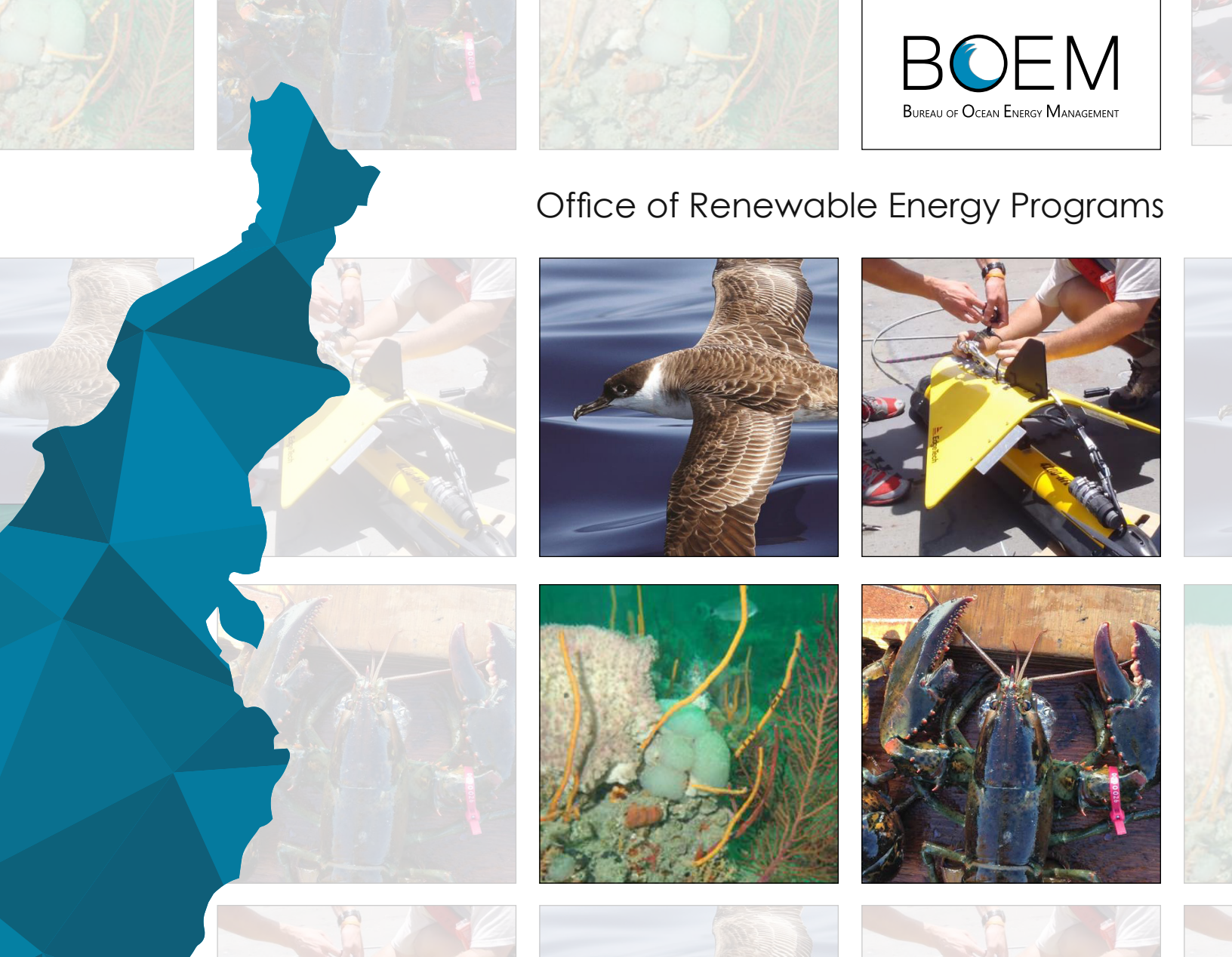


Office of Renewable Energy Programs



Atlantic Science | Year in Review

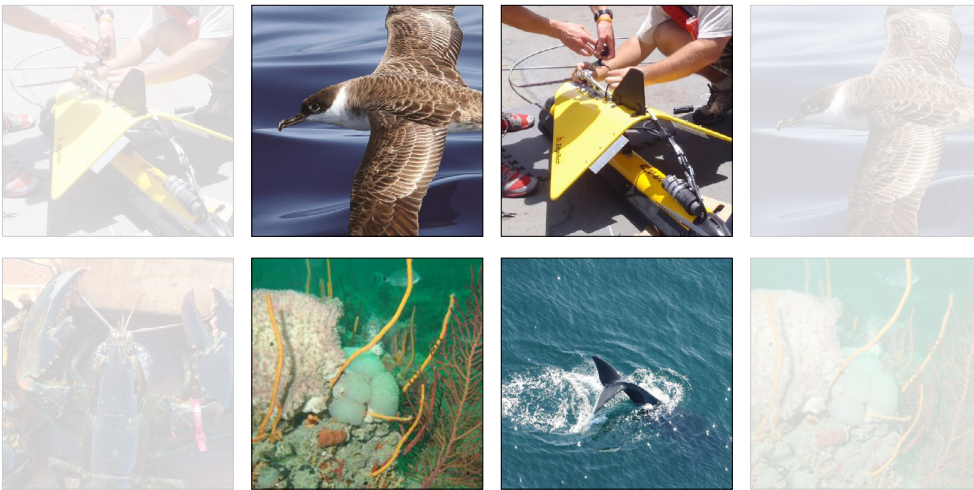
2016



Diver mapping a benthic habitat.



