assessing Contaminants at Virgin Islands National Park and the Coral Reef National Monument

By Kaitlin Kovacs and Timothy Bargar (USGS)



A view of Trunk Bay, USVI, part of the coastal ecosystem within the Caribbean Sea. Photo credit: USGS

The USVI attracts more than two million people each year, most of whom are eager to explore the white sandy beaches and tropical marine ecosystems, including coral reefs. However, coral reefs around the world, including those in the USVI, are experiencing a variety of stressors including increased sea surface temperature, disease, and a variety of environmental contaminants. The USGS has been conducting projects on St. John, USVI, to learn more about potential contamination in the waters of the Virgin Islands National Park (VIIS) and the Virgin Islands Coral Reef National Monument (VICR) to help the NPS manage these important protected areas.

Natural resource managers from the NPS are concerned with the negative effect of contaminants, including sunscreen chemicals worn by beachgoers, on sensitive coastal habitats such as coral reefs. Several studies conducted by the USGS in collaboration with the VIIS have begun addressing these concerns. Coral tissue, fish, plankton, detritus, and water were collected from multiple bays within the VIIS and VICR, and then analyzed for a variety of contaminants to get a general understanding of the presence of contaminants in these areas. The USGS is also investigating the potential presence of a banned component of antifouling paints in sediments in a couple of bays within the VIIS. Antifouling paints are commonly applied to the bottoms of boats to help prevent marine organisms such as barnacles or algae from growing and potentially damaging the vessel. Other research includes assessing nutrient enrichment

through collecting and analyzing water and algae samples from several bays and investigating the presence of sunscreen chemicals in coastal waters to better understand the possible risk of those chemicals for the aquatic plants and animals.

The studies have revealed that compounds used in chemical sunscreen are detectable in marine waters near high-use beaches on St. John. The impact of these chemicals is not yet known, but the USGS continues to investigate how these chemicals might affect coral reefs and the species that rely upon them.

Learn more about the study here: <http://ow.ly/Z15B50Fkcg6>



A USGS diver scientist samples detritus in shallow coastal waters of the VIIS. Photo credit: USGS



A healthy colony of *Montastrea annularis*, a common reef building coral in the Caribbean. Photo credit: USGS

How Loud is Too Loud?

By BOEM

The ocean is vast and full of sounds. For many species, relying on visual cues is not enough for survival. Ocean species, such as marine mammals, sea turtles, fish, and invertebrates, often listen to and process acoustic cues to help them survive—to find food, avoid danger, and communicate with each other across hundreds and even thousands of miles.

BOEM's Center for Marine Acoustics (CMA) is studying sea turtle hearing to understand how offshore activities can affect them. The CMA actively works to identify issues, deficiencies, and opportunities to improve or expand on ocean research and offshore regulatory decisions as they pertain to marine acoustics. Staffed by highly skilled and knowledgeable acoustics and modeling experts, the CMA addresses naturally occurring sounds and those generated by industrial activities that BOEM regulates, including offshore oil and gas, renewable energy, and marine minerals.

Learn more: <https://www.boem.gov/center-marine-acoustics>

How loud is too loud?
BOEM wants to know

Protecting the environment while ensuring the safe development of offshore energy is a critical part of BOEM's mission.

Sea turtles are endangered species and a sentinel species for the effectiveness of climate change. Good underwater activities, such as seismic surveys or pile driving for renewable energy installations, could be harmful to these protected animals.

BOEM seeks to understand how the activities we permit impact these species so we can make informed, science-based decisions.

Sound may be an important cue for sea turtles for environmental awareness, navigation, locating prey, and avoiding predators.

However, scientists still don't understand what sounds different species and life stages are able to detect.

BOEM's Environmental Studies Program develops, funds, and manages scientific research to ensure that the best available science informs our decision making.

To understand how sounds associated with construction impact sea turtles, we need to know how the animals hear.

With few studies available, improving what we know requires us to directly measure how sea turtles hear at different frequencies.

This study aims to measure sea turtle hearing to determine what sounds produced by human activities they can detect.

We measure sea turtle hearing the same way we measure human hearing—by recording the signals the ear sends to the brain when it detects a sound.

BOEM Bureau of Ocean Energy Management
More information at BOEM.gov/center

START for the Arctic

By Jim Lawler (NPS) and Casey Burns (BLM)

The Arctic includes diverse ecosystems that sustain important and unique biodiversity—from insects and fish to mammals and birds that are unique to the planet or have evolved to depend upon Arctic conditions as part of their life cycle. The Arctic also supports indigenous people and other arctic residents who depend on these ecosystems for their livelihoods. Arctic species and ecosystems are currently largely intact due partially to their remoteness and harsh climate. Times change, however, and the Arctic is increasingly under stress from climate change, industrial and commercial development, pollution, local disturbance, and invasive species. Some of the more visible changes include changes to the physical environment such as reduced sea ice, increased erosion, degraded permafrost, and increased industrial development.

The Conservation of Arctic Flora and Fauna (CAFF) is the biodiversity working group of the Arctic Council. Within the CAFF, the Circumpolar Biodiversity Monitoring Program (CBMP) is an international network of scientists, governments, indigenous organizations, and conservation groups that are organized around

four major ecosystems: marine, fresh water, terrestrial, and coastal. The Terrestrial Expert Group recently completed the first State of the Arctic Terrestrial Biodiversity Report (START, 2021). The report provides an assessment of the current status and trends in terrestrial biodiversity and biodiversity monitoring.

