

NEWSWAVE

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

Special Feature—Long-Term Monitoring of Alaska Nearshore Ecosystems

Spring 2019



The view from below as a wave breaks over healthy coral in Hawai'i dissipating energy. Photo credit: Curt Storlazzi, USGS

Value of Coral Reefs

By Curt Storlazzi (USGS), Ryan McClymont (USGS), and Tanya Joshua (DOI)

A new U.S. Geological Survey (USGS) study, partly funded by the U.S. Department of the Interior's (DOI) Office of Insular Affairs, demonstrates benefits coral reefs provide to coastal communities in the United States and its trust territories.

The reefs provide a flood-protection barrier for more than 18,000 coastal citizens and \$1.8 billion worth of coastal infrastructure.

“Our Office was glad to collaborate with the USGS and leverage funds available through the Coral Reef and Natural Resources Initiative,” said DOI Insular and International Affairs Assistant Secretary Doug Domenech.

See Coral Reefs page 8

New Tools for Visualizing Sea-Level Rise Data

By Zafer Defne (USGS), Erika Lentz (USGS), Richard Signell (USGS), William Sweet (NOAA), and Chris Weaver (USGCRP)

In February, USGS researchers announced the release of two new products developed through inter-agency collaboration that helps users see and interact with the 2018 National Climate Assessment (NCA) data.

The U.S. Ocean Policy Committee and the U.S. Global Change Research Program convened the Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Interagency Task Force to support the Fourth NCA 2018

See Visualizing page 5

Offshore Wind Auction Smashes Record with \$405 Million in Winning Bids

By Solomon Odom (BOEM)

In December 2018, the DOI announced the completion of the Nation's eighth and highest grossing competitive lease sale for renewable energy in Federal waters.

“This auction will further the Administration's comprehensive effort to secure the nation's energy future,” said Bureau of Ocean Energy Management (BOEM) Acting Director Walter Cruickshank. “The Commonwealth of Massachusetts and members of the Massachusetts Renewable Energy Task Force have been great partners throughout this process. We look forward to working with them and the lessees as we move forward

See Offshore Wind Auction page 3



Three companies claim winning bids for Massachusetts offshore wind. Wind areas could support approximately 4.1 gigawatts of commercial wind generation, enough to power nearly 1.5 million homes. Image credit: BSEE

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



The Asian Carp Problem

Learn more about these invasive fish and the threats they pose to ecosystems and economies.

See related story page 14.



What you need to know about Asian carp:

Watch the video: <https://youtu.be/1O0K-J6wXgY>

Additional videos: <http://www.asiancarp.us/PhotosVideos.html>

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/pmb/ocean/newswave>

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Offshore Wind Auction continued from page 1

with next steps for developing offshore wind energy in a responsible manner.”

The lease sale offered approximately 390,000 acres offshore Massachusetts for potential wind energy development and drew competitive winning bids from three companies totaling approximately \$405 million in winning bids. If fully developed, the areas could support approximately 4.1 gigawatts of commercial wind generation, enough electricity to power nearly 1.5 million homes.

Before December’s lease sale, the highest grossing offshore wind lease sale was held in December 2016 for the lease area offshore New York that received a winning bid of more than \$42 million.

After this auction, BOEM now has 15 active wind leases. These lease sales have generated more than \$473 million in winning bids for nearly two million acres in federal waters. Money received from offshore wind lease sales go to the United States Treasury.

For more information: <https://www.boem.gov/Massachusetts/>

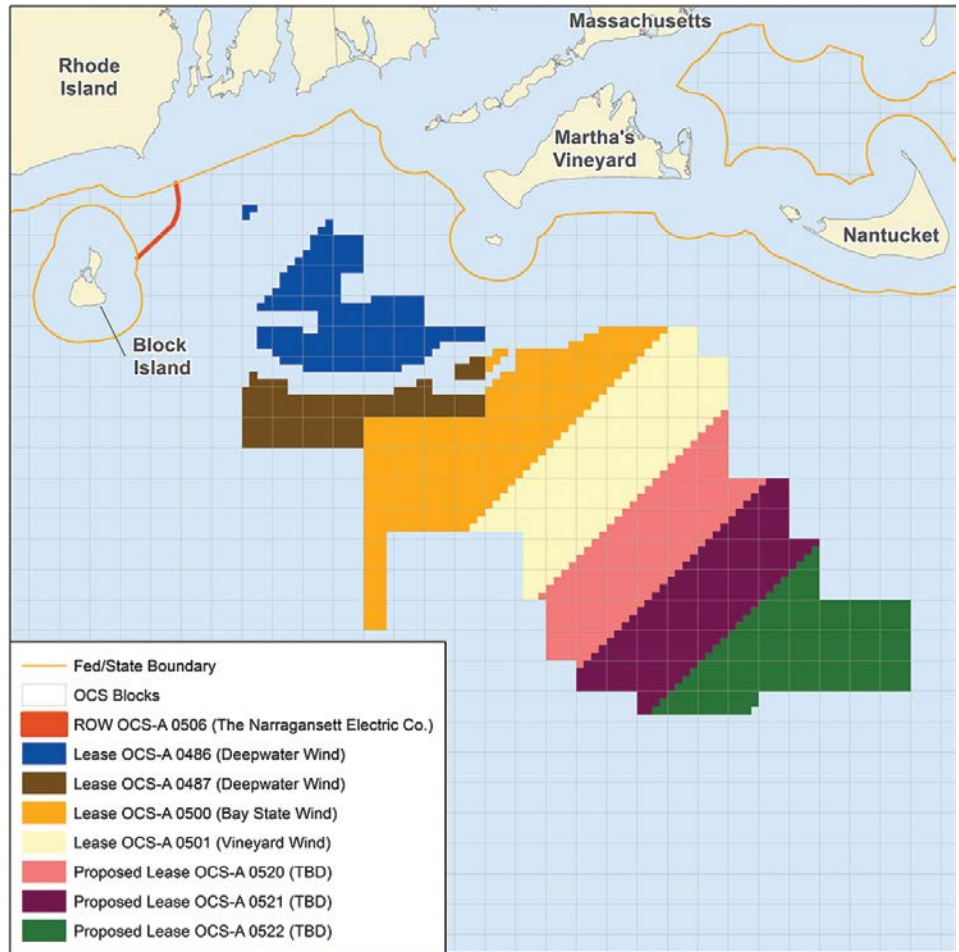
<https://www.doi.gov/pressreleases/bidding-bonanza-trump-administration-smashes-record-offshore-wind-auction-405-million>

Agencies and Fishing Industry Sign New Memorandum of Understanding

Responsible wind energy development underpins new agreement for Northeast U.S. waters

By BOEM

The BOEM, National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service



Offshore wind project areas off the Atlantic coast of Rhode Island and Massachusetts. The new lease areas are located 19.8 nautical miles from Martha’s Vineyard, 16.7 nautical miles from Nantucket, and 44.5 nautical miles from Block Island. Image credit: BOEM

The provisional winners of the lease sale are the following:

Provisional winner	Lease area	Acres	Winning bid
Equinor Wind US, LLC	OCS-A 0520	128,811	\$135,000,000.00
Mayflower Wind Energy, LLC	OCS-A 0521	127,388	\$135,000,000.00
Vineyard Wind, LLC	OCS-A 0522	132,370	\$135,100,000.00

(NOAA Fisheries), and the Responsible Offshore Development Alliance (RODA) signed a 10-year Memorandum of Understanding that brings local and regional fishing interests together with Federal regulators to collaborate on the science and process of offshore wind energy development on the Atlantic Outer Continental Shelf.

Safe, reliable, and affordable domestic energy production powers the U.S. economy, promotes jobs, and is critical to our Nation’s security. Offshore

wind is an abundant, domestic energy resource that is located close to major coastal load centers, providing an alternative to long-distance transmission or development of electricity generation in these land-constrained regions.

Fishing has occurred in New England and Mid-Atlantic waters for hundreds of years and is an integral part of the region’s culture and economy. Regional fisheries not only provide a healthy and sustainable source of

See Memorandum page 4

Memorandum continued from page 3

food for both domestic and international markets, but also recreational opportunities for thousands of anglers, divers, and nature enthusiasts. Fisheries also support numerous shoreside processing jobs and support industries important to the economies of many coastal communities.

"Any development on the Outer Continental Shelf must consider how these activities can affect current ocean users and the marine environment," said BOEM Acting Director Walter Cruickshank. "That is why working with Federal, State, and local agencies, fishing communities, and the public is such an essential part of our renewable energy program. We look forward to working with NOAA and RODA through early and constant communication to ensure that the most recent information is available to decision makers."

"With wind energy developing in the New England/Mid-Atlantic region, this collaboration comes at a crucial time," said Chris Oliver, assistant administrator for NOAA Fisheries, the primary Federal agency charged with sustaining U.S. marine resources and habitats. "This Memorandum of Understanding will help achieve NOAA Fisheries' strategic national goal of maximizing fishing opportunities while supporting responsible resource development."

RODA, which is a broad membership-based coalition of fishing industry associations and fishing companies, will work with NOAA Fisheries and BOEM to compile, develop, and deliver the best available scientific products and information necessary to address offshore development, fisheries management, and ecosystem health.

"The fishing industry has expressed its concern about the potential impacts of rapid large-scale wind energy development to coastal communities and sustainable fishing practices," said

NOAA, BOEM, and RODA agree to collaborate on the following:

- engaging local and regional fishing interests in the offshore wind development process,
- identifying the most effective ways to bring fishing industry expertise and information into planning and development processes, and
- developing a collaborative regional research and monitoring framework to ensure decisions are based on the best available science.

The new Memorandum of Understanding identifies four areas of mutual interest that include the following:

- responsible planning,
- siting, and
- development of offshore wind power; and
- working with regional and local fishing interests.

Annie Hawkins, executive director of RODA. "This agreement paves a way forward for fishing communities to give meaningful input to Federal regulators in determining the future of our ocean resources."

Working together to engage local and regional fishing interests early and often throughout the offshore wind development processes will help develop a collaborative regional research and monitoring program and lead to scientifically sound decisions.

"This unified approach will help ensure the best possible science and information is used to inform offshore energy development planning, siting, and operations," said Dr. Jon Hare, science and research director for the Northeast Fisheries Science Center. "Tapping into the expertise and the knowledge of the fishing industry is essential to this process."

Focus on Engagement, Research, and Monitoring

Today, the Federal Government has 15 active leases covering nearly 1.7 million acres in the Outer Continental Shelf for potential offshore wind development. Collectively, these leases could generate more than 19 gigawatts of energy—enough to power more than 6.5 million homes and further solidify our Nation's energy future.

NOAA Fisheries manages more than 42 commercially and recreationally

important species as part of 14 fishery management plans. In 2016, approximately 4,600 vessels landed more than 1 billion pounds of key fish species, supporting roughly 140,000 seafood jobs. The region is also vital for many endangered and threatened marine species, including the North Atlantic right whale (*Eubalaena glacialis*), necessitating protective measures to ensure their survival for future generations.

Collaborating with BOEM, States, and fishing industry interests throughout the renewable energy leasing process will help improve compatibility of offshore wind with other ocean uses and create an effective regional research and monitoring program that will help improve our understanding of potential ecological, economic, and social impacts of offshore wind development. *See related stories, pages 1 and 12.*

Learn more: <https://www.boem.gov/NOAA-BOEM-MOU/>

Offshore Wind in the Northeast Region—a webpage collaboratively managed by the Mid-Atlantic and New England Fishery Management Councils: <http://www.mafmc.org/northeast-offshore-wind>

Responsible Offshore Development Alliance: <https://www.rodafisheries.org/>

BOEM Renewable Energy Program: <https://www.boem.gov/Renewable-Energy/>

Visualizing continued from page 1

report. The agencies participating in the task force were U.S. Department of Defense (DOD), U.S. Environmental Protection Agency (EPA), Federal Emergency Management Agency (FEMA), National Aeronautics and Space Administration (NASA), NOAA, U.S. Army Corps of Engineers (USACE), and the USGS. The Task Force focused its efforts on three primary tasks: (1) updating scenarios of global mean sea-level rise, (2) integrating the global scenarios with regional factors contributing to sea-level change for the entire U.S. coastline, and (3) incorporating these regionally appropriate scenarios within coastal risk management tools and capabilities deployed by individual agencies in support of the needs of specific stakeholder groups and user communities.

“The initial work of the interagency task force was to get robust sea-level rise scenario data generated and published to support the 2018 NCA publication,” said Erika Lentz, a USGS research geologist and one of the authors of the new products. USGS researchers Zafer Defne and Richard Signell led the effort with Lentz to develop the products, working in close coordination with William Sweet (NOAA) and Chris Weaver (U.S. Global Change Research Program), who led the development of the scenario report. “The NCA generated the sea-level rise scenario data, and these new products were created to serve users the data as well as tools to visualize, interact with, and explore the data both temporally and geospatially,” said Lentz.

The Sea Level Change Geo-Narrative, or story map, is an interactive platform that serves the data and provides important context for understanding the scenarios and how they were generated using information from the original sea-level rise scenario report.

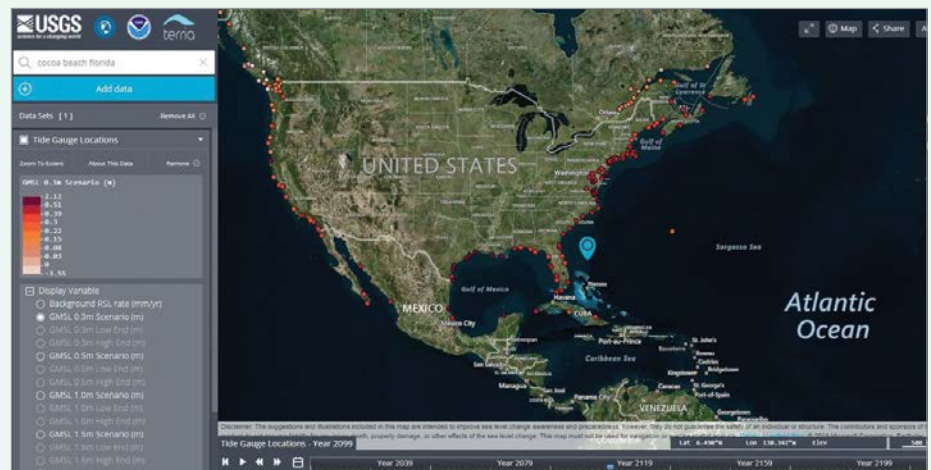
“These tools will help coastal planners and managers understand vulnerability and risk related to sea-level rise scenarios. Products and collaborations like these fulfill the USGS mission of providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life,” said Lentz.

Access the story map and data viewer (which is embedded in the story map): <http://arcg.is/1He0Tz>

For specific information about the viewer, contact Erika Lentz via email: elentz@usgs.gov

Learn more about the Fourth National Climate Assessment: <https://nca2018.globalchange.gov/>

The Sea-Level Change Data Viewer provides access to the sea-level rise scenarios at tide-gage locations throughout the United States. Users can explore singular or multiple scenarios through time to examine the full suite of potential sea levels for specific locations.