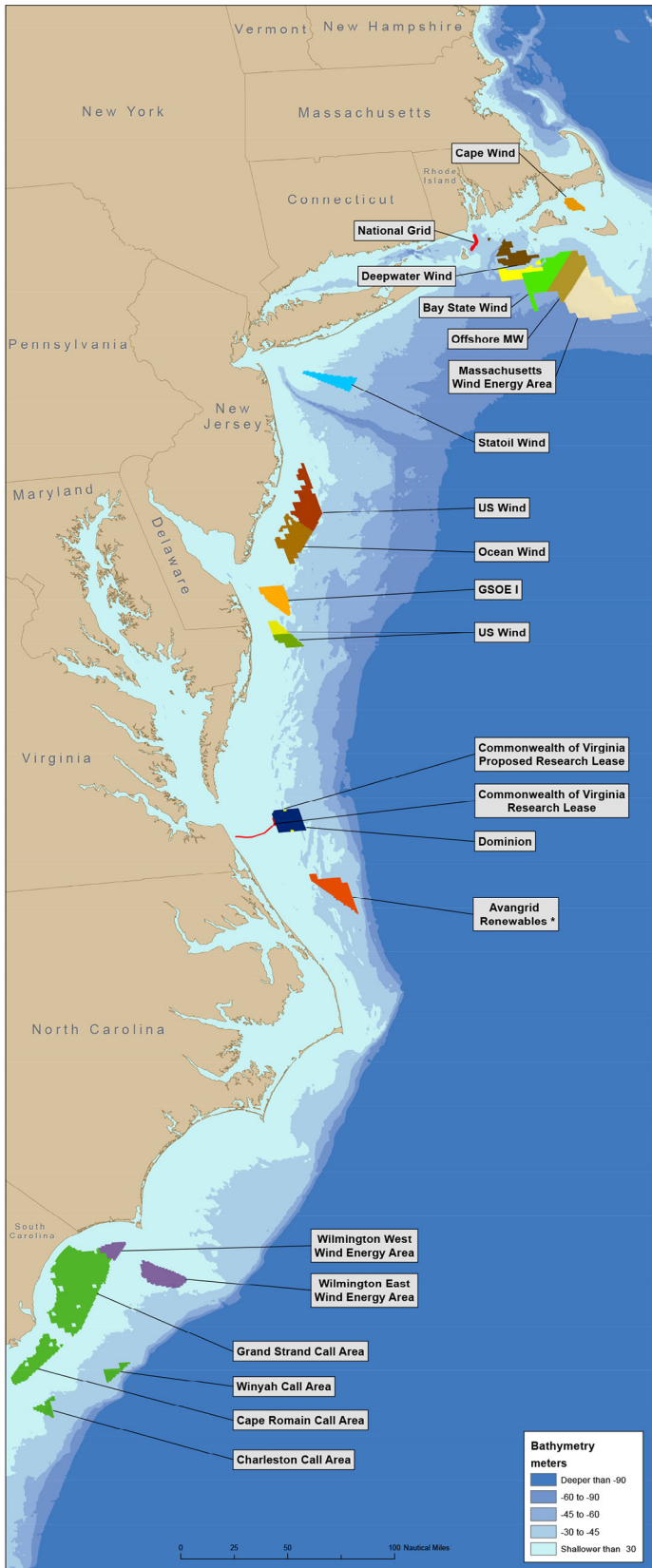
Office of Renewable Energy Programs



The Bureau of Ocean Energy Management (BOEM) funds environmental studies for information needed to predict, assess, and manage impacts from offshore energy and marine mineral activities on human, marine, and coastal environments as mandated under Section 20 of the Outer Continental Shelf (OCS) Lands Act (OCSLA).

This year in review presents the studies completed in 2016 in support of BOEM's Offshore Renewable Energy Program along the Atlantic coast. The studies represent a broad spectrum of research and monitoring to address a variety of environmental concerns and issues. This review represents a snapshot of the ongoing and completed studies funded in whole or in part by BOEM.

To learn more about other studies, please visit the BOEM website at www.boem.gov.





Marine Mammals & Other Protected Species

- Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for [Large Whales and Sea Turtles](#)



Birds & Bats

- Abundance and Distribution of [Seabirds](#) Off Southeastern Massachusetts, 2011–2015
- Modeling At-Sea Occurrence and Abundance of [Marine Birds](#) to Support Atlantic Marine Renewable Energy Planning Phase I Report
- Risk of an Offshore Wind Project to a [Migrant Shorebird](#)
- Mobile [Avian Survey Data](#) Collection Software Application



Social Science

- The Identification of [Port Modifications](#) and the Environmental and Socioeconomic Consequences



Fish & Fisheries

- Spatial and Temporal Distributions of [Lobsters and Crabs](#) in the Rhode Island/Massachusetts Wind Energy Area
- [Benthic Habitat Mapping](#) and Assessment in the Wilmington-East Wind Energy Call Area
- Collaborative [Fisheries](#) Planning for Virginia's Offshore Wind Energy Area



Physical Environment

- Virginia Ocean [Geophysical Survey](#) Phase II Analyses: Offshore Virginia Wind Energy Area



Environmental Monitoring

- Use [Finite-Volume Modeling](#) and the Northeast Coastal Ocean Forecast System in Offshore Wind Energy Resource Planning



Cultural & Archaeological Resources

- Maryland Collaborative [Archaeological Survey](#)
- Virginia Collaborative [Archaeological Survey](#)



What's Next?

Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles

Conducted by: New England Aquarium | Cornell Bioacoustics Research Program | Provincetown Center for Coastal Studies

Key Researchers: Scott Krauss, PhD | Charles Mayo, PhD | Robert Kenny, PhD | Chris Clark, PhD



Funded by: Massachusetts Clean Energy Center | Bureau of Ocean Energy Management (BOEM)

In this study, researchers collected visual (aerial) and acoustic data of marine mammals—particularly endangered whales and sea turtles—in the Massachusetts Wind Energy Area (WEA) and Rhode Island/Massachusetts WEA. Monthly aerial surveys were conducted between October 2011 and June 2015, totaling to 76 aerial surveys. The researchers also collected acoustic data between November 2011 and October 2012 using nine marine autonomous recording units (MARUs), six in the MA WEA and three in the RIMA WEA.

Findings

Both survey methods uncovered a relatively large number and diversity of marine mammals in the spring and summer. North Atlantic right whales were more common in the winter and spring (December through April). Three species of endangered sea turtles were observed during this study, and most turtles (mainly loggerhead and leatherback sea turtles) were observed during the summer and fall.

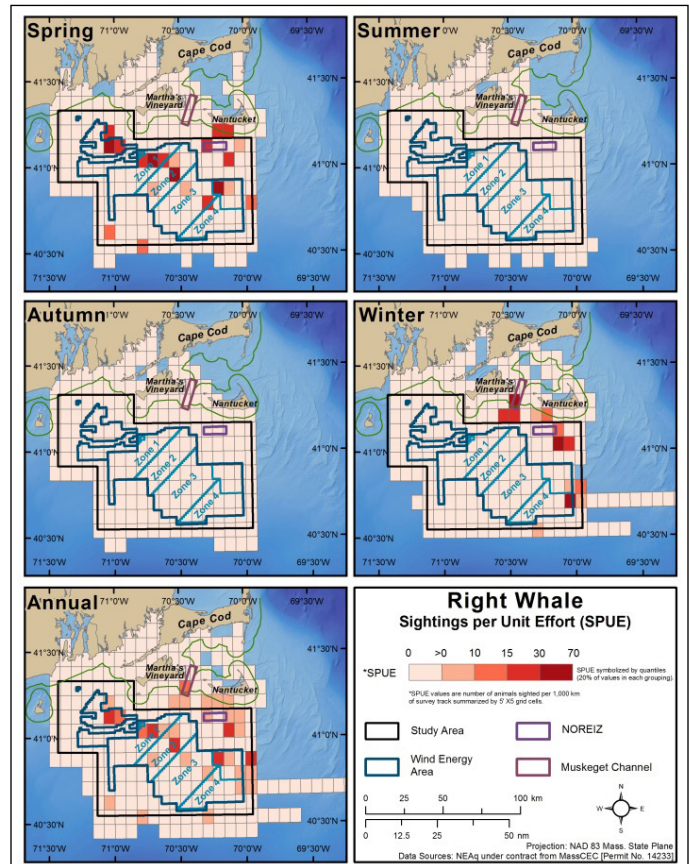
How BOEM will use this information

- For conducting environmental assessments for future offshore wind facilities
- For mitigating potential impacts to endangered species
- For informing the design, construction, and operation of future wind facilities

Where to find this study and data

Data are available upon request through the North Atlantic Right Whale Consortium at www.narwc.org/pdf/consortium_database.pdf.