The START report was preceded by other reports focused on understanding the biodiversity of the region:

- the State of the Arctic Marine Biodiversity Report, 2017 (<https://www.arcticbiodiversity.is/marine>),
- the State of the Arctic Freshwater Biodiversity Report, 2019 (<https://www.arcticbiodiversity.is/freshwater>), and
- the Arctic Coastal Biodiversity Monitoring Plan, 2020 (<https://www.caff.is/coastal/coastal-monitoring-plan>).

START is primarily based upon published data, from a special issue of *Ambio* (2020) containing 13 articles by more than 180 Arctic experts (<https://link.springer.com/journal/13280/volumes-and-issues/49-3>).

Key findings of the START report include:

- Climate change is the overwhelming driver of change in terrestrial Arctic ecosystems, causing diverse, unpredictable, and significant impacts that are expected to intensify;
- Changing frequency, intensity, and timing of extreme and unusual weather caused by climate change



This map of the Arctic (North America on the left) shows the boundary (in red) that defines the area covered by the CAFF working group of the Arctic Council. Each Arctic Council country was responsible for defining their Arctic boundary. Image credit: CAFF/Arctic Biodiversity Data Service—GeoNetwork Catalogue: <http://geo.abds.is/geonetwork/srv/eng/catalog.search#/home>

are affecting some species, with unknown effects on populations;

- Although some trends have been observed, natural variability in Arctic terrestrial environments and large information gaps make it difficult to assess and summarize global trends for Arctic terrestrial biodiversity;
- Species from southern ecosystems are moving into the Arctic and are expected to push Arctic species northwards, creating an “Arctic squeeze,” and change species’ interactions;
- Changes in culturally important food resources have implications on the food security and cultures of indigenous peoples and Arctic residents; and
- The range and complexity of drivers affecting Arctic terrestrial biodiversity signals the need for comprehensive, integrated, ecosystem-based monitoring programs, coupled with targeted research projects to help decipher causal patterns of change.

Learn more about the Arctic Council:
<https://arctic-council.org/en/>

How much do you know about Arctic issues?



Take the Quiz: <https://arctic-council.org/en/about/quiz/>



Journey to Challenger Deep— The Surfing Bison

The Deepest Spot on Earth

Exploring the Seafloor in a Subduction Zone



Watch the video: “Nicole Yamase from Micronesia First Pacific Islander to the Challenger Deep,” created by Verola Media, here: <https://www.youtube.com/watch?v=Af2EWQAm0>

Vescovo and Yamase (at right) are exuberant after a successful dive.

By Tanya Harris Joshua (OIA) and Ann Tihan-sky (USGS)

On March 11, 2021, Nicole Yamase, became the first Pacific Islander to descend into the in the Mariana (also known as the Marianas) Trench, in the Challenger Deep, 11,000 kilometers (36,000 feet) below sea level, the deepest spot on Earth.

See related story, page 3.

Nicole was hosted by the Five Deeps Expedition, led by Victor Vescovo on the Deep Submergence Support Vessel *Pressure Drop* and the Deep Submergence Vessel *The Limiting Factor*.

This series of images captured from the video, share parts of the historic day:

The Challenger Deep is in the Mariana Trench, which is part of the Mariana

Volcanic Arc in the western Pacific Ocean, north of Guam. The Mariana region contains 9 volcanic islands and more than 60 submarine volcanoes, of which at least 20 are hydrothermally active. The summits of these submarine volcanoes range from 50 meters to more than 1,800 meters below sea level. This area is known as a subduction zone and is tectonically active with frequent earthquakes and some of the most active volcanic region on Earth. The Mariana Arc hosts frequent moderate-to-large earthquakes, where the Pacific plate begins its subduction beneath the overriding Philippine Sea plate. Here, ocean crust that was born along the midocean ridges millions of years ago in the eastern Pacific is “recycled” back into the Earth’s mantle as the ocean floor descends into the Mariana Trench. Part of the ocean crust remelts and rises to the surface behind the trench along a line of submarine volcanoes and volcanic islands extending north of Guam for more than 1,000 kilometers. Many of the hydrothermally active sites are part of the Mariana Trench Marine National Monument.

Learn more about subduction zones: <https://www.usgs.gov/special-topic/subduction-zone/>

Learn more about the geology of subduction zones here: <https://www.usgs.gov/special-topics/subduction-zone-science/science/introduction-subduction-zones-amazing-events>



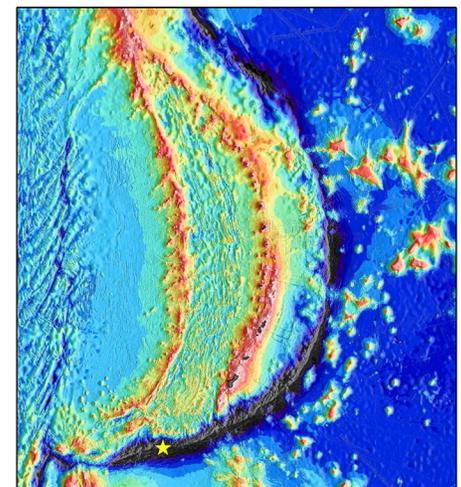
A map from the YouTube video showing the location of the Challenger Deep and Guam for reference. Image credit: OIA



Yamase gets a preliminary tour of *The Limiting Factor*.



The team of Yamase and Vescovo signs off with the surface crew and gives the ok to descend. Images from video by Verola Media.



Bathymetric map of the Mariana island-arc system in the western Pacific. The star marks Challenger Deep, the deepest part of the seafloor. Image credit: Daniel Schierer, USGS