A screen shot from the online Sea-Level Change Data Viewer showing tide-gage stations (red dots) where scenario data are available. Image credit: USGS

New Issue of BOEM Ocean Science

Inside this issue:

BOEM scientists describe a variety of studies from our four offshore regions. For Alaska, we bring you up to date on whale monitoring efforts and activities that incorporate traditional knowledge from Alaska Natives using aerial surveys and tagging. Our Pacific team reviews sea otter and sea lion studies, and broad regional studies on protected species. Finally, we describe how BOEM develops seismic mitigation measures in the Gulf of Mexico, and listens to whales, dolphins, and porpoises along the Atlantic coast to inform decisions. *See related stories in this issue of NEWSWAVE (beaked whales in the Atlantic, and Glacier Bay whales in Alaska, page 6).*



BOEM Ocean Science is available online: <https://www.boem.gov/Ocean-Science-Aug-Nov-2018/>

To receive BOEM Ocean Science, visit www.boem.gov, click on the BOEM Ocean Science magazine cover, and then select “Sign up for Ocean Science” at the bottom of the page; or send an email to: Melanie.Damour@boem.gov

Studying Whales in the Atlantic—The MAPS Project

By BOEM

Sperm whales and beaked whales are two of the most cryptic whales species. To learn more about them, in February 2019, for the very first time, researchers with the Marine Mammal Passive Acoustics and Spatial Ecology (MAPS) project attached a high-resolution digital acoustic recording tag to a sperm whale to record data about its diving depth and behavior in the deep mid-Atlantic waters. The passive acoustic surveys and tagging help scientists better understand how these animals behave long after they dip below the surface and are out of view.

Because no known sperm whales have ever been tagged in this area, and certainly not in winter, their acoustic, diving, and foraging behavior in this area of the Atlantic is completely unknown, creating a significant knowledge gap for the species and region.

The tagging data will fill in some of the gaps to better understand sperm and beaked whale habitat use and acoustic behavior in the outer continental shelf, as well as to learn about their abundance and distribution, which will help BOEM make decisions and mitigate impacts from any future offshore energy and marine mineral development, as required by Federal law.

The scientists in this BOEM partnership study, aboard the R/V *Song of the Whale*, collected sound and behavior data about the deepest diving marine mammals for the MAPS project off the coast of North and South Carolina between January and May 2019.

Updates from the cruise team: <https://openexplorer.nationalgeographic.com/expedition/beakedwhales>

For the BOEM study profile: <https://marinecadastre.gov/espis/#/search/study/100213>

Learn more about why submarine acoustics are important to marine mammals: <https://www.youtube.com/watch?v=ubgmZ6iTz80>

Check out this new video about a study looking at ocean habits of sperm whales and beaked whales in the Atlantic Ocean. This BOEM partnership are aboard the R/V *Song Of The Whale* in the deep mid-Atlantic waters collecting data for the Marine Mammal Passive Acoustics & Spatial Ecology (MAPS) project in 2019. Study partners include the University of North Carolina Wilmington (UNCW), Duke University's Marine Lab, Marine Conservation Research, Conserve.IO, Wild Me, the North Carolina Aquarium at Fort Fisher, and the MarineQuest science outreach program at UNCW.



Link: <https://youtu.be/Y7e79FenS9Y>

Watch and subscribe to BOEM video on YouTube: <https://www.youtube.com/channel/UCXL807nkJMCuxNj5kF09LLQ>

2018 Report Shows Decline in Humpback Whale Numbers

By NPS

It has been a tough few years for whales in Glacier Bay National Park and for the researchers who spend many long days on the water monitoring them. In 2013, the National Park Service (NPS) whale research team identified as many as 239 individual humpbacks (*Megaptera novaeangliae*) in Glacier Bay and Icy Strait, but those numbers have dropped every year since. According to Glacier Bay's 2018 whale report, researchers counted only 100 unique humpbacks. That is a 58% decline from their 2013 peak and the lowest annual count since 2002.

The reasons for these declines are not yet clear. There is growing evidence that the North Pacific's recent marine



Read the report Glacier Bay & Icy Strait Humpback Whale Population Monitoring: 2018 Update. Available online: <https://irma.nps.gov/DataStore/DownloadFile/620535>

heatwave may be driving it. But that still begs the question—are the humpbacks dying off, or just heading for greener pastures (or in this case, cooler climes)? *See related story, page 16.*

One of the reasons these monitoring studies are so helpful is that they are used to directly influence park decisions that help protect whales. For example, the park can institute "whale waters," which are restrictions on the course and speed of vessels in park waters where the whales are

See Humpback Whales page 7

Humpback Whales continued from page 6

feeding. Also, although the news of their numbers can be rather gloomy, we have examples of animal populations rebounding when humans take conservation actions. Steller sea lions (*Eumetopias jubatus*), for example, were granted protection under the Endangered Species Act after massive losses in their populations. Today some of their populations (the eastern populations) have begun to rebound.

In the meantime, NPS researchers are on the hunt for the missing whales. Recently they teamed up with Happywhale.com to expand their search throughout the North Pacific.

Find out more on Glacier Bay's whale monitoring web page: <https://www.nps.gov/glba/learn/nature/whales.htm>

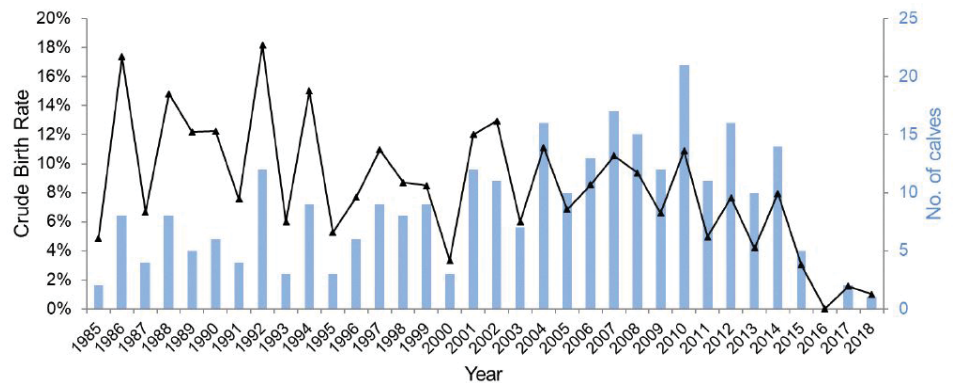
Learn more about the Humpback Whale Monitoring Program. Watch the video, "For the Protection of Humpbacks," created in 2012:

<https://www.nps.gov/media/video/view.htm?id=B2FF59AE-1DD8-B71B-0B32B23B01769C76>



Humpback whales bubble netting in Icy Strait, AK. Photo credit: J. Neilson, NPS, taken under NMFS ESA/MMPA Permit No. 21059

Not only are whale numbers dropping, so is their weight. For the third year in a row, the whales were abnormally thin. Perhaps even more discouraging—no new calves survived the summer.



Crude birth rate (black line; number of calves/total number of whales) and annual number of calves (blue bars) in GB-IS from 1985 to 2018. Image credit: NPS

Gulf of Mexico Lease Sale 252 Yields More Than \$244 Million in High Bids

By BOEM

In February 2019, Joe Balash, DOI Assistant Secretary for Land and Minerals Management, and Walter Cruickshank, BOEM Acting Director, announced that BOEM would offer 78 million acres for a region-wide lease sale, including all available unleased areas in Federal waters of the Gulf of Mexico.

On March 20, region-wide Gulf of Mexico Lease Sale 252 generated \$244,299,344 in high bids for 227 tracts covering 1,261,133 acres in Federal waters of the Gulf of Mexico. A total of 30 companies participated in the lease sale, submitting \$283,782,480 in all bids.

Assistant Secretary Joe Balash said this lease sale, "shows strong bidding by established companies, which indicates that the Gulf of Mexico will continue to be a leading energy source for our nation long into the future."

"The development of our abundant offshore resources is a major pillar of this Administration's energy strategy," said Assistant Secretary Balash. "America benefits from domestic energy production, which provides money for our Treasury, thousands of well-paying jobs, affordable

and reliable energy to heat our homes, fuel our cars, and power our economy."

"Developing our nation's offshore energy resources is vital to our economy and energy security," said Acting BOEM Director Dr. Walter Cruickshank. "Our staff is committed to ensuring offshore development is done in an environmentally responsible manner."

"The Gulf of Mexico remains a premier basin, covering about 160 million acres. It holds about 48.5 billion barrels of oil and 141 trillion cubic feet of undiscovered and technically recoverable gas," said Acting BOEM Director Walter Cruickshank.

Revenues received from Outer Continental Shelf (OCS) leases (including high bids, rental payments, and royalty payments) are directed to the U.S. Treasury, certain Gulf Coast States (Texas, Louisiana, Mississippi, Alabama), the Land and Water Conservation Fund, and the Historic Preservation Fund.

Lease sale 252: <https://www.doi.gov/pressreleases/interior-announces-region-wide-oil-and-gas-lease-sale-gulf-mexico-0>

Lease sale 253: <https://www.doi.gov/pressreleases/interior-proposes-region-wide-oil-and-gas-lease-sale-253-gulf-mexico>



Map showing 100-year flood areas, areas with a 1-percent chance of a very large flood in any given year, on the coast of Maui, Hawai'i. Blue areas denote the areas that would flood during a 100-year storm; the red areas denote the regions that would flood without the presence of coral reefs (marked in gray) and thus are protected by coral reefs. Map credit: USGS

Coral Reefs continued from page 1

“This highlights the important role that coral reefs play not only for coastal communities in the U.S. mainland, but also in the U.S. insular areas. These research results will be of great interest to the U.S. Coral Reef Task Force, a body tasked to lead U.S. efforts on coral reef ecosystems and that the Interior and the Department of Commerce chair jointly.”

“As this study shows, USGS science can help save lives, minimize property damage and reduce risks from natural hazards,” said USGS Director James Reilly. “Information at this fine resolution is critical to coastal managers and planners working on flood mitigation, coastal defense, transportation, and hurricane response and recovery from the local to national scales.”

The research will help managers take effective actions to reduce the risk to, and increase the resiliency of, U.S. mainland and U.S. insular area coastal communities to flooding and other hazards.

“Our goal in this study was to provide sound science to identify where, when and how U.S. coral reefs provide significant coastal flood reduction

Coral Reef Judicial Education Training in the Pacific

By Russ Mathieson (U.S. Courts in the Ninth Circuit, Office of the Circuit Executive)

A recent report from the 2018 Pacific Islands Judicial Education program highlighted a DOI-funded conference (total funding: \$62,752) about coral reef and fisheries data and research to enhance knowledge within the judiciaries of American territories and Freely Associated States in the Pacific. The DOI’s Office of Insular Affairs and the U.S. Congress use these programs to fulfill the mission and stewardship entrusted to the Ninth Circuit Judicial Council Pacific Islands Committee.

Recognizing that coral reefs provide essential ecological, economic, and cultural services to the people of the Pacific Islands, the 2017 conference was supported by DOI’s Compact Funds and Technical Assistance Grants with the objective to provide judges with an overview of up-to-date research regarding coral reefs and fisheries. The



Noah Idechong, former chief of Palau’s Division of Marine Resources, presents to participants and faculty at the 2017 Pacific Islands Committee’s Judicial Education program on coral reefs and fisheries. Photo credit: Russ Mathieson, U.S. Courts in the Ninth Circuit

scientific knowledge about reefs and their structure, function, and response to stressors has increased exponentially over the past few decades, whereas the state of reefs globally has declined during this period. Training on the evaluation of scientific data was also provided. More than 30 attendees from the courts in Guam, Commonwealth of the Northern Mariana Islands, Palau, and the Federated States of Micronesia (Kosrae, Yap, Chuuk, and Pohnpei) participated.

Learn more: <https://www.goldmanprize.org/recipient/noah-idechong/>



Conference participants and faculty at the 2017 Pacific Islands Committee’s Judicial Education program. Photo credit: Judiciary of Guam

benefits to ultimately save dollars and protect lives,” said USGS research geologist Curt Storlazzi.

Read the press release: <https://www.usgs.gov/news/coral-reef-barriers-provide-flood-protection-more-18000-people-and-18-billion-worth-coastal>

New Coastal Modeling Research Helps California Prepare for Rising Seas and Storms

By Patrick Barnard and Paul Laustsen (USGS)

USGS scientists and collaborators used state-of-the-art computer models to determine the coastal flooding and erosion that could result from 21st century sea-level rise (SLR) and storm scenarios and then translated those hazards into a range of projected economic and social exposure data.

The new USGS-led coastal modeling research provides State, Federal, and commercial entities with varying storm and SLR scenarios to assist with planning for future infrastructure and mitigation needs along the California coast.

Coastal inundation due to SLR is projected to displace hundreds of millions of people worldwide over the next century, creating significant economic, humanitarian, and national-security challenges. However, the majority of previous efforts to characterize potential coastal impacts of climate change have focused primarily on long-term SLR with a static tide level, and have not comprehensively accounted for dynamic physical drivers such as tidal non-linearity, storms, short-term climate variability, erosion response, and consequent flooding responses. Although most vulnerability analyses only look at flooding directly caused by SLR, this is the first study to examine a combination of the effects related to a changing climate on the California coast. The study modeled the impacts for a wide range of scenarios with SLR increments from 0 meters to 2.0 meters as well as an extreme 5.0-meter SLR case. Those SLR values were then combined with four different storm scenarios (average daily conditions, annual storm, 20-year storm, 100-year storm).

“It’s not just sea-level rise that we need to consider when assessing the



Waves flood across a coastal road near Santa Cruz, CA. Photo credit: Amy Foxgrover, USGS

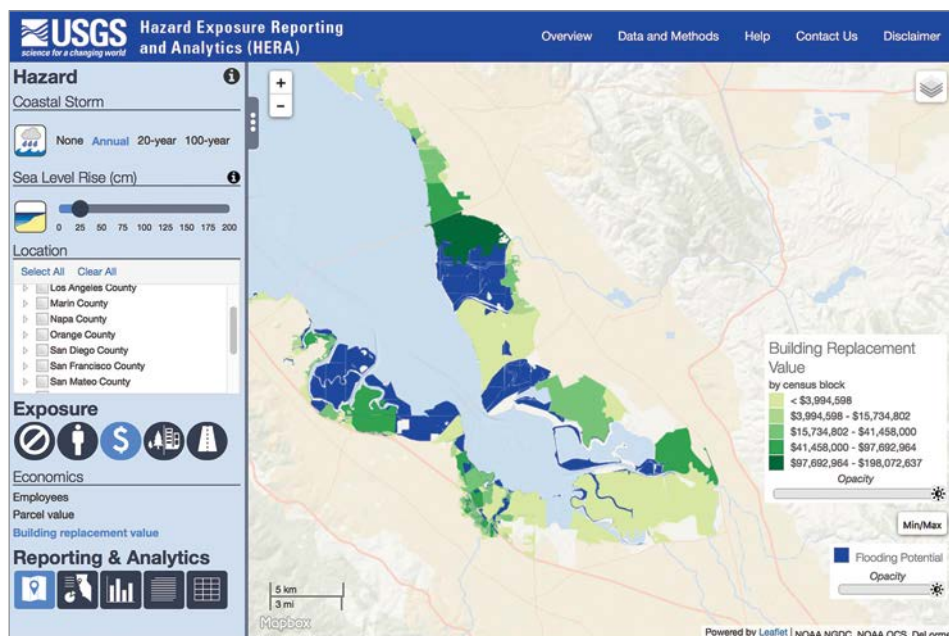
impacts of climate change, but it is also the combination of sea-level rise with storms and every daily high tide we experience along the coast,” said USGS research geologist Patrick Barnard, lead author of the report.

The research is being used to help coastal managers prioritize planning and mitigation efforts. These include the NPS, DOD, NOAA, California Department of Transportation (CALTRANS), California Department of

Emergency Services, and every major city and county in California.

“The Port of San Diego is currently using the flooding and inundation data from the USGS’s Coastal Storm Modeling System to assess exposure of Port assets to different amounts of sea-level change and storm events,” said Philip Gibbons, program manager for Energy and Sustainability at the Port of San Diego. “We are also using the flood depth and duration data to

See Coastal Modeling page 10



Screen shot of the Hazard Exposure Reporting and Analytics (HERA) website showing southern San Francisco Bay Area flooding and building replacement value impact forecasts with 10 inches (25 centimeters) of sea-level rise plus a storm expected every year. Image credit: USGS

Coastal Modeling continued from page 9

properly ‘tell the story’ of the impacts that sea-level rise will have within our jurisdiction in the future.”