The final report is available on the BOEM website at www.boem.gov/RI-MA-Whales-Turtles/.



Seasonal and annual sightings of the North Atlantic Right Whale in the study area.



Equipment used for monitoring whales. Left: acoustic recording instrument. Right: camera and mounting equipment.

Abundance and Distribution of Seabirds Off Southeastern Massachusetts, 2011–2015

Conducted by: College of Staten Island | City University of New York

Key Researchers: Richard Viet, PhD | Timothy White, PhD | Shannon Curley, PhD



Funded by: Massachusetts Clean Energy Center | Bureau of Ocean Energy Management (BOEM)

To identify areas of high bird densities in the wind energy areas offshore Massachusetts and Rhode Island, researchers conducted 38 aerial surveys from November 2011 to January 2015 to map the distribution and abundance of seabirds.

Findings

Two areas exhibited persistent high densities of birds — one near Nantucket Shoals and a second in the Muskeget Channel. Nantucket Shoals was a hotspot for long-tailed ducks and white-winged scoters and is also a likely hotspot for common and roseate terns.

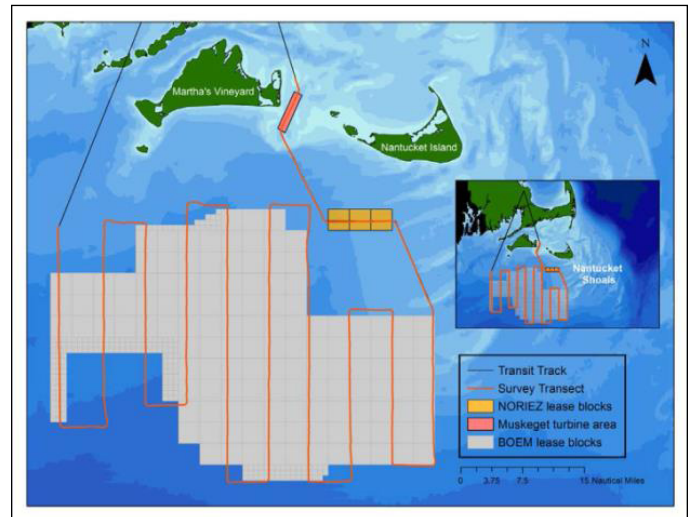
How BOEM will use this information

- For conducting environmental assessments for future offshore wind facilities
- For mitigating potential impacts to endangered species
- For informing the design, construction, and operation of future wind facilities

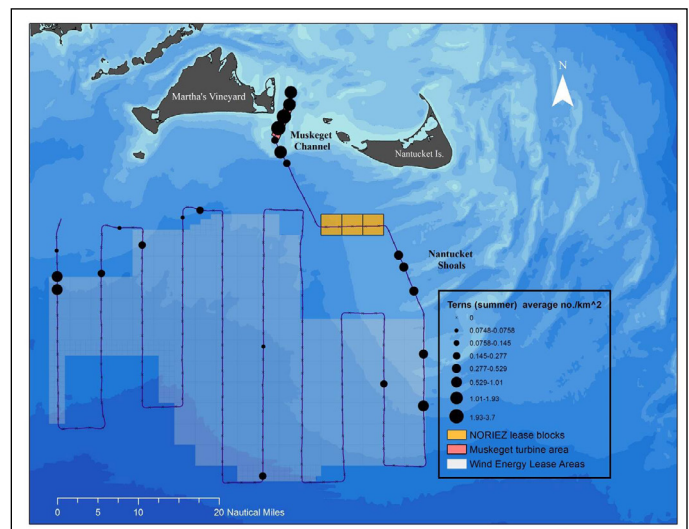
Where to find this study and data

The data were provided to the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP) for incorporation into distribution and abundance maps.

The final report is available on the BOEM website at www.boem.gov/RI-MA-Seabirds/.



Study areas and configuration of transect lines.



Winter distribution of long-tailed ducks.

Modeling At-Sea Occurrence and Abundance of Marine Birds to Support Atlantic Marine Renewable Energy Planning Phase I Report

Conducted by: National Oceanic and Atmospheric Administration (NOAA) | National Centers for Coastal Ocean Science (NCCOS)

Key Researchers: Brian Kinlan, PhD | Arliss Winship, PhD

 **Funded by:** Bureau of Ocean Energy Management (BOEM)

To better understand where marine birds spend their time on the open ocean, this project produced maps of sighting data for marine bird species in U.S. Atlantic Outer Continental Shelf (OCS) waters. The data used in this study spanned over three decades and were analyzed to address variations between surveys. Marine bird behavior and environmental factors were incorporated into a spatial predictive model for explaining patterns of bird distributions at sea.

Results

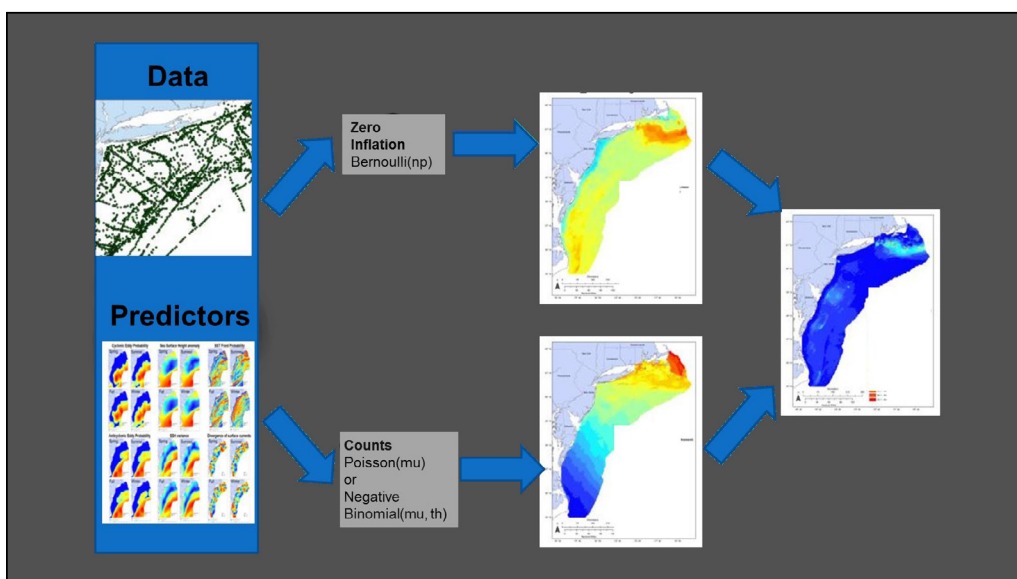
Seasonal and annual maps were produced showing the spatial distributions of 40 marine bird species in U.S. Atlantic OCS waters from Florida to Maine. A second phase of the project is currently underway to expand and improve the modeling and results of this first report.

How BOEM will use this information

- For identifying appropriate areas for potential offshore renewable energy leases
- For developing mitigation measures within leased areas

Where to find this data

- BOEM final report: www.boem.gov/ESPIS/5/5512.pdf
- Study data: <http://coastalscience.noaa.gov/projects/detail?key=279>
- Interactive maps in the Northeast Ocean Data Portal: www.northeastoceandata.org/data-explorer/?birds
- Interactive maps in the Mid-Atlantic Ocean Data Portal: <http://midatlanticocean.org/data-portal/>



Process for data reduction into relative distribution and abundance maps.

Risk of an Offshore Wind Project to a Migrant Shorebird

Conducted by: Western EcoSystems Technology, Inc.

Key Researchers: Caleb Gordon, PhD | Chris Nations, PhD

 **Funded by:** Bureau of Ocean Energy Management (BOEM)

In this study, the researchers estimated the potential fatality rates of rufa red knots resulting from possible collisions at a future offshore wind energy facility approved for construction offshore of Nantucket Sound, MA. The researchers developed a predictive model to account for a variety of factors such as migratory patterns, rufa red knot flight characteristics, and environmental conditions.

Findings

The model predicted an average rufa red knot collision fatality rate of one fatality every 6.25 years at the approved facility. Collisions with stationary structures, particularly turbine towers, accounted for roughly 90% of all collision fatalities in most simulations.

How BOEM will use this information and model

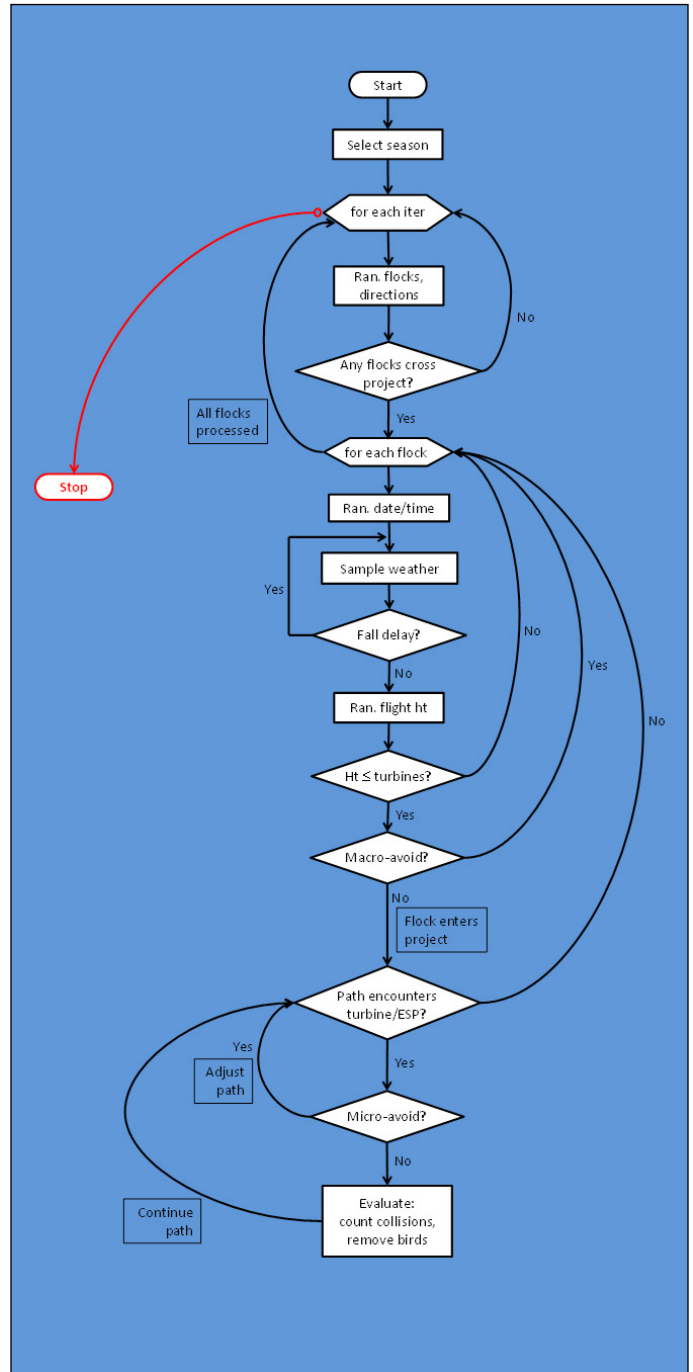
- For evaluating the risk of collision with wind turbines at different locations along the Atlantic coast where red knots are known to occur

Where to find this study

The final report is available on the BOEM website at www.boem.gov/WEST-final-report-M14PD00050/.



Red knot.



Flow chart representing the operation of the collision risk model.

Mobile Avian Survey Data Collection Software Application

Conducted by: Biodiversity Research Institute

Key Researchers: Andrew Gilbert, PhD | Ian Stenhouse, PhD

 **Funded by:** Bureau of Ocean Energy Management (BOEM)

Offshore seabird, marine mammal, and sea turtle surveys are necessary to collect baseline and project-specific data for offshore development. Previously, there were only a handful of computer applications designed to collect such data in the field, so the developers created SeaScribe, an application that collects standardized, quality-controlled marine animal survey data.

Findings

SeaScribe makes it possible to collect uniform survey data, while giving users flexibility to add data fields as necessary to satisfy research needs. The app can be used with both Android and Apple iOS operating systems and includes on-the-fly data checking, data standardization across surveys, improved data entry design, and reduced time to access the quality-controlled data.

How BOEM will use this application

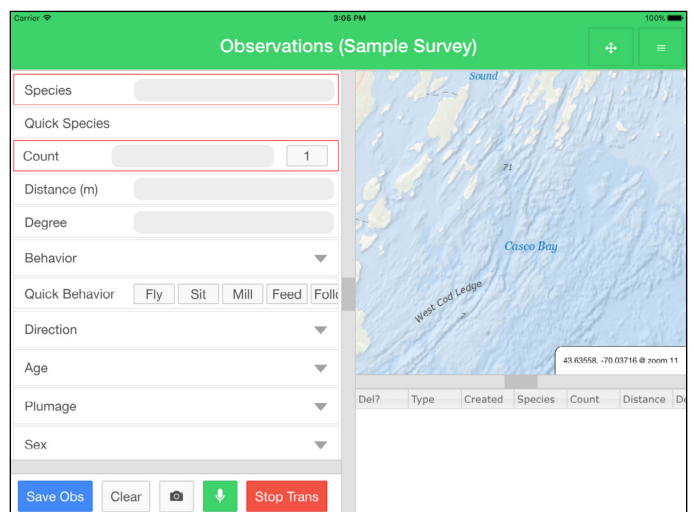
- For collecting standardized field observations from researchers
- For providing valuable data to established data repositories
- For developing maps showing abundance and distribution of birds along the Atlantic coast

Where to find this app

SeaScribe and associated user's manual are available on the BOEM website at www.boem.gov/Survey-Guidelines/.