USGS scientists and collaborators used state-of-the-art computer models to determine the coastal flooding and erosion that could result from a range of peer-reviewed, published 21st century SLR and storm scenarios. The authors then translated those hazards into a range of projected economic and social exposure data to show the

lives and dollars that could be at risk from climate change in California during the 21st century. Their analysis focused on highly developed coastal counties in southern California and the San Francisco Bay area, home to 95 percent of the State’s coastal population.

The new report titled “Dynamic Flood Modeling Essential to Assess the Coastal Impacts of Climate Change” is available online. Researchers from the USGS, Coastal Carolina

University, Deltares, the University of Illinois at Chicago, and Point Blue Conservation Science collaborated on this study. The report is available online at <https://www.nature.com/articles/s41598-019-40742-z>

Read the press release: <https://www.usgs.gov/news/new-us-geological-survey-led-research-helps-california-coastal-managers-prioritize-planning-and>

See related story, page 1.

Talking Coastal Hazards—Scientists Help CA Infrastructure Planners Understand Risk

By Juliette Finzi Hart (USGS)

The Coastal Storm Modeling System (CoSMoS) models all the relevant physics of a coastal storm (for example, tides, waves, and storm surge), which are then scaled down to local flood projections for use in community-level coastal planning and decision-making.

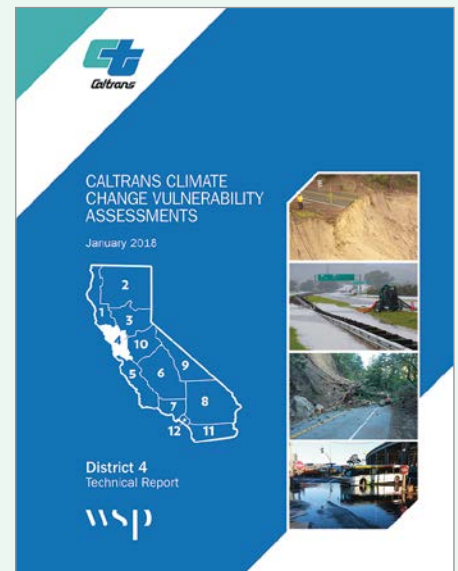
Since its inception, USGS CoSMoS modeling scientists have been working closely with local communities and regional and State organizations to ensure they understand what CoSMoS provides and how it can support their respective planning needs. Currently (2019), CoSMoS has been used in local- and State-level coastal planning as well as hazard mitigation planning by more than a dozen coastal cities, including the four largest (San Francisco, Los Angeles, San Diego, and San Jose), and 11 coastal counties, representing 20 U.S. Congressional Districts, along with being the go-to source for coastal hazard science for many of the CA State agencies. *See related story, page 9.*

The California Department of Transportation (CalTrans) uses CoSMoS for developing their regional Sea Level Rise Vulnerability Assessments—a key resource in helping the State plan for future hazards.

Most recently, CoSMoS has been highlighted at several important State and regional infrastructure-focused meetings and discussions. In February 2019, CalTrans invited USGS Oceanographer Juliette Finzi Hart to the 2019 California Transportation Planning Conference, “Partnering for Sustainable Transportation: Navigating California’s Changing Landscape,” held in San Diego, CA.

Similarly, USGS Research Geologist Patrick Barnard represents the USGS on the San Francisco Bay Regional Coastal Hazards Adaptation Resiliency Group (CHARG) sea-level rise (SLR) working group. CHARG uses CoSMoS to inform decision-making for critical infrastructure in the San Francisco Bay region. And, in response to the recent paper published by Barnard and others (2019), Los Angeles County’s Office of Emergency Management is working with the USGS Earthquake Science Center and Coastal/Marine Hazards and Resources Program to develop multi-hazard emergency management plans that address risk from CoSMoS-projected coastal hazards as well as potentially concurrent impacts from earthquakes, landslides, and tsunamis.

Through engagement with stakeholders and practitioners—from the small



The State of California used the USGS CoSMoS model in this technical report to understand the associated impacts of various storm events combined with future sea-level rise along the California coast and within San Francisco Bay. Image credit: CalTrans

coastal communities to the large State infrastructure agencies—USGS scientists are working with decision makers to ensure that our Nation has the essential science and tools needed to reduce risk and enhance quality of life.

Learn more:

CHARG: <https://sfbaycharg.org/>

California Department of Transportation: <http://dot.ca.gov/>

Technical Report: http://www.dot.ca.gov/transplanning/ocp/docs/rCT_D4_Technical_Report_VerAL.pdf

Big Savings and Big Changes for the Coastal Barrier Resources System

By Teresa Fish, Katie Niemi, and Dana Wright (USFWS)

In December 2018, new U.S. Fish and Wildlife Service (USFWS) maps (produced mostly through a pilot project) depicting 59 Coastal Barrier Resources System (CBRS) units in Delaware, Florida, North Carolina, and South Carolina were made effective when President Trump signed H.R. 5787, the Strengthening Coastal Communities Act of 2018 (Public Law 115-358). This law updated the maps for 7% of the CBRS units, which constitutes the largest legislative update to the CBRS since 1990. The revised maps removed 521 acres from the CBRS and added 18,761 acres. Additionally, in March of 2019, Congress enacted Public Law 116-9 to remove areas in Gulf County, Florida, that were erroneously included in the past and to add additional undeveloped areas to the CBRS.

The adoption of modernized maps produced through the USFWS's comprehensive review process helps to (1) preserve the long-term integrity of the CBRS by correcting legitimate mapping errors; (2) enhance coastal resiliency and sustainability by adding areas to the CBRS that are highly vulnerable to flooding and severe storms; and (3) improve awareness of and compliance with CBRA by providing more accurate and accessible CBRS maps and digital data for planning coastal infrastructure projects, habitat conservation efforts, and flood risk mitigation measures.

In the late 1970s and early 1980s, Congress recognized that certain actions and programs of the Federal Government had historically subsidized and encouraged development



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

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, Congress enacted the Coastal Barrier Resources Act (CBRA) of 1982, which designated more than 450,000 acres of relatively undeveloped coastal barriers along the Atlantic and Gulf of Mexico coasts as the CBRS. The law employs a free market approach to conservation by prohibiting most new Federal expenditures and financial assistance within the CBRS while imposing no restrictions on development conducted with private, State, or local funds.

When signing CBRA into law, President Reagan stated "... it simply adopts the sensible approach that risk associated with new private development in these sensitive areas should be borne by the private sector, not underwritten by the American taxpayer." Subsequent CBRA reauthorizations and amendments over the years have expanded the CBRS, which now encompasses 3.5 million acres within 870 geographic units along the Atlantic, Gulf of Mexico, Great Lakes,

U.S. Virgin Islands, and Puerto Rico coasts.

Coastal barriers are popular areas for recreation and tourism, thereby making them the drivers of many local economies. They also provide habitat for diverse wildlife, including migratory birds, marine mammals, fish, and invertebrates. Undeveloped coastal barriers and adjacent wetlands absorb the brunt of the destructive forces of hurricanes and storm surges, reducing wave energy and inland flooding and providing resistance to the flow of water. These natural defenses provide significant economic and public safety protections for mainland communities.

Since its inception in 1982, CBRA has helped reduce the intensity of development along the coasts and has saved the American taxpayers billions of dollars in avoided Federal expenditures for flood insurance, disaster assistance, and infrastructure projects. A 2007 Government Accountability Office report determined that about 97% of all CBRS units either remained undeveloped or experienced minimal development. A recent study published in the *Journal of Coastal Research* shows the economic benefits

See Big Savings page 12

Big Savings continued from page 11

from CBRA. According to this study, CBRA reduced Federal coastal disaster expenditures by \$9.5 billion between 1989 and 2013, and forecasts that additional savings will range between \$11 and \$109 billion over the next 50 years.

Despite CBRA's effectiveness over the years, the official CBRS maps were first created more than 35 years ago and were outdated and difficult to use, presenting a significant challenge for the USFWS. Current (2018) technology produces refined maps that are more accurate as well as more easily accessed and understood. In the 2000 CBRA reauthorization, Congress directed the USFWS to conduct a "Digital Mapping Pilot Project" (pilot project) to remap a subset of the CBRS using digital technology, and the 2006 reauthorization required the USFWS to prepare digital maps for the remainder of the CBRS and make recommendations for its expansion.

Following the close of the final public review period for this project in April, the USFWS will make appropriate adjustments to the boundaries based on public comments, statutory criteria, and objective mapping protocols, and will then prepare final recommended maps for Congressional consideration. The final recommended maps are planned for transmittal to Congress in 2020. The changes to the CBRS will only become effective if the revised maps are adopted by Congress through legislation.

Today, CBRA is more relevant than ever before. The costs of armoring vulnerable shorelines, replenishing eroded beaches, rebuilding washed out roads, dredging channels, and subsidizing coastal flood insurance will only continue to increase along with the projected frequency and severity of storms impacting our coasts through the 21st century and beyond. Reducing the intensity of development along coastal barriers by limiting

Federal expenditures provides numerous benefits to fish, wildlife, and people; and the USFWS's mapping efforts will help CBRA endure into the future.

Additional information about the Coastal Barrier Resources Act: www.fws.gov/cbra

The economic study, published in the *Journal of Coastal Research*, is available online: <https://www.jcronline.org/doi/abs/10.2112/JCOASTRES-D-18-00114.1>



Top photo: The rufa red knot (*Calidris canutus rufa*) is a master of long-distance aviation with some red knots flying more than 9,300 miles each way between breeding and wintering areas. Successful migration depends on suitable habitat, food, and weather conditions at far-flung sites across the Western Hemisphere, from the extreme south of Tierra del Fuego to the far north of the central Canadian Arctic. Red knots need to encounter these favorable habitat, food, and weather conditions within narrow seasonal windows as the birds hopscotch along the migration stopovers. This red knot was photographed in Mispillion Harbor, DE. Photo credit: Gregory Breese, USFWS. Bottom photo: A biologist from Canadian Wildlife Service releases a nano-tagged red knot in the Mingan Archipelago, Quebec, Canada. Photo credit: Yves Aubry, Environment and Climate Change Canada

Tracking Threatened Red Knots in U.S. Atlantic Outer Continental Shelf Waters

By Pam Loring (USFWS)

In the past several years, the USFWS and BOEM have been developing a strong partnership to study the movements and flight patterns of important bird species and how they intersect with offshore wind energy areas. Both agencies have important stewardship roles for energy and wildlife management: BOEM is responsible for managing energy and mineral development on the U.S. Outer Continental Shelf (OCS) and the USFWS Migratory Bird Program works with partners to protect, restore, and conserve bird populations and their habitats.

With large areas of the Atlantic OCS under consideration for development of offshore wind energy, information on offshore movements of high-priority bird species is needed to inform environmental assessments. The rufa red knot (*Calidris canutus rufa*) is a federally threatened shorebird that migrates long distances. It breeds in Arctic Canada and has a wintering range that extends from the coast of the southeastern United States all the way to southernmost South America. During spring and fall, the rufa red knots migrate over the Atlantic OCS, resting and refueling during the journey at select stopover sites along the U.S. Atlantic coast. Researchers want to better understand specifics about how the overall red knot population migrates between and uses these sites.

BOEM funded a recent study where USFWS and partners used digital very high frequency (VHF) transmitters and an array of automated radio telemetry stations to track the movements and flight altitudes of the rufa red knot in Federal waters of the OCS.

See Tracking Red Knots page 13

Tracking Red Knots continued from page 12

Researchers fitted more than 380 red knots with transmitters at major stopover areas in Canada and the U.S. Atlantic coast during fall migration to learn more about their migratory patterns. Scientists then used the tracking data to develop models of red knot movements along the Atlantic OCS from Massachusetts to Virginia. These models allowed them to estimate when and how many birds fly through the delineated Wind Energy Areas (WEA) and planning areas during fall migration.

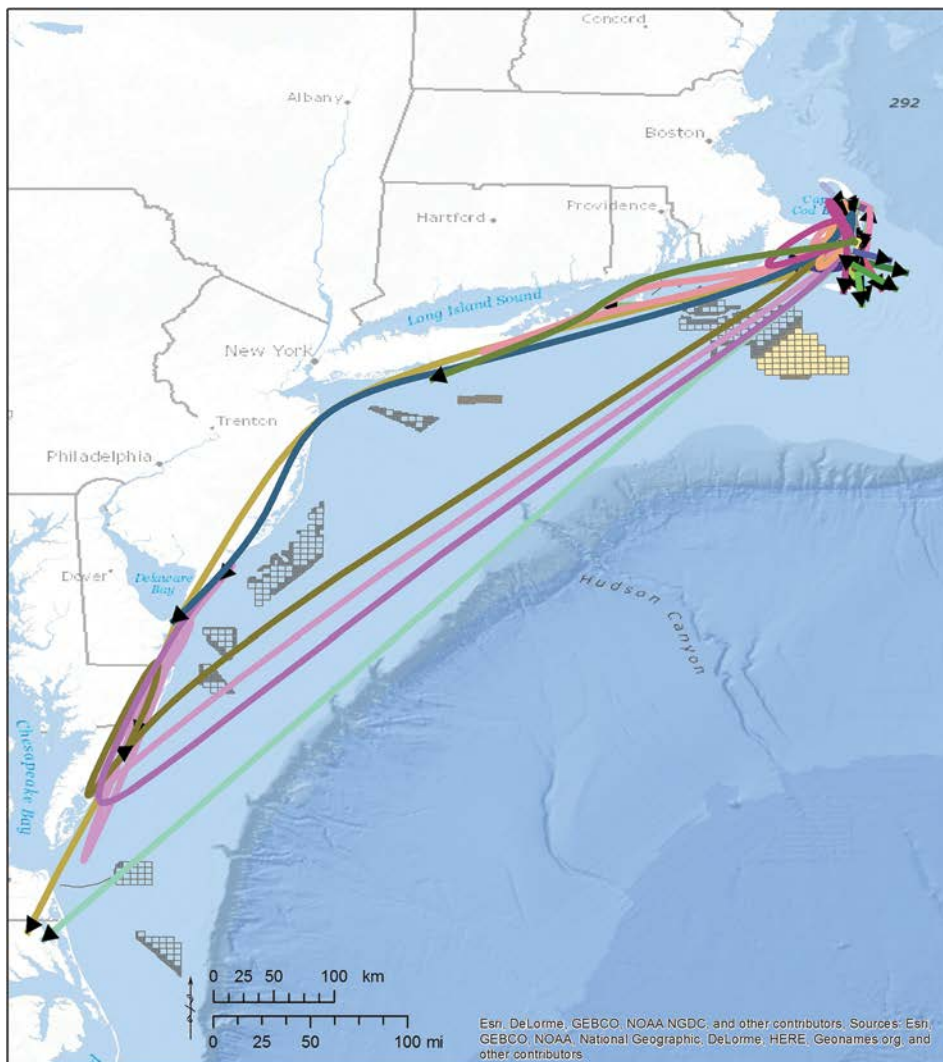
This study is one of three funded by BOEM in the past five years that used digital tracking technologies to help inform wind energy planning and provide valuable data for managing bird species. Major partners include Environment and Climate Change Canada, USFWS Eastern Massachusetts National Wildlife Refuge Complex, Conserve Wildlife Foundation of New Jersey, University of Massachusetts Amherst, University of Rhode Island, and Bird Studies Canada.