Observing birds in the North Atlantic.



Example data entry page from SeaScribe.



The Identification of Port Modifications and the Environmental and Socioeconomic Consequences

Conducted by: ESS Group, Inc.

Key Researchers: Payson Whitney III | Stephanie Wilson | Stephanie Chaston | Chris Elkinton, PhD | Alex Uriate, PhD

 **Funded by:** Bureau of Ocean Energy Management (BOEM)

In this study, researchers assessed the Atlantic coast port facilities for port expansion and modifications needed to support proposed Atlantic offshore wind energy development projects. The study also addressed potential environmental and socioeconomic impacts of these modifications and discussed possible mitigation measures.

Findings

Today's ports have many of the capabilities needed to support offshore wind development, but very few ports can accommodate the heaviest construction components. Environmental and socioeconomic impacts of potential port modifications are largely location specific. Many complex factors contribute to port selection.

How BOEM will use this information

- For conducting environmental reviews of offshore wind energy projects
- For assessing environmental and socioeconomic impacts of port expansion and modification projects



Specialized cranes lifting a wind turbine blade. *Photo courtesy of Port of Vancouver USA*

Where to find this study

The final report is available on the BOEM website at www.boem.gov/ESPIS/5/5508.pdf.



Section of a wind turbine tower.

Spatial and Temporal Distributions of Lobsters and Crabs in the Rhode Island/Massachusetts Wind Energy Area

Conducted by: University of Rhode Island

Key Researchers: Jeremy Collie, PhD | John King, PhD



Funded by: University of Rhode Island | Bureau of Ocean Energy Management (BOEM)

This study was conducted to establish a baseline of lobster and crab distribution in the southern New England area prior to wind energy development activities. With the assistance of local fishermen, lobster traps were placed offshore Rhode Island and Massachusetts north of Cox Ledge. This study also evaluated the lobster stock, which is in decline in the area. An additional field season is scheduled for 2017.

Findings

The American lobster population on Cox Ledge is relatively healthy, with low rates of shell disease compared to inshore waters. Greater densities of lobsters were found in shallower sites and areas with boulders or a transition from boulders to medium sand. Jonah crabs were the most numerous species caught and generally were found in areas of soft and sand substrates.

How BOEM will use this information

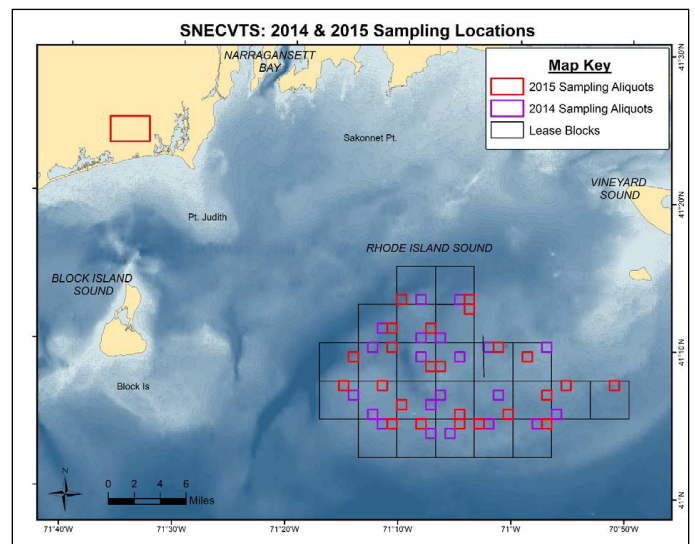
- For evaluating changes in distribution and abundance after construction of wind facilities in the area
- For working with fisheries to improve management of offshore lobster and Jonah crab

Where to find this study

The interim final report is available on the BOEM website at www.boem.gov/Spatial-and-Temporal-Distributions/.



Lobster trap.



Study site in the Rhode Island/Massachusetts Lease Area.

Benthic Habitat Mapping and Assessment in the Wilmington-East Wind Energy Call Area

Conducted by: National Oceanic and Atmospheric Administration (NOAA) | University of North Carolina (UNC)

Key Researchers: Christopher Taylor, PhD | Avery Paxton | Christine Voss, PhD



Funded by: UNC | NOAA | National Center for Coastal Ocean Science (NCCOS) | Bureau of Ocean Energy Management (BOEM)

The researchers surveyed the Wilmington-East Call Area for fish habitat, including rocky outcrops and shipwrecks, using multi-beam and side scan sonar technology. Divers visually assessed the benthic and fish communities, the seasonal changes in communities, and the influence of sand and sediment movement around hardbottom habitats.

Findings

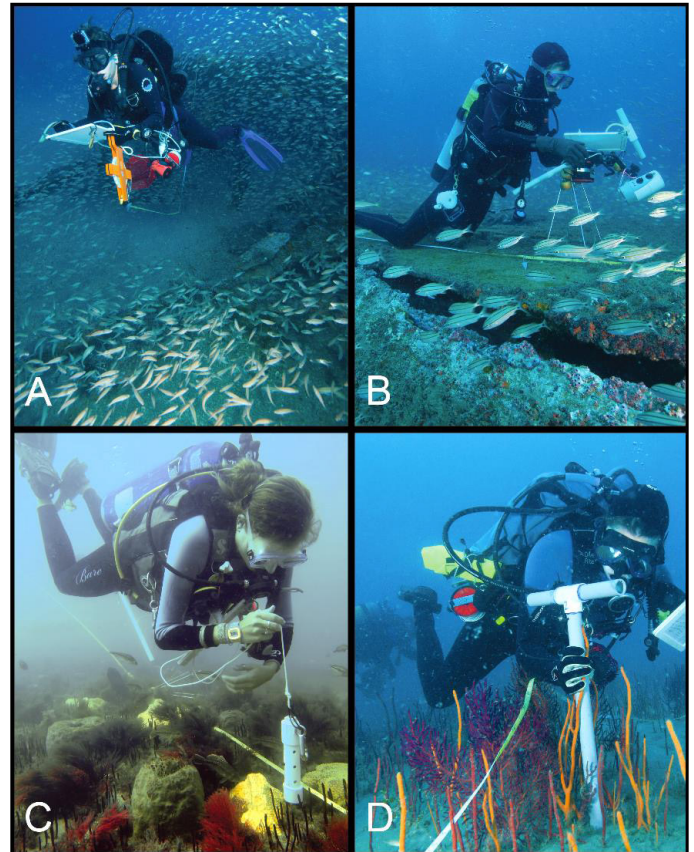
Rocky outcrops are clustered in patches in discrete regions of the study area and seem to correlate with areas used for fishing. Five shipwrecks were confirmed, and their positions were more accurately identified. Two new potential shipwreck sites were also found in the study area.