The full report from the red knot study can be found here: https://espis.boem.gov/Final%20Reports/BOEM_2018-046.pdf

Learn more about the USFWS Migratory Bird Program: <https://www.fws.gov/birds/about-us.php>

To learn more about BOEM visit: <https://www.boem.gov/>

To learn more about BOEM’s studies related to offshore renewable energy visit: <https://www.boem.gov/Renewable-Energy-Environmental-Studies/>



Some key findings from the study:

- Red knots that migrated during early fall departed from the Atlantic coast in a southeast direction, likely heading to long-distance wintering destinations in South America
- In contrast, red knots that migrated during late fall traveled southwest across the Mid-Atlantic Bight, likely heading to short-distance wintering destinations in the southeastern United States and Caribbean
- Red knots migrated through Federal waters of the Atlantic Outer Continental Shelf during evenings with fair weather and a tail-wind blowing in their direction of travel



This is a Rufa red knot (*Calidris canutus rufa*) with tag. Photo credit: Gregory Breese, USFWS.

Flight trajectories (colored lines with arrows showing direction of travel) of red knots (n=76) tagged on Cape Cod, MA, during fall migration 2016. Image credit: USFWS and BOEM

Invasive Newly Hatched Grass Carp Confirmed in the Great Lakes Watershed

By Patrick Kočovský (USGS), Marisa Lubeck (USGS), and Christine Billau (University of Toledo)

In March 2019, a genetic analysis conducted by the USGS confirmed that larval, or newly hatched, fish collected from the Maumee River during the summer of 2018 are grass carp, one species of invasive Asian carps that threaten the Great Lakes. The Maumee River is a tributary to Lake Erie. “If grass carp become abundant in Lake Erie, they could consume large amounts of aquatic vegetation, ultimately reducing habitat for native fish and other aquatic animals and diminishing food resources for

waterbirds,” said USGS scientist Patrick Kočovský. “The Lake Erie ecosystem is a major contributor to the Great Lakes’ multibillion dollar per year fishery.”

“Collecting larval fish in a Great Lake is like finding a needle in a haystack,” said Christine Mayer of The University of Toledo Department of Environmental Sciences and Lake Erie Center. “Our finding helps make the haystack smaller when looking for spawning grass carp.” Other life stages, including fertilized eggs, juveniles and adults, have been previously documented in tributaries and shoreline areas of Lake Erie. By identifying locations of larval grass carp, management decisions and natural resource agencies can better focus limited resources on grass carp removal efforts.

The capture of these larval grass carp confirms previous evidence that they spawn in the Maumee River, and the capture of larvae during separate high-flow events confirms the possibility of more than one successful spawning event within a year. This new discovery does not indicate the population size in the Maumee River, but underscores the continued need for early detection.

Read the press release: <http://www.asiancarp.us/News/Newly-hatched-grass-carp-Maumee.html>

Learn more: <http://www.asiancarp.us/AsianCarpProblem.html>

For more information about the threat of Asian carp in the Great Lakes, please visit the USGS Great Lakes Restoration Initiative website: <https://www.usgs.gov/centers/glri>

The Asian Carp Problem

“Asian carp” refers to several species of related fish that originated from Asia. As many as 10 types of Asian carp are considered invasive around the world, but in the United States and Canada we use “Asian carp” to refer to four of these species—black carp, grass carp, bighead carp, and silver carp. All are fast growing and prolific feeders that out-compete native fish and leave a trail of environmental destruction in their wake.

The four types of Asian carp currently found in the United States were imported into the country for use in aquaculture ponds. Through flooding and accidental releases, black, grass, bighead, and silver carps entered the Mississippi River system. The Mississippi River system is like a giant freshwater highway that has given invasive Asian carp access to many of the country’s rivers and streams.

Partnerships at Work

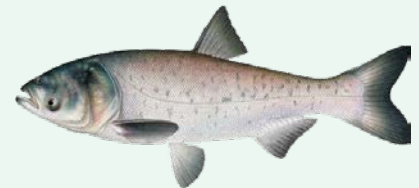
The USGS, USFWS, and NPS, all bureaus in the DOI, work with numerous partners at State, regional, and international levels as part of the



Black carp, *Mylopharyngodon piceus*



Grass carp, *Ctenopharyngodon idella*
Image credits: Joseph Tomelleri



Bighead carp, *Hypophthalmichthys nobilis*



Silver carp, *Hypophthalmichthys molitrix*

You can help raise awareness about this threat. Learn to recognize these four species. Meet the Asian carp: <http://www.asiancarp.us/BigheadCarp.html>

Share these handouts and educational resources: <http://www.asiancarp.us/PrintableHandouts.html>

Asian Carp Regional Coordinating Committee. These partners are united and committed to protecting the Great Lakes and the waterways of the United States and Canada from invasive Asian carp.

In 2007, the Management and Control Plan for bighead, black, grass, and silver carp was created to prevent further spread of invasive carps and to control existing carp populations. Regional

partnerships have formed across the United States and Canada to coordinate the implementation of this National Plan.

Partners: <http://www.asiancarp.us/ACRCCPartnerAgencies.html>

Read the plan: http://www.asiancarp.us/Documents/Carps_Management_Plan.pdf

Long-Term Monitoring of Nearshore Marine Ecosystems

Gulf of Alaska 30 Years Since Exxon Valdez Oil Spill

By Heather Coletti, Stacia Backensto, and Nina Chambers (NPS)

The 30th anniversary of the largest environmental disaster in Alaska's history passed this spring, and in the years since, a lot of work has been done to study and mitigate the effects of the *Exxon Valdez* oil spill. The long-term monitoring programs provide foundational information for ecosystem-scale understanding of the effects of the spill.

The *Exxon Valdez* Oil Spill Trustee Council (EVOS TC) was formed soon after initial spill response efforts. The EVOS TC supported a variety of investigations and monitoring programs. Partnerships at the DOI between agencies such as USGS and the NPS also initiated long-term monitoring programs to better understand nearshore marine ecosystems and their recovery after the oil spill. In 2012, Gulf Watch Alaska (GWA) became the EVOS TC's long-term monitoring program, which supports and leverages a wide array of agency, university, and nonprofit programs, including nearshore monitoring. The 1989 oil spill made us realize we did not understand enough about marine ecosystems to know the extent of the damage or provide a context for oil spill recovery or other changes occurring in the oceans.

Marine birds or seabirds are an important component of the nearshore. Monitoring focuses on birds that are trophically linked to the nearshore food web, such as sea ducks: harlequins (*Histrionicus histrionicus*), Barrow's goldeneye (*Bucephala islandica*), mergansers (*Mergus* sp.), and scoters (*Melanitta* sp.); black



A researcher records a dead glaucous gull (*Larus hyperboreus*), part of the 2018 seabird die-off in the Bering Sea. Photo credit: Stacia Backensto, NPS

oystercatchers (*Haematopus bachmani*), as well as various guilds of other seabirds such as: pigeon guillemots (*Cepphus columba*), blacklegged kittiwakes (*Rissa tridactyla*), and cormorants (*Phalacrocoracidae* sp.) that occupy other marine food webs or habitats.

Monitoring these various guilds simultaneously improves our ability to discriminate among potential causes of change in seabird populations and the nearshore ecosystem. Many of these species were impacted by the *Exxon Valdez* oil spill and exhibited extended recovery periods, a consequence of lingering oil in nearshore habitats. Public concern exists for the welfare of seabirds because they are affected by human activities like oil pollution, commercial fishing, and other stressors in marine and coastal environments.

Through collecting these long-term datasets, we can see patterns in abundance and distribution that provide insight about changes in the marine



A researcher sifts through sediment looking for clams in Kenai Fjords as part of the Nearshore Monitoring program. Photo credit: P. Calamari, NPS

On March 24, 1989, the oil tanker *Exxon Valdez* ran aground on Bligh Reef and spilled almost 11 million gallons of crude oil into Alaska's Prince William Sound, a remote, scenic, and biologically productive body of water. Prior to the 2010 *Deepwater Horizon* oil spill, it was the largest single oil spill in U.S. coastal waters. The oil spread over a wide area in Prince William Sound and beyond, resulting in a previously unprecedented response and cleanup.



Shoreline cleanup of Prince William Sound, AK, in 1989. Photo credit: Exxon Valdez Oil Spill Trustee Council

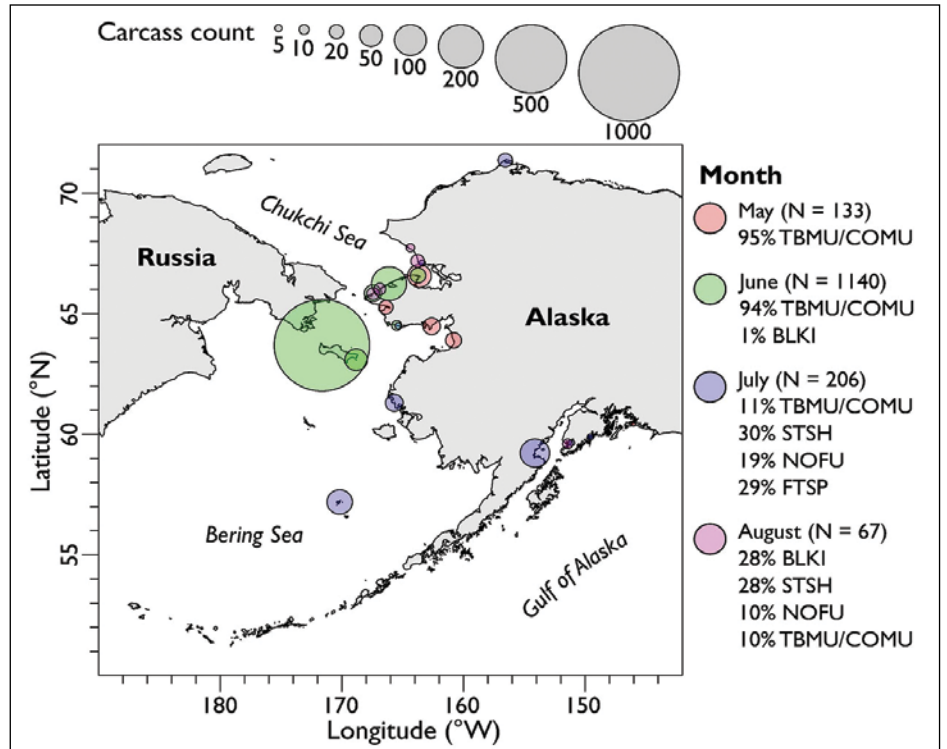
See Special Feature page 17

Seabird Die-Offs are Becoming More Extreme

Wreck is the term used for a massive bird die-off; it seems appropriate. Since 2014, North Pacific and Arctic coastlines of the United States have witnessed seven seabird mass mortality events concurrent with warming oceans, a rate far exceeding historical baselines. Four of the events occurred in Alaska, including one of the largest and most extensive die-off episodes ever recorded (murrens in the Gulf of Alaska in 2015–16).

Seabirds are good indicators of ocean ecosystem health. Recent mortality events are concerning because they occur more frequently and are of longer durations and at magnitudes that dwarf previous events in the North Pacific. Significant changes in the marine ecosystem are underway. Northern oceans have been experiencing record-breaking, above-average sea surface temperatures and record-breaking low levels of minimum sea ice extent during spring. In 2017, the cold-water barrier (cold = 2 degrees Celsius water temperature) that separates the southern Bering Sea from the northern Bering Sea disappeared for the first time in 37 years of surveys. Seabirds eat fish and zooplankton, which are both reliant on cold water. If the cold-water fishes have relocated because the ocean is too warm, or less zooplankton are produced in the warmer water, then seabirds have a harder time finding enough food. Changes to their food supply and quality can impact basic functions such as flying, feather molt and weatherproofing, and thermal regulation. To date, all bird carcasses collected during recent mortality events and examined by the USGS National Wildlife Health Center were determined to have died of starvation, though there may be other contributing factors. Harmful algal toxins (Saxitoxin) were detected in half of the carcasses collected from die-offs, but low levels of Saxitoxin were also found in healthy birds. The significance of low dose neurotoxin exposure and how it may influence behavior and feeding in emaciated birds is unknown.

Many seabirds rely heavily on habitats and prey associated with the marine nearshore ecosystem. These species are top-level consumers of fish and marine invertebrates, such as mussels, clams, snails, and limpets. Because of these characteristics, these birds are good indicators of change in the marine ecosystem.



Map of the location and magnitude of the dead seabirds found during the 2018 die-off event. Learn more: <https://www.nps.gov/subjects/aknatureandscience/commonmurrewreck.htm>



Between the fall of 2015 and the spring of 2016, hundreds of thousands of seabirds, mostly common murrens (*Uria aalge*), died of starvation in one of the largest seabird die-offs recorded.

Photo credit: David Irons, USFWS

Special Feature continued from page 15

environment. For example, before common murres (*Uria aalge*) carcasses began showing up on beaches across the Gulf of Alaska, we saw large shifts in the distribution of common murres that foretold of the die-off (see page 16 on recent seabird die-offs). Long-term monitoring data provide observations of oil spill recovery and are also valuable for detecting other trends and patterns.

More Information:

Exxon Valdez Oil Spill Trustee Council:

<http://www.evostc.state.ak.us/>

Gulf Watch Alaska:

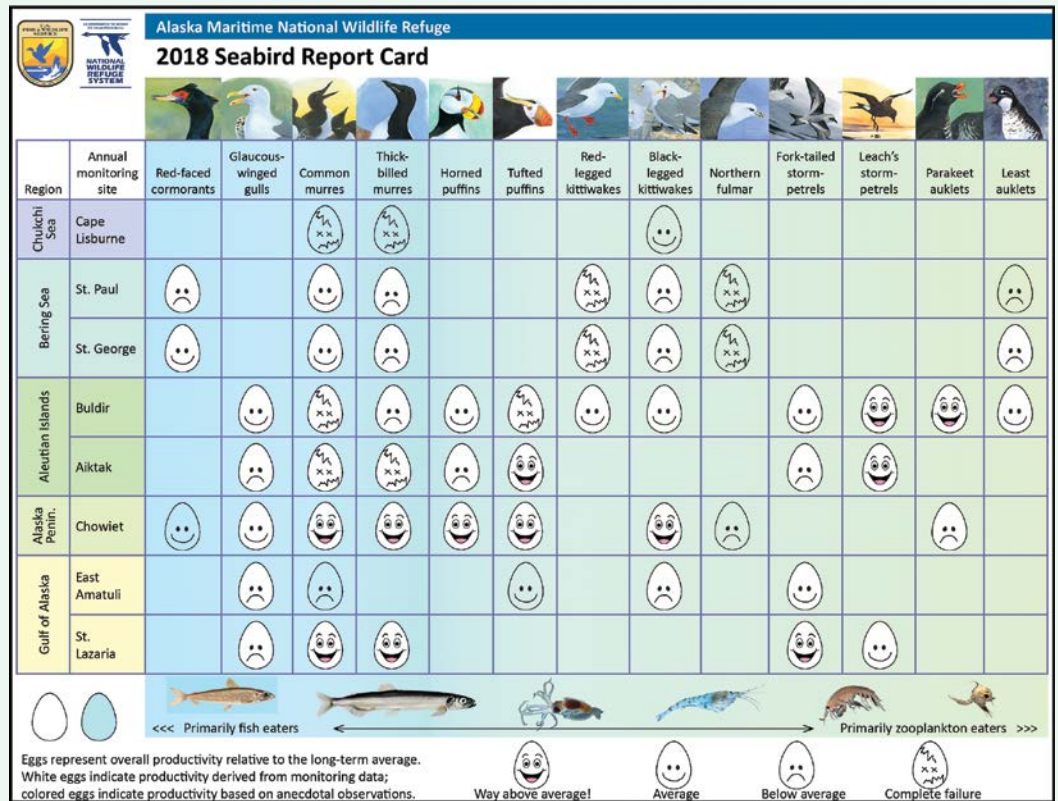
<https://gulfwatchalaska.org/>

Nearshore Marine Systems:

<https://www.nps.gov/im/swan/nearshore.htm>

Coastal Issues:

<https://www.nps.gov/subjects/aknatureandscience/coastalissues.htm>



The 2018 Seabird Report Card for 13 species from the Gulf of Alaska to the Chukchi Sea provided by the USFWS, Alaska Maritime National Wildlife Refuge.

Seabird Die-Offs: <https://www.nps.gov/subjects/aknatureandscience/commonmurrewreck.htm>

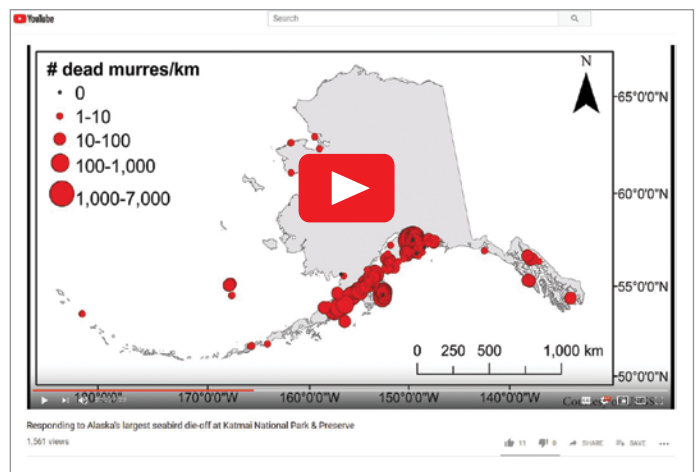
Harmful Algal Bloom Toxins in Alaska Seabirds: http://aocs.org/wp-content/uploads/2018/11/USGS_HAB_toxins_in_Alaska_sea_birds_September_2018a.pdf

Coastal Observation and Seabird Survey Team: <http://depts.washington.edu/coasst/>

Video Explores Seabird Die-Offs

The National Park Service works with many partners to document and understand seabird die-offs, including the Coastal Observation and Seabird Survey Team; Alaska SeaLife Center, the U.S. Fish and Wildlife Service Migratory Bird Management Program and the Alaska Maritime Refuge; the U.S. Geological Survey Alaska Science Center, Alaska Fisheries Science Center, and National Wildlife Health Center; coastal communities across Alaska; Kawerak and Maniilaq Native Corporations; and Alaska Sea Grant provided transboundary reports from Chukotka, Russia.

Learn more about the relationship between bird die-offs and warm sea-surface temperatures anomalies and the challenge for biologists in monitoring these events.



This video explores a multi-agency effort to respond to Alaska's largest seabird die-off at Katmai National Park and Preserve.

<https://www.youtube.com/watch?v=Nhji4H5u65M>

Maps of Offshore Sand Deposits, New National Marine Minerals Information System

By Marjorie Weisskohl (BOEM)

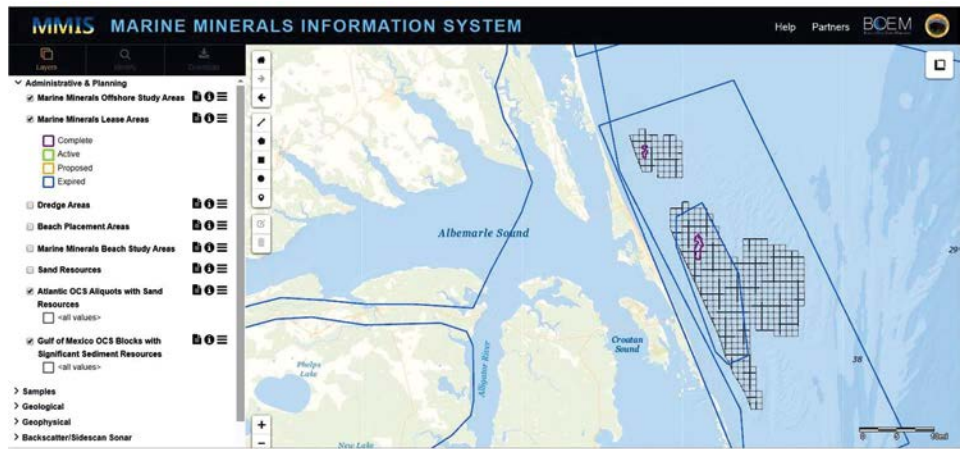
In February 2019, BOEM launched the Marine Minerals Information System (MMIS), a state-of-the-art tool designed to assist decision makers in planning and managing coastal recovery and coastal resilience projects. The MMIS maps offshore sand information in support of managing physical sediment resources in the Outer Continental Shelf (OCS).

The goal of the National Offshore Sand Inventory and MMIS is to help to reduce response time in disaster recovery and facilitate long-term planning to strengthen the resilience of coastal communities and infrastructure. Ensuring all parties have access to detailed offshore information is critical to responsible decision-making.

“BOEM is the Federal Government’s steward of offshore sediment resources, and it’s critical that we have organized and easy access to as much information as possible about these resources and where they are located. Making this data available through the MMIS is a huge step forward for coastal resilience efforts and disaster relief decision-making.” said BOEM Acting Director Walter Cruickshank.

The release of the MMIS marks a big step forward in BOEM’s efforts to build a National Offshore Sand Inventory, providing offshore sediment data including 30 years of BOEM-funded research and data from more than 40 partner organizations.

OCS sand and gravel resources are vital sources of material for the construction of coastal protection and restoration projects, including efforts to protect coastal communities, national defense facilities, and Federal and State infrastructure.



A look at BOEM’s online MMIS Viewer showing sand resources offshore North Carolina’s Outer Banks. As the system continues to grow and mature, BOEM plans to add more features and datasets. The information on offshore sand and gravel covers resources throughout the U.S. Atlantic, Gulf of Mexico, and Pacific OCS. The MMIS is accessible at <https://mmis.doi.gov/BOEMMMIS>. Image credit: BOEM

BOEM's Marine Minerals Program

BOEM has invested more than \$40 million during the past 25 years to identify non-energy resources on the OCS, conducted world-class scientific research, and leased OCS resources to coastal communities and other Federal agencies in need. Information from environmental research and resource identification has informed environmental assessment and leasing decisions concerning the use of OCS sand resources in beach nourishment and coastal restoration.

BOEM’s Marine Minerals Program: <http://www.boem.gov/Marine-Minerals-Program/>

BOEM’s newly launched Marine Minerals Information System (MMIS)—an interactive support tool that provides public access to OCS marine mineral data and information: <https://mmis.doi.gov/BOEMMMIS/>

Key MMIS features include the following:

- More than 30 years of BOEM-funded geological and geophysical research data
- Data from more than 40 partners in Federal, State, and local government, academia, and other entities
- A viewer with more than 20 available data layers
- Sediment data offshore 18 coastal States
- GIS-mapping capabilities
- Tools to download data into geodatabases, shapefiles, or .csv files
- Statistics on sand volume, number of projects, number of States, and use trends
- Links to environmental studies and assessments, and data from State cooperative agreements

In recent years, there has been a growing demand for OCS sediment for planned projects, as well as for emergency needs to restore areas damaged by natural disasters. On a national scale, little is known about the character, quantity, and location of sand

resources on the OCS and the habitat it provides for biological communities. *See related story, page 30.*

Proponents of planned infrastructure projects are requesting higher volumes

See MMIS page 19

MMS continued from page 18

of OCS sediment. Further, given the significant number of other ocean users (for example, energy infrastructure, fiber optic telecommunication cables, electrical transmission lines, and fisheries), BOEM strives to reduce or eliminate the potential for multiple use conflicts or environmental impacts that could result from marine minerals projects.

Learn more: <https://www.boem.gov/note02142019/>

See related stories, pages 24 and 29.

Renourishing Beaches and Dunes in Sandbridge, Virginia

By Marjorie Weisskohl (BOEM)

In April 2019, BOEM, USACE (Norfolk District), and the City of Virginia Beach signed an agreement authorizing the use of up to 2.2 million cubic yards of sand from Federal waters to renourish approximately five miles of beaches and dunes in Sandbridge, Virginia. The project will use sand from Sandbridge Shoal located on the Outer Continental Shelf (OCS). Dredging is expected to begin later in 2019.

“As a coastal community, Sandbridge is vulnerable to storm events and longer-term erosion.” said Renee Orr, BOEM’s Chief of the Office of Strategic Resources. “By helping the city to renourish coastal areas periodically, BOEM is playing an important role in protecting public infrastructure from severe storms.”

“Along with our many partner organizations—like BOEM and the City of Virginia Beach—we are proud to build critical infrastructure that has a tremendous impact at the local, State, and national level. This project will reduce the risk of damage from future storms,” said Colonel Patrick Kinsman, USACE Norfolk District Commander.

“As Virginia’s largest city and a coastal city, the health of our beaches and coastline are so important to our citizens and economy,” said Mayor Robert M. Dyer of Virginia Beach. “We have worked closely with BOEM and USACE in the past, and I believe this is one more joint project that will be a huge success for Virginia Beach and its residents.”

To meet its stewardship responsibilities, prior to construction of the Sandbridge project, BOEM and USACE reviewed existing environmental analyses and updated them where needed. This process included extensive coordination between State and Federal partners. The parties negotiated an agreement that avoids, minimizes, and (or) mitigates possible adverse impacts to wildlife and protects the human environment. See related stories, pages 18 and 20.

Read the press release: <https://www.boem.gov/press04032019/>

BOEM’s Environmental Assessment is available on BOEM’s Marine Minerals Program Virginia project page: <https://www.boem.gov/Sandbridge-EA-All-Appendices/>

\$48.5 Million for Communities Affected by 2017 Hurricanes Harvey, Irma, and Maria

By NPS

On February 6, the NPS announced \$48.5 million in supplemental assistance grants to help historic resources recover in areas impacted by Hurricanes Harvey, Irma, and Maria in 2017. Communities in Florida, Georgia, Louisiana, Puerto Rico, South Carolina, Texas, and the U.S. Virgin Islands will receive assistance for historic preservation projects related to hurricane recovery efforts.

“Preserving our historic resources is a critical component in the National Park Service’s mission to protect and share our interwoven histories,” said NPS Deputy Director P. Daniel Smith.

As national emergencies arise, Congress may appropriate funding from the Historic Preservation Fund (HPF) to provide relief for historic preservation projects impacted by natural disasters. The HPF uses revenue from Federal oil leases on the OCS, providing assistance for a broad range of preservation projects without expending tax dollars.

These grants will support preservation repair, recovery, and resilience of properties listed in or eligible for inclusion in the National Register. The historic preservation projects in the following States and Tribal communities will include steps to mitigate future damage and will be done in accordance with the Secretary of the Interior’s Standards for Archeology and Historic Preservation.

Read more: https://www.nps.gov/orgs/1207/2017_hurricane_recovery_grants.htm

HPF Disaster program: <http://go.nps.gov/disaster>

State or Tribe (Hurricane)	Amount
Florida (Irma)	\$5,932,724
Georgia (Irma)	\$3,414,742
Louisiana (Harvey)	\$1,013,757
Puerto Rico (Irma and Maria)	\$12,717,381
South Carolina (Irma)	\$1,946,485
Texas (Harvey)	\$12,318,047
U.S. Virgin Islands (Irma and Maria)	\$10,056,864
Coushatta Tribe of Louisiana (Harvey)	\$700,000
Seminole Tribe of Florida (Irma)	\$400,000
TOTAL	\$48,500,000

Sand Resources to Restore Bogue Bank Beaches after Hurricane Florence

By BOEM

In February, BOEM and Carteret County, North Carolina, signed an agreement to provide up to two million cubic yards of sand from Federal waters for the towns of Emerald Isle, Indian Beach, and unincorporated Salter Path. The project will reclaim dredged navigation material from the Morehead City Harbor Ocean Dredged Material Disposal Site (ODMDS), portions of which lie in Federal waters, to renourish approximately 5.2 miles of beach.

This project is part of the county's 50-year Bogue Banks Master Beach and Inlet Management Plan and will help address sand deficits caused by erosion and storms such as Hurricane Florence, fortify the coast against future storm impacts, and restore habitat for shorebirds and nesting sea turtles.

"BOEM stands ready to assist coastal communities whose beaches experience erosion from storms such as Hurricane Florence. We know how important these beaches are to the local economy," said BOEM Acting Director Walter Cruickshank.

"Hurricane Florence was the storm of record for Carteret County and the beaches are our main flood defense and the linchpin of our tourism economy," said Greg "Rudi" Rudolph, Carteret County Shore Protection Manager. "It was fortuitous we were already working with BOEM to secure a sand and gravel lease for a beach nourishment project."

Read the press release: <https://www.boem.gov/press02262019/>

See related stories, pages 18 and 19.



Top photo: The view along the beach at 12th Street, Emerald Isle, before Hurricane Florence. Bottom photo: The same view in September 2018 after the passing of Hurricane Florence. Photo credits: Carteret County, NC

Risk-Based Inspections: Improving Safety Performance

By Tiffany Gray (BSEE)

In March 2018, the Bureau of Safety and Environmental Enforcement (BSEE) began implementing a risk-based inspection protocol to supplement its existing inspection program for offshore oil and gas drilling rigs and production facilities.

The inspection protocol relies on data analysis to identify higher-risk facilities or types of operations on which to focus inspections and resources. As of March 2019, BSEE has performed three rounds of performance-based risk inspections and four facility-based risk inspections. It is an important part of BSEE's effort to move beyond regulation to drive continual improvement in safety performance and environmental stewardship on the U.S. Outer Continental Shelf.

Learn more: <https://www.bsee.gov/what-we-do/offshore-regulatory-programs/offshore-safety-improvement/inspection-programs/risk-based-inspection-program>



BSEE's first performance-based risk inspection focused on crane operations. Photo credit: Karla Marshall, BSEE



BSEE Inspector Daniel Woods (at right) discusses inspection results with a colleague from the U.S. Coast Guard during a March 2018 risk-based inspection. Photo credit: Karla Marshall, BSEE

Salt Marsh Species At Risk and Strategies to Save Them



Saltmarsh sparrow, the only native bird species endemic to the Northeastern United States, has adapted to tidal floods in its high-marsh breeding habitat. However, sea-level rise in recent decades has probably increased nest flooding rates and reduced its productivity. Photo credit: Paul J. Fusco, CT DEEP-Wildlife

By Mitschka (Mitch) Hartley and Aimee Weldon (USFWS)

Vast salt marshes greater than 10,000 acres once covered the East Coast where some of the largest U.S. cities now stand—including New York and Boston. In these urban areas today, salt marsh ecosystems occupy only 10 to 20 percent of their original area.

The remaining salt marsh system is under great stress—tidal restrictions from roads and rail lines limit the extent and function of many salt marshes, and development continues to encroach upon marsh ecosystems. Invasive plant species such as the common reed (*Phragmites australis*) colonize less saline areas behind tidal restrictions, dominating many former salt marshes.

While policies increased protection of wetlands, wildlife populations continue to decline. Accelerated sea-level rise—at a rate three to four times the global average in some places—may be pushing tidal marsh



The United States has a large proportion of the world's saltmarsh habitat and the highest rates of endemism; in the Northeastern United States, much of this habitat has been lost or degraded due to human development and mosquito control. Photo credit: Jack Flanagan

bird populations, especially those in the Northeastern United States, over a tipping point.