How BOEM will use this information

- For evaluating the best locations for installation of turbines and related structures within the Wilmington-East Wind Energy Area (WEA)
- For determining the need to avoid hard grounds that are important to fish, fisheries, and shipwrecks that have cultural value

Where to find this study

- Final report: www.boem.gov/BOEM-WECA-Final-Report-NCCOS/
- Appendices: www.boem.gov/Appendices-2016-003-NOAA-Tech-memo-NOS-NCCOS-196/



Survey methods for seasonal assessments of hardbottom habitat and biological associates: A) fishes along a belt transect; B) benthic community in a photoquadrat; C) structural complexity using a water level logger; D) sediment depth using a T-rod.

Collaborative Fisheries Planning for Virginia's Offshore Wind Energy Area

Conducted by: Virginia Coastal Zone Management Program (VA CZM)

Project Manager: Laura McKay



Funded by: Virginia Department of Mines, Minerals, and Energy (DMME) | Bureau of Ocean Energy Management (BOEM)

To prepare for potential development of wind energy facilities off the coast of Virginia, BOEM, DMME, and VA CZM work together with recreational and commercial fishing communities to minimize space use conflicts. Through a collaborative process, the project developed accurate fine-scale maps of commercial, recreational, and charter fishing areas.

Findings

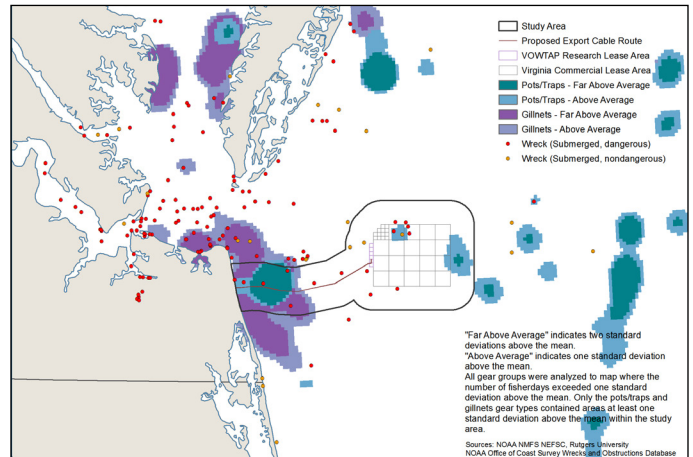
The highest level of overlap between commercial fishing and potential offshore wind development occurs in the proposed export cable route for the Virginia Offshore Wind Technology Advancement Project (VOWTAP). The study found that the gillnet and pots/traps communities were the highest users of the study area. The study identified best management practices on communication, design, operation, and environmental monitoring of a commercial wind facility.

How BOEM will use this information

- To understand where fishing occurs and the best ways to work with the fishing community
- To determine how to avoid or mitigate impacts to fishermen through the use of best management practices

Where to find this study

The final report is available on the BOEM website at www.boem.gov/VWEA-Final-Report/.



Map of fishing areas from the Communities at Sea study.



Public meeting with fishermen.



Meeting participant providing information about fishing locations using the interactive computer program.

Virginia Ocean Geophysical Survey Phase II Analyses: Offshore Virginia Wind Energy Area

Conducted by: Fugro Consultants, Inc.

Key Researchers: Susan Sullivan | Kevin Smith | Dave Sackett

Funded by: Virginia Department of Mines, Minerals, and Energy | Bureau of Ocean Energy Management (BOEM) | Fugro Consultants, Inc.

In 2013, Fugro Consultants conducted a regional geophysical survey across the offshore Virginia Wind Energy Area (WEA) and evaluated the subsurface geology of the Virginia Outer Continental Shelf for data that can be used in planning wind energy development activities in this area. For the Phase II report completed in 2016, the researchers reprocessed the 2013 data and continued their analysis.

Findings

Phase II data analyses increased the resolution/definition in the shallower parts of the seafloor and mapped a deeper portion of the subsurface (up to about 50 meters below).

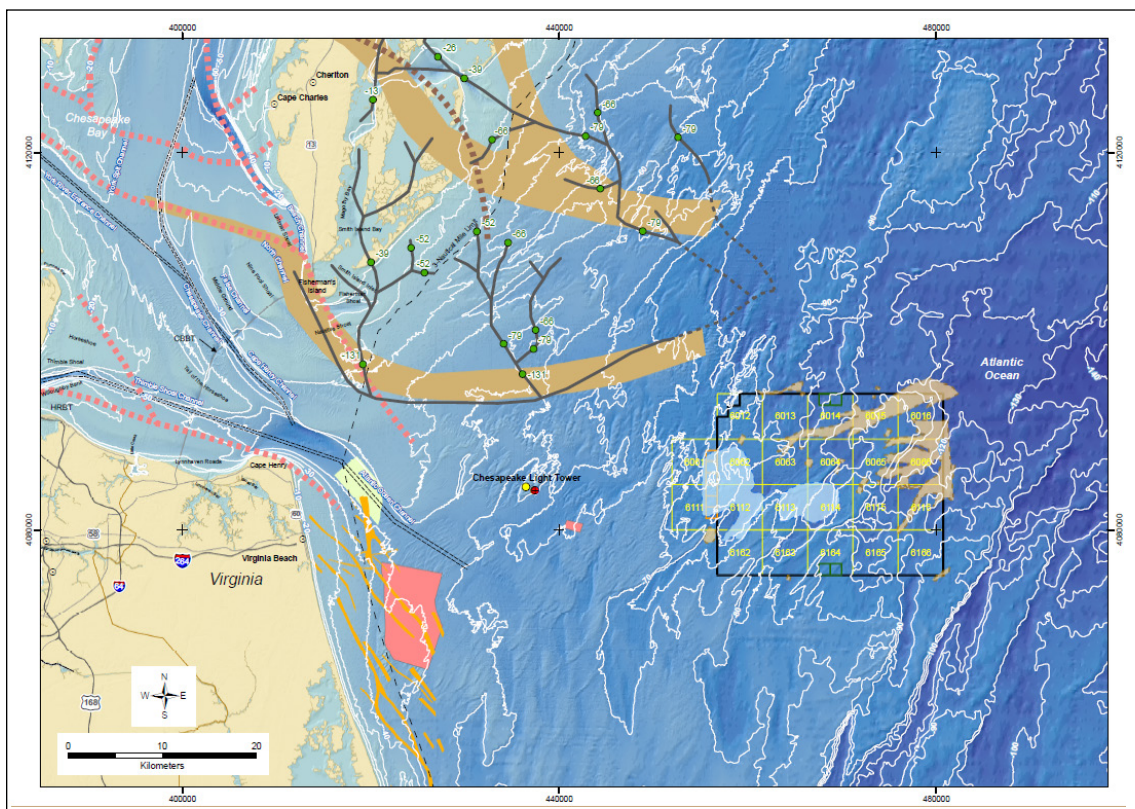
This study also identified methods and recommendations for future regional seismic surveys.

How BOEM will use this information

The regional broad-based survey data is useful for identifying specific areas where more detailed surveys should be conducted in this area when planning wind turbine placement and design.

Where to find this study

The data are available from NOAA National Centers for Environmental Information (www.ncei.noaa.gov).



Interpreted paleo-channel locations.

Use of Finite-Volume Modeling and the Northeast Coastal Ocean Forecast System in Offshore Wind Energy Resource Planning

Conducted by: University of Massachusetts-Dartmouth

Key Researchers: Changsheng Chen, PhD | Robert Beardsley, PhD | Jianhua Qi, PhD | Huichan Lin, PhD



Funded by: Bureau of Ocean Energy Management (BOEM)

Wind facilities can cause some changes in wave height and surface currents during storm events. This study evaluated the effect of wind turbines on ocean circulation patterns and biological process (i.e. larval transport) during severe storm events. Using a finer-scale version of UMass-Dartmouth's Northeast Coast Forecast System, the researchers evaluated a hypothetical wind facility using data from two historic storms to predict potential changes in ocean circulation. Additional particle tracking experiments showed how the turbines might affect larval transport.

Findings

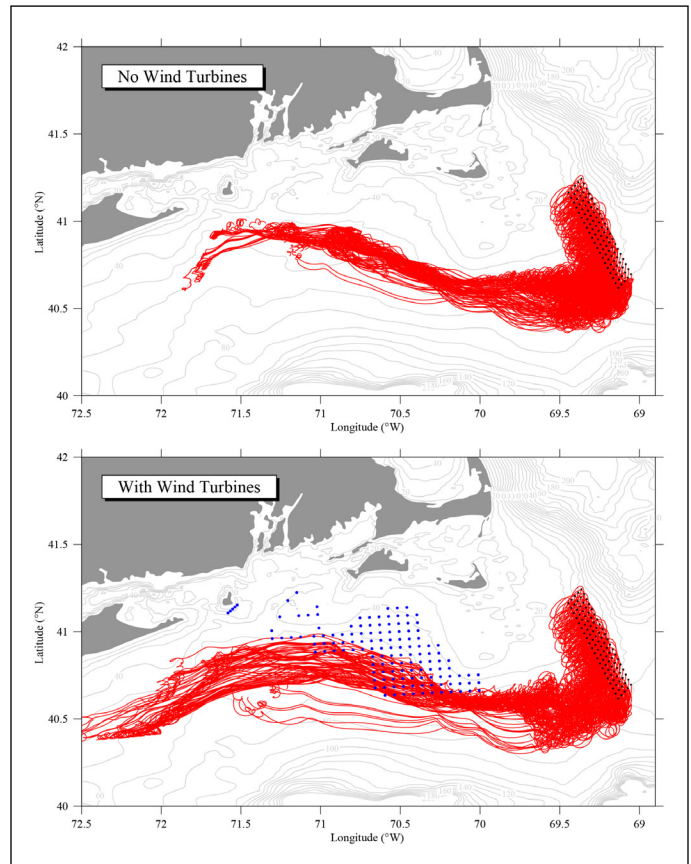
According to the study results, during storm events a wind turbine facility may cause more significant impacts on the eastern shelf of Block Island than over the outer shelves off Massachusetts and Rhode Island. Wind turbines in the proposed region are predicted to not have a significant influence on the southward larval transport, although the turbines could cause a relatively large cross-shelf larval dispersion.

How BOEM will use this information

- To address concerns that larvae will not settle in the same areas as they have in the past due to changes in ocean circulation patterns caused by the proposed wind turbines
- To provide new modeling techniques that may be used for future proposed wind facilities

Where to find this study

The final report is available on the BOEM website at www.boem.gov/NE-Ocean-Forecast-Model-Final-Report/.



Model-predicted trajectories of particles for the cases without (upper) and with (lower) wind turbines. A total of 100 turbines (black dots) were placed in the model domain.

Maryland Collaborative Archaeological Survey

Conducted by: Bureau of Ocean Energy Management (BOEM) | National Oceanic and Atmospheric Administration (NOAA) | Monitor National Marine Sanctuary

Key Researchers: Brandi Carrier | William Hoffman | Joseph Hoyt | Will Sassarossi



Funded by: BOEM

In anticipation of offshore wind energy development, this study was conducted to identify archaeological sites (shipwrecks) for consideration under the National Historic Preservation Act. Using existing remote sensing data collected by the Maryland Energy Administration, the researchers identified targets — potential shipwrecks — within the Maryland Wind Energy Area (WEA). The team then investigated eight of those targets using side scan sonar, sector scanning sonar, and direct investigation by divers.

Findings

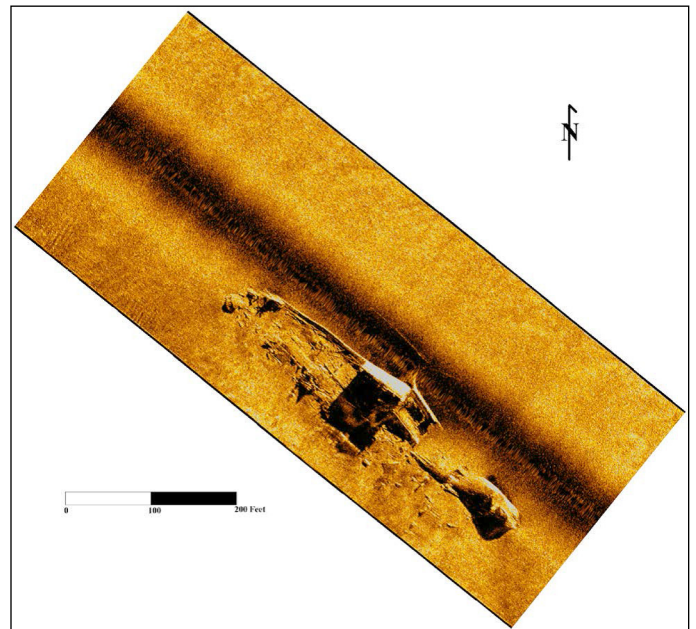
Four targets were confirmed to be shipwrecks, and the study recommended avoidance buffers and additional investigation for these sites. The remaining four targets are modern debris or geological features; no further investigation was recommended.