Recognizing this crisis, the Atlantic Coast Joint Venture Management Board in 2016 approved a strategic focus on coastal marsh ecosystems and adopted three flagship species: black rail (*Laterallus jamaicensis*), saltmarsh sparrow (*Ammospiza caudacuta*), and American black duck (*Anas rubripes*).

Wintering black ducks primarily use regularly flooded tidal low marsh and mudflats, whereas saltmarsh sparrow and black rail nest almost exclusively in high marsh. This makes the trio excellent representatives of many other species of waterfowl, shorebirds, wading birds, and landbirds that depend on coastal marsh habitats.

Many models indicate that, as the sea level rises, the quantity of low marsh will be stable or increase—at least for a number of decades. However, the news is not good for the saltmarsh sparrow and eastern subspecies of black rail. The USFWS recently proposed listing the eastern black rail as threatened under the federal Endangered Species Act, and the saltmarsh

sparrow is under review for potential listing. The high marsh habitat needed by these two species—and their populations—have both been declining. Many models predict drastic reductions in future decades.

Hiding in the Salt Marsh

Black rails and saltmarsh sparrows nest in the tallest, densest high-marsh vegetation they can find. Even the most ardent birdwatchers rarely see these secretive breeders. They require what is known as high-marsh habitat for nesting—a salt marsh ecosystem that lies just beyond the reach of daily flooding and is typically inundated only during storms or higher-than-average spring tides. High marsh can occupy extensive land areas but is most common along the margin where salt marsh transitions to upland forest or shrubs.

The rails place their nests on the ground and the sparrows use patches of stubby, whorled grass. It's a difficult tradeoff—nests higher up are less prone to flooding but may be more likely to be found by predators.

See *Salt Marsh Species* page 22

Salt Marsh Species continued from page 21

A recent breeding status assessment compared the historic and current distribution of black rails and reported that the species is now absent from most Northeastern States. Since 2014, State, Federal, and non-governmental partners surveyed more than 6,000 coastal locations to understand the status and distribution of black rail in the eastern United States and uncovered an alarming loss of more than 90 percent of their historical population.

The saltmarsh sparrow—the only breeding bird species endemic to the Northeastern United States—seems to be fighting the same losing battle to rising tides along the Atlantic Coast. Biologists estimate their population is declining at a rate of 9 percent per year, resulting in a population loss of 80 percent since 2000. If this trend continues, the population could collapse within 50 years. Currently, fewer than 60,000 individuals remain throughout the species' range.

More than a foot of sea-level rise in the Chesapeake Bay over the last century—nearly twice the global average—has resulted in more frequent nest inundation and failure, overwhelming the salt marsh sparrows' highly adaptive traits.

Turning the Tide

This year, the Atlantic Coast Joint Venture (ACJV) is scheduled to complete its Salt Marsh Conservation

Business Plan focused on recovering habitat for these imperiled birds.

Along with the plan, ACJV partners are developing tools and maps to focus attention on areas where efforts are likely to be most effective and are exploring innovative approaches to accelerate salt marsh conservation.

One strategy is to protect upland areas surrounding remaining tidal marshes. Anthropogenic activity and development around marshes lowers marsh bird community integrity and productivity. Buffer areas with gradual elevation change may allow wetland habitats to migrate as the sea level rises.

The Nature Conservancy recently produced maps identifying the most resilient salt marshes from Virginia to Maine and the best potential marsh migration corridors for strategic land protection efforts. Although marsh migration is already happening in the Southeastern and Mid-Atlantic States, the process may not be fast enough or result in enough high marsh to sustain black rails and saltmarsh sparrows.

In all cases, creation and restoration of quality high-marsh habitat should be the goal of any practice designed to benefit the most imperiled birds.

Learn more about the ACJV and the partners involved at <https://acjv.org/>

This article is adapted from The Wildlife Professional, Vol. 12.6. Reprinted with permission from The Wildlife Society, Bethesda, MD, 20814.



Stress associated with live trapped salt marsh voles can cause harm, known as capture myopathy, a disease complex associated with the capture or handling of any wild animal where the body's reaction to abnormal states such as infection, injury, extreme temperature, or even fear is from stress. Photo credit: Robert McCleery, Univ. of Florida

The Mysterious Salt Marsh Vole

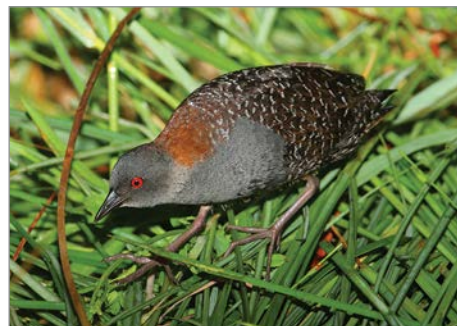
By Katie Conrad (USFWS)

The salt marsh vole, called the least understood endangered mammal in the United States, has currently only been found in a few salt marshes near Cedar Key, Florida. According to a habitat model, this is only about 10% of its possible 220-mile range of salt marsh within the Big Bend Region of Florida. The voles could potentially occupy a much larger extent; therefore, the USFWS Coastal Program funded a project to survey potential habitat from the north at St. Marks National Wildlife Refuge south to Chassahowitzka National Wildlife Refuge.

See Salt Marsh Vole page 23



Biologists banding a captured saltmarsh sparrow. Photo credit: USFWS



The black rail is one of the most secretive and rarely seen birds in North America. Photo credit: Bob Gress



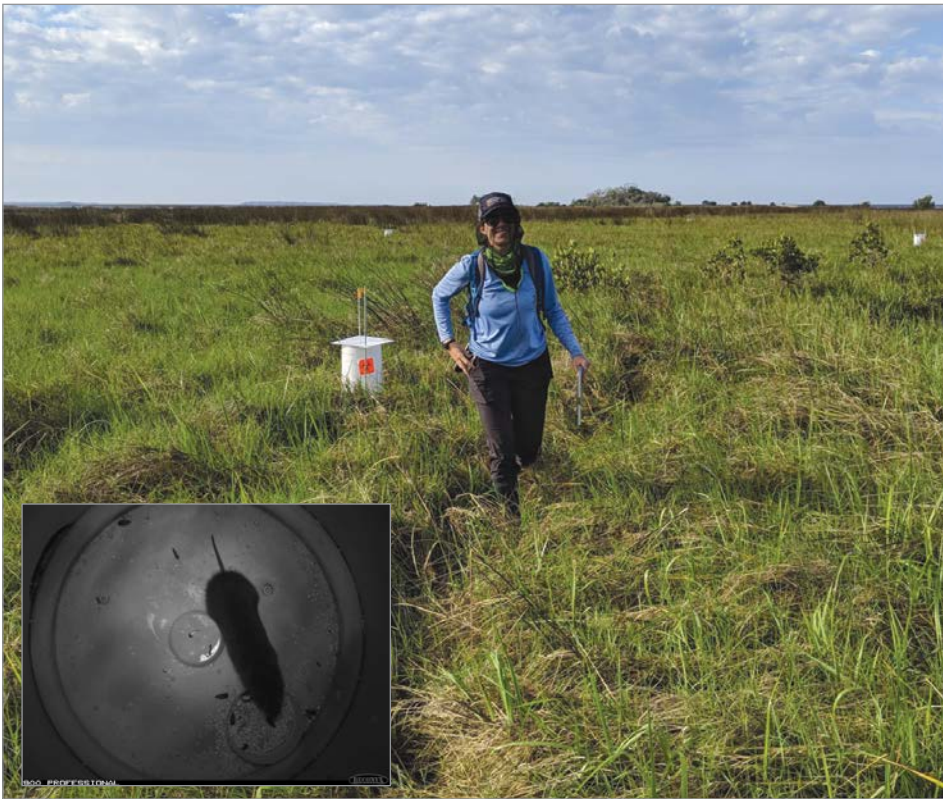
Most American black ducks spend the winter in salt marshes and mud flats along the Atlantic Coast. Photo credit: Jim Clark

Salt Marsh Vole continued from page 22

Researchers from the University of Florida are managing the project and are using camera traps to detect the voles, which allow researchers the ability to document the presence of these sensitive mammals without handling them. The researchers also conduct vegetation surveys at each camera trap site to determine what type of vegetation the salt marsh vole is using as habitat. The researchers are working with State-managed lands and four National Wildlife Refuges—St. Marks and St. Vincent National Wildlife Refuges, Lower Suwannee National Wildlife Refuge, and Crystal River National Wildlife Refuge Complex—to better understand salt marsh vole distribution and habitat characteristics.

The Florida Salt Marsh Vole

The Florida salt marsh vole is believed to represent a relict population of the widespread meadow vole (*Microtus pennsylvanicus*), which was much more widespread in Florida during the Pleistocene. The range of the species in Florida is believed to have been greatly reduced as climatic change resulted in vegetational changes from grassland to forest in Florida. The current restricted population is threatened by storm surges associated with hurricanes and tropical storms, the loss of coastal marshes due to flooding from rising sea level, and potentially by any human-caused alterations that might be proposed for these salt marshes.



Camera traps are placed in randomly selected quadrats throughout the marsh. The traps (white buckets in photo) sit on top of a float and are attached to posts so they can float up and down when the tide comes in and floods the marsh. Inset: The black and white image was taken by the camera trap when the vole entered the trap. University of Florida researcher, Marina Campbell, stands next to one of the camera traps in the marsh. Photo credit: Paul Taillie, University of Florida

Learn more about salt marsh voles: <https://www.fws.gov/northflorida/Species-Accounts/Saltmarsh-Vole-2005.htm?fbclid=IwAR01db3KPcdcTefy6ewIr8D1WsmbmoRb3A7HoM76VyLThTMxbEaTU0N5rwY>

Student Artists Connect with Nature

By B.G. Horvat (NPS)

The Cape Lookout National Seashore and the International Fiber Collaborative (IFC) have partnered to create an art exhibit at the park featuring works by more than 470 students from 19 North Carolina schools. The theme of the exhibit is “Connect with the Rhythms of Nature on the Southern Outer Banks.”

The exhibit features more than 60 mediums of varying compositions completed by 470 student artists representing 19 public and private schools from around North Carolina.

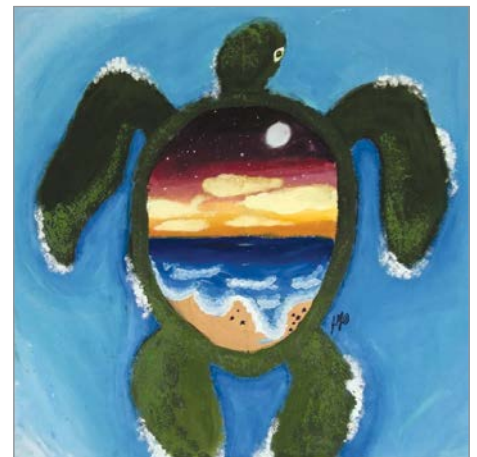
The main exhibit will be on display at the Harkers Island Visitor Center from March 9 through September 9, 2019.

Learn more: <http://www.internationalfibercollaborative.com/>

For more information about IFC art exhibits: www.ifcprojects.com

For park information, including visitor center hours of operation, please visit: www.nps.gov/calo

Read the press release: <https://www.nps.gov/calo/learn/news/2019-03-06.htm>



This painting from Swansboro High School (Swansboro, NC) is one of many impressions of the Southern Outer Banks that are featured in the student art exhibit at Cape Lookout National Seashore, NC. The exhibit runs from March 9 through September 9, 2019. Photo credit: Swansboro High School

New Improved Maps of Massachusetts' Coastal Zone

By Walter Barnhardt (USGS)

The USGS has produced a series of interpretive maps that describe the shallow geology, distribution, and texture of sea-floor sediments, and the physiographic zones of the sea floor along the south and west shores of Martha's Vineyard and the north shore of Nantucket, Massachusetts.

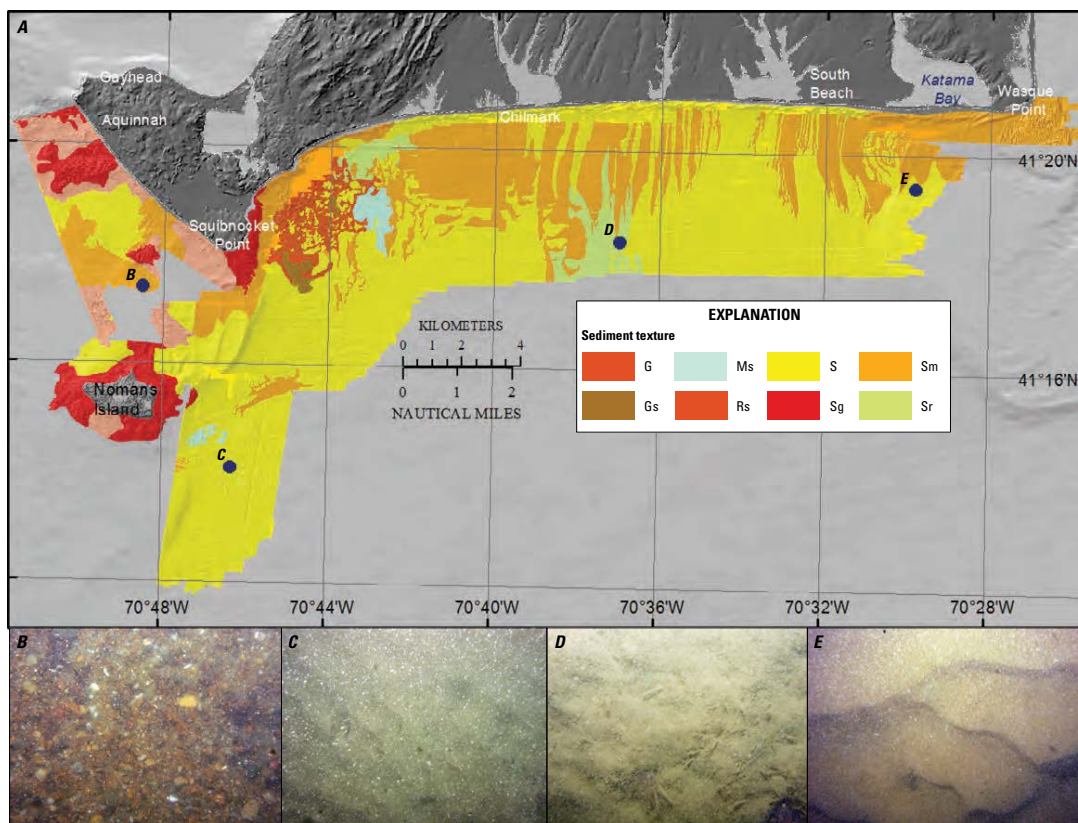
The geologic framework and seabed character of the coastal zone of Massachusetts is complex, heterogeneous, and controlled by the antecedent geology. This new study produced high-resolution geophysical datasets at full sea-floor coverage, supplemented with sediment samples and bottom photographs, allowing detailed surficial to shallow stratigraphic geologic maps, high-resolution sediment texture maps, and physiographic zone delineations that were previously unfeasible because of a lack of high-quality, high-density sea-floor mapping data.

These data are part of the project, Geologic Mapping of the Massachusetts Seafloor, where the USGS, in cooperation with the Massachusetts Office of Coastal Zone Management (CZM), is conducting geologic mapping of the sea floor to characterize the surface and shallow subsurface geologic framework within the Massachusetts coastal zone. The National Oceanic and Atmospheric Administration—National Ocean Service (NOAA–NOS) is also an important partner and contributes hydrographic data that are integrated into the maps.