How BOEM will use this information

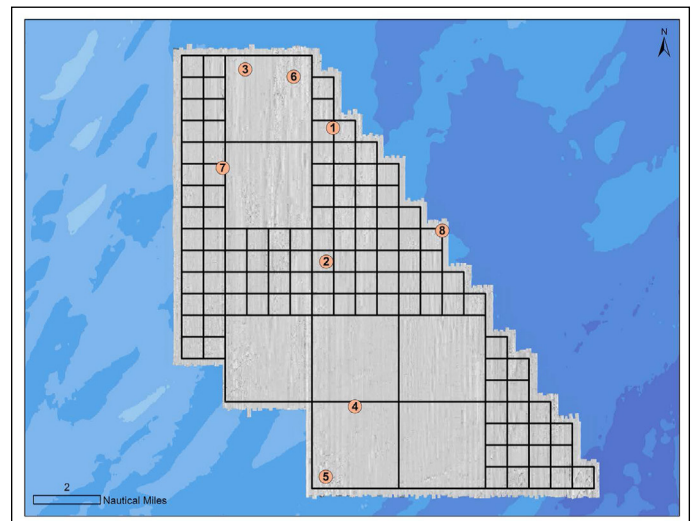
- For reducing the impact of wind energy development on archaeological sites

Where to find this study

The final report is available on the BOEM website at www.boem.gov/MCAS-Report-Final-Public/.



Side scan sonar image of a shipwreck within the Maryland Wind Energy Area.



Locations examined for potential shipwrecks based on previous seafloor surveys.

Virginia Collaborative Archaeological Survey

Conducted by: Bureau of Ocean Energy Management (BOEM) | National Oceanic and Atmospheric Administration (NOAA) | Monitor National Marine Sanctuary

Key Researchers: Brandi Carrier | William Hoffman | Joseph Hoyt | Will Sassarossi



Funded by: BOEM

In anticipation of offshore wind energy development, this study was conducted to identify archaeological sites (shipwrecks) for consideration under the National Historic Preservation Act. The project team used survey information from the Virginia Offshore Wind Technology Advancement Project (VOWTAP) to identify potential archaeological sites (shipwrecks) within and near the Virginia Wind Energy Area (WEA). The researchers investigated 13 locations using side scan sonar, sector scanning sonar, and direct observation by divers.

Findings

Six sites were confirmed to be shipwrecks, three sites were not conclusively identified, and four were determined to be modern shipwrecks and debris or geological features. The study also identified recommendations for each site on whether additional investigation or avoidance buffers are needed.

How BOEM will use this information

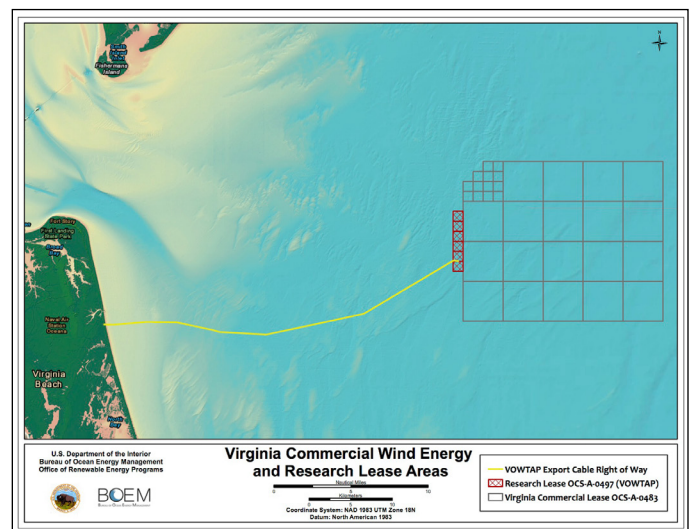
- For reducing the impact of wind energy development on archaeological sites

Where to find this study

The final report is available on the BOEM website at www.boem.gov/VCAS-Report/.



Diver investigating an encrusted anchor.

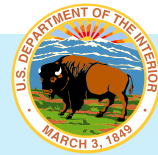
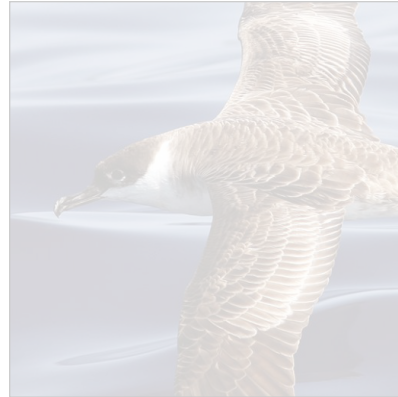
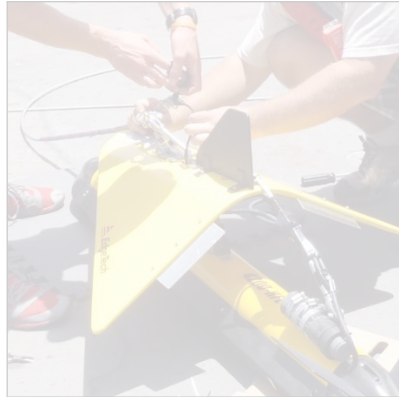
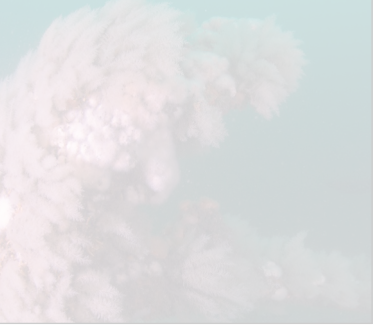


Virginia Wind Energy Area

Here are few of the new and continuing studies that are underway:

- In November 2016, BOEM and University of Rhode Island launched a new project: “**Analysis of the Effects of the Block Island Wind Farm on Rhode Island Recreation and Tourism Activities.**” The study will assess the effects of the first U.S. offshore wind project on recreational and tourism activities and will identify methodologies for assessing socioeconomic benefits from offshore wind development.
[Expected completion: 2019]
- BOEM is conducting four studies to extend the **monitoring of Atlantic sturgeon in wind energy areas off New York, Delaware, Maryland, and Virginia.** Atlantic sturgeon are being tagged with telemetry devices that send a signal to receivers placed on the ocean floor. The signals are individually coded, so researchers can track the movements of individuals.
[Expected completion: 2018–2019]
- Working with Fish and Wildlife Service, BOEM is continuing to fund the use of nanotags to **track the movements of common terns, roseate terns, piping plovers, and red knots between Long Island and Nantucket Island.** For the past four years, tags were placed on these small birds, and towers were erected at several locations to track their movements.
[Expected completion: 2018]

BOEM encourages input from the public when identifying topics for environmental studies. Opportunities to participate are communicated through our stakeholder announcements. You can sign up on the BOEM website at www.boem.gov.



The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the sound use of our land and water resources, protecting our fish, wildlife and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island communities.

The Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management works to manage the exploration and development of the nation's offshore resources in a way that appropriately balances economic development, energy independence, and environmental protection through oil and gas leases, renewable energy development and environmental reviews and studies.