These new interpretations are intended to aid statewide efforts to inventory and manage coastal and marine resources, link with existing data interpretations, and provide information for research focused on coastal evolution and environmental change. The products and knowledge developed by this project have broad application to regional science and resource-management issues. The geologic and bathymetric maps improve understanding of the processes that

have shaped the coast, how these processes change over time, and help evaluate the vulnerability of coastal environments to storms, sea-level rise, and long-term climate change. Accurate maps that depict the distribution of bottom types on the inner continental shelf provide scientific guidance for appropriately siting offshore development such as sand mining, pipelines, and renewable energy projects. The Massachusetts Division of Marine Fisheries (DMF) uses the maps to monitor habitat recovery following pipeline construction in Massachusetts Bay and to conduct fisheries research. The long-term goal of this mapping effort is to produce high-resolution geologic maps and a Geographic Information System (GIS) that will serve the needs of research, management, and the public, and ultimately, supporting the Massachusetts Ocean Management Plan, an integrated, multi-use proposal for the management of Massachusetts waters.

Learn more: https://www.usgs.gov/centers/whcmssc/science/geologic-mapping-massachusetts-seafloor?qt-science_center_objects=0#qt-science_center_objects



A, Sediment textures offshore of western and southern Martha's Vineyard. B, Photograph of coarse sand and gravel obtained from a section of sea floor classified as primarily sand with gravel (Sg). C, Photograph of the sea floor showing sandy sediment within an area classified as primarily sand (S). D, Photograph from a section of sea floor classified as primarily sand with some mud (Sm). E, Photograph from a section of sea floor classified as primarily sand (S). The scales of photographs B–E are approximately 60 to 100 cm(?). Bottom-type classification is from Barnhardt and others (1998). Image credit: USGS

More Than \$36 Million for Wetlands, Waterfowl Conservation, and Public Access

By Vanessa Kauffman (USFWS)

In September 2018, the Migratory Bird Conservation Commission approved \$23.8 million in grants for the USFWS and its partners to conserve or restore almost 135,000 acres of wetland and associated upland habitats for waterfowl, shorebirds, and other birds in 17 States throughout the United States.

The grants, made through the North American Wetlands Conservation Act (NAWCA), will be matched by more than \$60 million in partner funds. NAWCA grants ensure waterfowl and other birds are protected throughout their lifecycles. *See related stories, pages 12 and 15.*

Wetlands provide many ecological, economic, and social benefits such as habitat for fish, wildlife, and a variety of plants. NAWCA grants conserve bird populations and wetland habitat, while supporting local economies and American traditions such as hunting, fishing, birdwatching, family farming,

and cattle ranching. This year's projects include the following:

- Maine Wetlands Conservation Initiative: \$1 million to conserve 26,559 acres of wetlands for waterfowl, songbirds, and other species in coastal Maine.
- Klamath Basin Wetlands III: \$1 million to restore and enhance 12,038 acres of wetlands on a working cattle ranch and elsewhere in the Klamath Basin of Oregon and California, including wet meadows on a cattle ranch. Work will benefit northern pintail, sandhill crane, and many other species.
- Texas Beaches to Bays: \$1 million to permanently protect 5,369 acres of coastal prairie, coastal marsh, and other wetlands and uplands in the Texas Mid-Coast. The project will benefit mottled duck, mallard, redhead, and other species.

NAWCA is the only Federal grant program dedicated solely to the conservation of wetland habitats for migratory birds. Since 1989, funding has advanced the conservation of wetland habitats and their wildlife in all 50 U.S. States, Canada, and Mexico, while engaging more than 6,000 partners in more than 2,800 projects.



The canvasback is the largest diving duck in North America. Photo credit: Frank Schulenburg, Creative Commons CC BY-SA 3.0 license

More information about the grant projects is available here: <https://www.fws.gov/birds/grants/north-american-wetland-conservation-act.php>

Read the press release: [https://www.fws.gov/news/ShowNews.cfm?ref=interior-announces-more-than-\\$36-million-to-boost-to-wetland-waterfowl-&_ID=36309](https://www.fws.gov/news/ShowNews.cfm?ref=interior-announces-more-than-$36-million-to-boost-to-wetland-waterfowl-&_ID=36309)

Get the most up-to-date waterfowl habitat and population information about North American wetlands and waterfowl conservation: <https://www.fws.gov/birds/>

2018 Waterfowl Status Report Released

By USFWS

The 2018 Waterfowl Breeding Population and Habitat Survey Report—including the most current breeding population information available for waterfowl in North America—is now available.

In the traditional survey area, the total duck population estimate (excluding scoters, eiders, long-tailed ducks, mergansers, and wood ducks) was 41.2 million birds. This estimate was 13% lower than the 2017 estimate of 47.3 million and 17% higher than the long-term average (1955–2017).

The report provides population and abundance estimates for many individual species, including mallards, blue-winged teal, gadwall, northern shoveler, redheads, northern pintail, American wigeon, canvasbacks, lesser and greater scaups, goose, and swan.

The annual Waterfowl Breeding Population and Habitat Survey guides the USFWS's waterfowl conservation programs under authority of the 1918 Migratory Bird Treaty Act. Waterfowl population surveys and monitoring programs are critical components of successful waterfowl management and a reflection of the USFWS's commitment to generating high-quality scientific data to inform conservation planning.

Learn more: <https://www.fws.gov/birds/news/180820waterfowl-status.php>

For more information about the surveyed areas, the survey methodology, and the abundance estimates, read the full report: <https://www.fws.gov/migratorybirds/pdf/surveys-and-data/Population-status/Waterfowl/WaterfowlPopulationStatusReport18.pdf>

You can also read pilot biologists' flight blogs: <https://www.fws.gov/birds/surveys-and-data/population-surveys/aerial-ground-crew-blog.php>

Learn to identify North American waterfowl, page 32.

Improving White Sturgeon Recruitment in the Columbia River Basin

By Rachel Reagan and James Hatten (USGS)

White sturgeon (*Acipenser transmontanus*), found in large river systems along the west coast, are the largest freshwater fish in North America. This primitive-looking fish—with bony plates running along its back, a long flat snout, and whisker-like barbels—can reach lengths of 20 feet and live more than 100 years. Although some populations of white sturgeon migrate between ocean and freshwater, some also are landlocked and do not migrate at all. White sturgeon provide commercial and recreational fisheries, are an ecological cornerstone species, and are culturally important to regional Native American Tribes in the Pacific Northwest.

Overharvest and vast habitat changes caused by construction of dams and reservoirs and resultant river regulation have affected white sturgeon populations throughout their range. Specifically, dams have restricted the movement of white sturgeon in many rivers and altered their spawning and rearing habitats due to changes in hydraulics and substrate composition. In the Columbia River Basin, white sturgeon recruitment (that is, sturgeons surviving their first year) has varying levels of success, depending on the river's reach and habitat

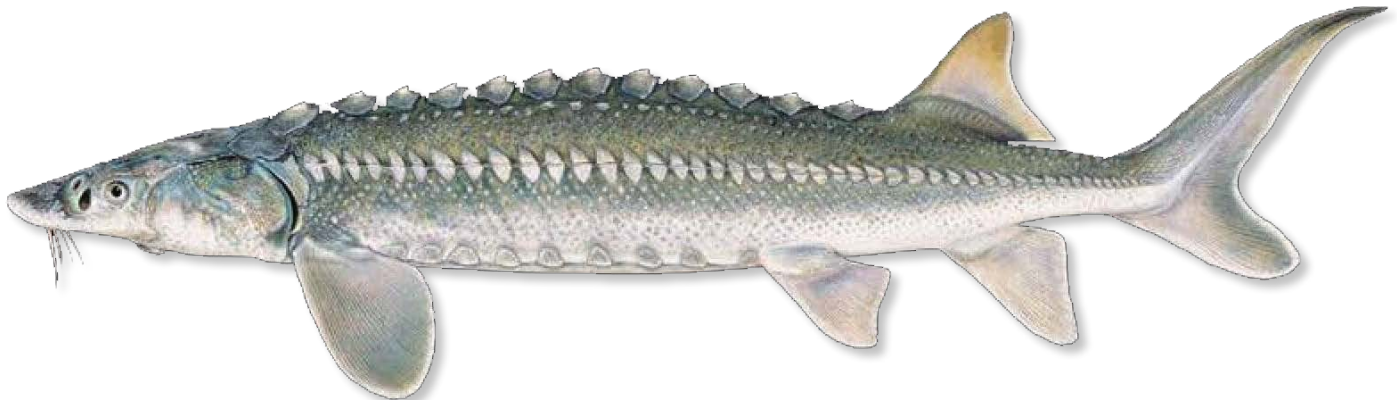
conditions. Some river reaches have virtually no recruitment, whereas others have consistent recruitment year after year. Understanding the habitat characteristics that lead to reproductive success in white sturgeon will be critical to prevent further decline of this important species.

USGS scientists from the Western Fisheries Research Center and Idaho Water Science Center teamed up to investigate why certain reaches of the Columbia River have consistent recruitment, whereas other reaches have inconsistent or no recruitment. Model simulations revealed significant gains in white sturgeon habitat in all three reaches when spring flows increased, embeddedness decreased, or gravel/cobble composition increased. This information is useful to biologists, water managers, and agencies charged with maintaining or restoring white sturgeon spawning habitat throughout the Columbia River Basin.

The data were recently published in the journal *Heliyon*: https://www.sciencedirect.com/science/article/pii/S2405844017332826?_rdoc=1&_fmt=high&_origin=gateway&_docanchor=&md5=b8429449ccfc9c30159a5f9aeea92ffb

Western Fisheries Research Center Newsletter

The U.S. Geological Survey, Western Fisheries Research Center (WFRC) newsletter is designed to update you on science, new publications, events, and news from the WFRC scientists. This group researches aquatic animal health, restoration ecology, and drivers of ecosystem change at four different field stations throughout Washington and Oregon. Please share with colleagues or others interested in these communications.



White sturgeon (*Acipenser transmontanus*). Photo credit: Joseph Tomelleri.

Pearl in the Making— Bolstering Oysters in the Chesapeake Bay

By Chris Eng (USFWS)

Jason Ruth comes from a waterman family, connected to the Bay, and is the latest in a line of folks who have made their living on the Chesapeake. When he was 13, Ruth got a job at Harris Seafood Company.

Ruth, who grew up on and near the bay, knows that development, pollution, and commerce have guaranteed that oysters no longer lie thick as stones in the Nation's largest estuary. But through his efforts, along with the USFWS and other partners, the tasty bivalve may be staging a small comeback in a segment of the bay.

The USFWS has been helping local communities create new oyster beds as well as restore some stretches of shoreline, which is good economic news for Ruth and the watermen who make their living on the bay. Conservation can be good for business.

Restoring Oysters, Shoreline

Over time, Ruth learned the seafood business, and in 2004, he bought the company. Ruth's time at the packing house gave him a firsthand look at how closely oysters and the environment are linked. An industry already under pressure from over-harvesting and pollution suffered another large setback in the 1980s when diseases, dermo and MSX, struck oyster beds and decimated their populations.

The year-round business generates between \$25 and \$30 million annually and that value of oysters wasn't lost on David Sutherland, a biologist in the USFWS's Coastal Program. Sutherland has been working with Ruth Harris Seafood Company and the Chesapeake Bay Environmental Center (CBEC) to recover oysters and restore shoreline on Kent Island and the surrounding area.

Nature's Good Neighbors—Making a Home For People and Wildlife

"The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased and not impaired in value."

—President Theodore Roosevelt

Nature's Good Neighbors is a series of stories highlighting people who depend on the land as much as the land depends on their stewardship. They are entrepreneurs who manage forests, farms, ranches, and fisheries. They are private landowners, land managers, tribal members, recreational guides and individuals in the energy, agriculture, and timber industries. With expertise, assistance, funding, and tools from the U.S. Fish and Wildlife Service, these modern-day stewards are working with nature to benefit both people and wildlife. "Pearl in the Making" is just one example that shows how good neighbors are improving coastal communities. Learn more: <https://www.fws.gov/natures-good-neighbors/>



Volunteers place large mesh bags full of oyster shells near the shoreline in an effort to establish an oyster reef. Photo credit: Chesapeake Bay Environmental Center

It's important work. Having healthy oysters has profound implications for the environment as well as the wallet. One oyster can filter 50 gallons of water each day. Thriving oysters means cleaner water. Oyster beds also provide habitat for fish, crabs, and other aquatic species. Foraging ducks, cormorants, and other waterbirds thrive alongside oysters. Another benefit of oysters: they help keep shorelines intact. Oyster beds, scientists know, can reduce the force of waves hitting shore. The increase in sea levels, storm surges, and even shipping vessels in the bay have eroded some areas of shoreline. According to

Sutherland, a thriving oyster population lessens that impact.

Together, over the years, they've planted more than 10 million spat. The Maryland Department of Natural Resources, Maryland Artificial Reef Initiative, and the Coastal Conservation Association have also helped.

The oysters have grown up nicely. It is something to pique an oyster's lover's interest...and appetite.

This story has been shortened from the original. You can read the original here: <https://www.fws.gov/natures-good-neighbors/stories/pearl-in-the-making/>

Restoring Wild Rice

By Todd Koehler (USFWS)

Allouez Bay in Douglas County, Wisconsin, is a diverse coastal wetland that supports large numbers of fish, waterfowl, and mammals. The Allouez Bay Wild Rice Restoration project focused on approximately 50 acres of emergent wetland in Allouez Bay within the St. Louis River System Area of Concern. In addition to reestablishing wild rice, these efforts have improved habitat and forage quality for waterbirds and waterfowl like ducks, geese, swans, and other migratory birds, and reduced the impact of invasive plant species, namely the purple loosestrife.

Partners assisting with the project include the USFWS’s Coastal Program, University of Wisconsin Superior’s Lake Superior Research Institute (LSRI), Douglas County, Wisconsin Department of Natural Resources, and the Great Lakes Indian Fish and Wildlife Commission (GLIFWC).

The project area is open to public hunting, fishing, and other forms of outdoor recreation, which will benefit from efforts such as this project that restore and enhance healthy natural resources and habitat.

Wild rice is an annual aquatic grass that produces seed that is a delicious and nutritious source of food for wildlife and people.

Historically, wild rice provided an important staple for Native American tribes including the Ojibwa, Menomonee, and Dakota.

Working together, this Federal, State, and tribal agency partnership is improving fish and wildlife habitat on public coastal waters in the State of Wisconsin.

Learn more: <https://www.fws.gov/midwest/fisheries/fishlines/feature5.html>



USFWS staff seed wild rice in the Great Lakes region. Photo credit: Ducks Unlimited

How to Harvest Wild Rice

If you like to collect your own food and support your local economy, harvesting uncultivated wild rice can be a great option! In many places, like Minnesota and Wisconsin, you must obtain a permit and harvest as traditional Native Americans do. You can only travel by canoe or other non-motorized boat because the use of machines and mechanical devices is prohibited. Learn the rules, regulations, tips, and techniques, so you can harvest wild rice.

Visit: <https://dnr.wi.gov/topic/outdoorrecreation/activities/rice.html>



Watch the video to learn how to harvest wild rice: https://www.youtube.com/watch?time_continue=58&v=wCQfVYiRpsA

Storm Recovery Activities for USGS

Providing science needed to respond, assess impacts, and prepare for the next one

By Jo Ellen Hinck and Joseph Stachyra (USGS)

Congress provided \$42.2 million funding to the USGS to support recovery and rebuilding decisions in the wake of Hurricanes Harvey, Irma, and Maria. These activities include:

- hydrologic monitoring
- coral reef monitoring and hazards assessment
- elevation mapping
- assessing impacts of coastal damage and landslide risks

Read the fact sheet: <https://pubs.usgs.gov/fs/2018/3063/fs20183063.pdf>

Activity	Amount
Equipment repair and replacement	\$20.1M
High-resolution elevation data collection	\$10.1M
Scientific studies and assessments	\$8.0M
Other	\$4.0M

Equipment Repair and Replacement
Surface Water Gages in Texas, Florida, Puerto Rico, and U.S. Virgin Islands

- USGS streamgage network provides critical information about flood peaks and frequency.
- Gages were damaged or destroyed in Texas (29 gages), Florida (126), Puerto Rico (84), and U.S. Virgin Islands (1).
- Gage and related equipment will be repaired or replaced.

This four-page fact sheet outlines how \$42.2 million, provided to the USGS as part of the Additional Supplemental Appropriations for Disaster Relief Requirements Act 2018, was used for equipment repair and replacement, high-resolution elevation data collection, and scientific studies and assessments that will support recovery and rebuilding decisions in the wake of Hurricanes Harvey, Irma, and Maria. Available online: <https://pubs.usgs.gov/fs/2018/3063/fs20183063.pdf>

Mapping Supports Management in Lake Superior

By Walter Barnhardt and Brian Andrews (USGS)

Historical copper mine tailings were dumped on the floor of Lake Superior at many locations in the early 20th century. These large amounts of waste material, called “stamp sands,” have wide-reaching consequences that continue today. Ongoing erosion and re-deposition of the toxic stamp sands have buried miles of native, white-sand beaches offshore of the town of Gay on the Keweenaw Peninsula of Michigan. The stamp sands are also steadily encroaching on Buffalo Reef, a large area of cobble/boulder substrate that supports productive fisheries in the lake.

Modeling studies by USACE previously concluded that the reef area buried by stamp sands will more than double from 25 percent to 60 percent over the next 10 years if no action is taken. Several mitigation options are being examined, including (1) construct a stone revetment around the spoils pile, (2) remove the spoils pile and dump in deep water, (3) excavate an underwater trough to intercept the sands before they reach the reef.

To test potential outcomes under these (and other) possible scenarios, the USGS has cooperated with other institutions to map the current distribution of stamp sands and collect data to help understand the processes and pathways related to sediment transport in the area. These data will build on the expertise from Michigan Technical University (MTU), where they have maintained research on the environmental legacy of copper mining in the region for many years.

In September 2018, the USGS brought the 25-foot mapping vessel, R/V *Rafael* to conduct high-resolution geophysical mapping focused offshore of the Keweenaw Peninsula. They mapped sea-floor bathymetry and other associated geologic characteristics to inform management decisions.

Funded jointly by the USGS and the USACE, the cooperative mapping project will develop a framework for scientific research and information required for managing coastal resources within northern Michigan.

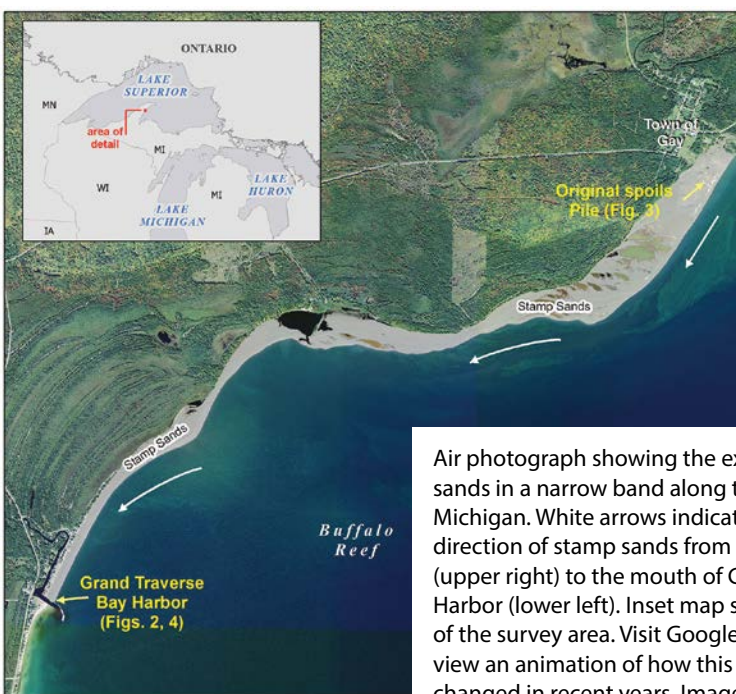
Read more: <https://soundwaves.usgs.gov/2019/01/fieldwork.html>

What is a Stamp Sand?

The stamp sands—dark gray in color with metal-rich geochemical signatures—are readily distinguishable from the region's native quartz sands and thereby represent an excellent tracer for tracking sediment movement across the submerged landscape. The well-constrained history of emplacement and subsequent erosion of the stamp sands offers a unique opportunity to validate models of sediment supply on coastal evolution since mining ceased in the 1930s. Of the approximately 22.7 million metric tons (37.3 million cubic yards) deposited at the Gay site, MTU investigators have estimated that more than 85 percent of the original pile of stamp sand has been eroded. Movement of that sediment has caused progradation of the beach and damming of stream outlets downdrift of the pile. In the offshore, USGS mapping will characterize the extent of sedimentation on the sensitive hard-bottom habitats, and will help quantify the spreading environmental effects from copper and other metals that threaten critical fish breeding grounds.



Photograph showing a high scarp cut into the large pile of stamp sands at the town of Gay, MI. Nearly a century of erosion by waves and currents has transported millions of cubic yards of mine tailings along the coast and spread them across the adjacent lake floor. Photo credit: USGS



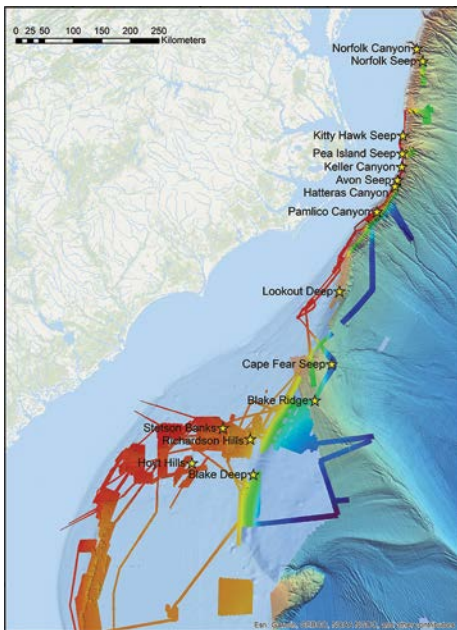
Air photograph showing the extent of the stamp sands in a narrow band along the coast of northern Michigan. White arrows indicate net transport direction of stamp sands from the spoils pile (upper right) to the mouth of Grand Traverse Bay Harbor (lower left). Inset map shows the location of the survey area. Visit Google Earth Engine to view an animation of how this stretch of coast has changed in recent years. Image credit: USGS

DEEP SEARCH Expedition Explores Deep-Sea Habitats Offshore Mid- and South Atlantic Coasts

By Kaitlin Kovacs (USGS) and Marjorie Weisskohl (BOEM)

USGS and BOEM scientists headed out to sea in April to continue the exploration of deep-sea ecosystems offshore the United States' Mid- and South Atlantic coast. This is the fourth cruise associated with the DEEP Sea Exploration to Advance Research on Coral/Canyon/Cold seep Habitat (DEEP SEARCH) project, a collaboration between the USGS, BOEM, and the NOAA.

Sailing aboard NOAA Ship *Ronald H. Brown*, the DEEP SEARCH team spent three weeks visiting this extensive reef system between Virginia and Georgia to collect baseline information on coral, canyon, and cold seep



Map of DEEP SEARCH study area. From April 9–30, 2019, DEEP SEARCH planned daily dives with ROV *Jason* at targets indicated by yellow stars. Bathymetry data shown in full-color were collected by recent NOAA Ship *Okeanos Explorer* missions and by the 2018 R/V *Atlantis* cruise. Bathymetry data shown in muted, transparent color represent the full extent of data in the region. Map credit: USGS

habitats to help inform management activities in the region.

Deep-sea ecosystems, such as coral reefs, canyons, and cold seeps, play an integral role in carbon and energy cycling and provide food for animals higher up in the food chain, including species of commercial and recreational value. Despite its noted importance, very little is known about the deep sea; it is estimated that only 5% of the sea floor has been explored. *See related story, page 6.*

In April 2019, the science team used the remotely operated vehicle (ROV) *Jason*, also operated by WHOI, to collect data and biological and geological samples. Ship-based multibeam mapping; conductivity, temperature, and depth (CTD) casts; and multicore sediment sampling were also used. The information collected during the four DEEP SEARCH expeditions will ultimately help characterize the region's largely unexplored natural resources.

Support for the study is shared equally among USGS, NOAA, and BOEM, either in partner funding or in-kind support. Temple University's Erik Cordes is the lead principal investigator for the multi-year study and project manager for TDI-Brooks International, Inc., which is the primary contractor for BOEM. Five USGS science teams, led by USGS scientist Amanda Demopoulos, provide scientific support and expertise in various disciplines.

This study is sponsored by the National Oceanographic Partnership Program (NOPP) and builds upon partnerships from the award-winning Mid-Atlantic Canyons study that took place from 2011 to 2015. That project was also coordinated under the NOPP and focused on deep-water habitats and species north of the DEEP SEARCH study area.

Learn more about DEEP SEARCH 2019—You can check out Mission Logs, Meet the Explorers, View Image

Learn more about the 2018 DEEP Search expedition:

A new video captures highlights of the August 2018 expedition.

Watch the video to see footage of the DEEP SEARCH research cruise activities at sea and hear scientists describe the research objectives and how partnerships contribute to greater capabilities and new discoveries. <https://www.youtube.com/watch?v=RwpB6u2XiqA&feature=youtu.be>



DEEP Search Mission Log

August 24, 2018:

<https://oceanexplorer.noaa.gov/explorations/18deepsearch/logs/aug24/aug24.html>

Mission overview:

<https://oceanexplorer.noaa.gov/explorations/18deepsearch/welcome.html>

and Video galleries, Find Educator Info and Media resources, and more: <https://oceanexplorer.noaa.gov/explorations/19deepsearch/welcome.html>

For more information on this and other USGS deep-sea coral expeditions, visit: <https://www2.usgs.gov/ecosystems/environments/DISCOVER/index.html>

For BOEM's study profile, visit: <https://opendata.boem.gov/BOEM-ESP-Ongoing-Study-Profiles-2019-FYQ2/BOEM-ESP-AT-17-06.pdf>

National Oceanographic Partnership Program: <https://www.nopp.org/projects/deep-search/>



USGS divers (left to right) Kasia Kelly, Ashley Spoljaric, and Meredith Nevers are shown diving in Lake Michigan near Mt. Baldy in Indiana Dunes National Park in August of 2018. Photo credit: Charles Morris, National Park Service

Scientists with SCUBA Skills Support Collaborative Science in the Great Lakes

By Meredith Nevers (USGS) and Wendy Smith (NPS)

The USGS Great Lakes Science Center (GLSC) has 17 divers who investigate a variety of research questions beneath the water's surface. They support work in aquatic invasive species, artificial reef spawning, assessment of fish habitat, and a host of other topics critical to the Great Lakes ecosystem.

Glen Black, the Science Center's Dive Safety Officer, works to ensure they all have the safety training and certifications they need. Black has been diving since 1983 and has participated in more than 3,000 dives.

As a USGS diver, he has collaborated with the NPS, the EPA, and the USFWS on a wide variety of projects.

USGS divers are required to dive at least 12 times each year and to continue to increase their skills through training opportunities. This March, Black traveled to the USGS Lake Michigan Ecological Research Station at Indiana Dunes National Park and to the nearby Michigan City YMCA pool to train USGS divers Meredith Nevers, Kasia Kelly, Ashley Spoljaric, and Emily Wimmer in dry suit diving and diving with a full face mask.

GLSC divers have a range of skill certifications that allow them to dive safely in deep water sites, in low visibility, at night, and even under ice.

The dive program gives USGS a first-hand look at the natural resources they are trying to protect. This is important for getting a holistic look at study sites, and it allows researchers to better define their insight of the ecosystem.

Tools of deep sea exploration:



Human occupied vehicle (HOV) *Alvin* is part of the National Deep Submergence Facility (NDSF). *Alvin* enables in-situ data collection and observation by two scientists to depths reaching 4,500 meters during dives lasting up to 10 hours. Photo credit: Woods Hole Oceanographic Institution

Learn more about the HOV *Alvin*: <https://www.whoi.edu/what-we-do/explore/underwater-vehicles/hov-alvin/>



Jason and *Medea* are part of the NDSF. *Jason* and *Medea* are a remotely operated vehicle (ROV) system designed and built by WHOI's Deep Submergence Laboratory and funded by the National Science Foundation to allow scientists to have access to the seafloor without leaving the deck of a ship. Photo credit: Woods Hole Oceanographic Institution

Learn more about ROV *Jason/Medea*: <https://www.whoi.edu/what-we-do/explore/underwater-vehicles/ndsf-jason/>



The autonomous underwater vehicle (AUV) *Sentry* is part of the NDSF. *Sentry* is a fully autonomous underwater vehicle capable of exploring the ocean down to a depth of 6,000 meters (19,685 feet). *Sentry* has improved speed, range, and maneuverability with a hydrodynamic shape that allows faster ascents and descents. Photo credit: Woods Hole Oceanographic Institution

Learn more about the AUV *Sentry*: <https://www.whoi.edu/what-we-do/explore/underwater-vehicles/sentry/>



Photo credit: USFWS

Learn to Identify Waterfowl

<https://www.fws.gov/birds/bird-enthusiasts/bird-watching/waterfowl-identification.php>

The Surfing Bison

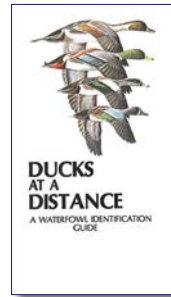


Have you ever wondered, what is that bird? The first step in bird identification is learning to observe. Watch and listen. It often helps to record your observations in a journal using descriptive words, sketches, or drawings. Photographing birds is another way to capture a permanent record of what you have seen so you can study it later.

Explore the various species of North American waterfowl divided into these five categories.

Ducks at a distance:

- Dabbling ducks
- Diving ducks
- Sea ducks
- Swan and geese
- Whistling ducks

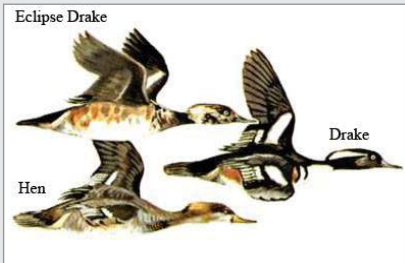


This online guide (adapted from Ducks at a Distance) will help you identify North American waterfowl.

Improve your knowledge about waterfowl behavior, migration patterns, and the sounds they make. Study flock patterns and wing characteristics. This waterfowl identification guide has everything you need to recognize ducks, swans, and geese in the field or on the fly!

In this online guide you can view the following:

Illustrations



Goldeneyes, buffleheads, and mergansers are easily confused. Overall size, shape, and amount of white are the key field marks. Hooded mergansers are medium in size and the drakes show large amounts of white on the head. Differences in size, shape, plumage patterns and colors, wing beat, flocking behavior, voice, and habitat all help to distinguish one species from another. Image credits: Robert W. Hines, USFWS

Full-Color Photos



The harlequin duck, (*Histrionicus histrionicus*) drake has glossy slate-blue plumage enlivened by white streaks and patches rimmed with black, giving it a striking appearance. Photo credits: Peter Pearsall, USFWS

Video Footage with Descriptive Narration for Each Species



The videos provided in this online guide provide tips and pointers for recognizing various species using footage from the wild with descriptive narration and graphics that show behavior, markings, and sounds. The bottom example shows how to distinguish the green-winged teal from the blue-winged teal. Video credits: USFWS