

# MIMS OCEAN SCIENCE

VOLUME 6 ISSUE 3  
JULY/AUGUST/SEPTEMBER 2009

THE SCIENCE & TECHNOLOGY JOURNAL OF THE MINERALS MANAGEMENT SERVICE



**The Big Picture:  
Mexico-U.S. Loop  
Current Studies**

**Kemp's Ridley  
Sea Turtle**

**First Offshore  
Wind Development  
Exploratory Leases**

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Grant Project**

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Conservation  
and Interagency  
Collaboration**

**Making Waves:  
Renewable Energy  
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**Superstructure Ice  
Protection  
Technologies**



MMS *OCEAN SCIENCE* is published quarterly by the Minerals Management Service to communicate recent ocean science and technological information and issues of interest related to offshore energy recovery, ocean stewardship, and mineral revenues.



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Top left: The Gulf State Pier, Gulf Shores, Alabama. Photo courtesy of Alabama State Parks.

Top middle: Kemps' ridley hatchlings released by Park Rangers at Padre Island National Seashore. Photo courtesy of the National Park Service.

Top right: Dr. Ann Jochens aboard the research vessel *Gyre* in the Gulf of Mexico.

Main photo: Icing on a drilling rig blowout preventor. Stock photo courtesy of Schatz Publishing.

Back page: Background platform image by Gregory S. Boland.

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[www.mms.gov](http://www.mms.gov)

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# OCEAN SCIENCE WELCOMES LIZ BIRNBAUM,

## 10<sup>TH</sup> DIRECTOR OF THE MINERALS MANAGEMENT SERVICE

**T**he Minerals Management Service (MMS) has a new leader. S. Elizabeth (Liz) Birnbaum assumed her duties as the 10<sup>th</sup> Director of MMS on July 15, 2009. Appointed by Secretary of the Interior Ken Salazar on June 25, 2009, Birnbaum is responsible for 1,600 employees and an annual budget of \$323 million.

As MMS Director, Birnbaum administers programs that ensure the effective management of renewable and traditional energy and mineral resources on the Nation's Outer Continental Shelf (OCS), including the environmentally safe exploration, development, and production of oil and natural gas, and the collection and distribution of revenues for minerals developed on Federal and American Indian lands.

"I'm excited to join Secretary Salazar's team and continue his initiative to push our Nation toward a new energy frontier," Birnbaum said.

An attorney with 20 years of Federal and private sector experience in energy and environmental policy, Birnbaum received her J.D. degree

from Harvard University and her A.B. degree, magna cum laude, from Brown University. She was Editor in Chief of the Harvard Environmental Law Review, Vol. 8.

"Her in-depth knowledge of energy issues, natural resource policy and environmental law as well as her managerial expertise and work in coalition building will be especially important," Secretary Salazar said.

Before her appointment, Birnbaum was staff director of the Committee on House Administration. As Vice President for Government Affairs and General Counsel for American Rivers, Birnbaum directed advocacy programs for the Nation's leading river conservation organization.

At the Department of the Interior, Birnbaum was Associate Solicitor for mineral resources, and a special assistant to the Interior Solicitor. She was also counsel to the House Committee on Natural Resources.

Birnbaum takes the helm at an exciting time as MMS looks ahead into renewable energy activities



**"Her in-depth knowledge of energy issues, natural resource policy and environmental law as well as her managerial expertise and work in coalition building will be especially important."**

on the OCS and works to learn more about new technologies, the populations they may affect, and how to promote responsible use of them.

### MMS Mission

To manage the ocean energy and mineral resources on the Outer Continental Shelf and Federal and Indian mineral revenues to enhance public and trust benefits, promote responsible use, and realize fair value.

# THE BIG PICTURE: MEXICO-U.S. LOOP CURRENT STUDIES

**A**lthough often the basis of political boundaries, the planet's physical features have no political loyalties. While nations map lines of demarcation to indicate jurisdictions in the world's oceans, nature herself is apolitical.

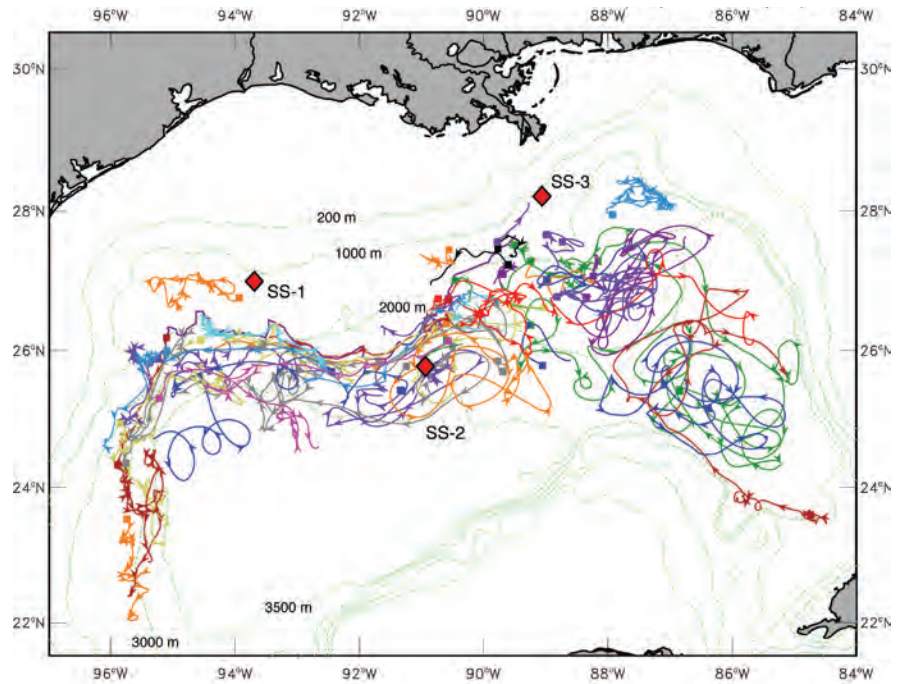
Each nation has special rights over the marine resources within its Exclusive Economic Zone (EEZ), which usually extends into the sea about 200 nautical miles from its coast. In the Gulf of Mexico, jurisdiction is divided into the Cuban, Mexican, and U.S. EEZ's.

But Gulf activities—storms, hurricanes, ocean circulation, and water temperature changes that can have regional as well as global effects—do not honor EEZ's.

Understanding the Gulf—particularly the Loop Current—is vital to hurricane forecasting, fisheries management, offshore energy operations and facility design, international transportation, the study of climate change, recreation, and other activities.

Although Mexico, the U.S., and Cuba share the effects of Gulf activity, and the same waters of the Gulf move through these nations' EEZ's, we typically conduct research separately, each in our own EEZ. This makes it difficult to have a unified picture of the Loop Current's dynamics.

Recently, however, the Minerals Management Service's (MMS) physical oceanographer Alexis Lugo-Fernández has bridged the EEZ gap by working directly with colleagues at Mexico's Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE) on a subject of great mutual interest: the dynamics of the Loop Current as it enters the Gulf through the Yucatan Channel.



Plotted tracks of drifter buoys used to measure currents over a 12-month period in the northern Gulf of Mexico (U.S. EEZ). These drifters are located below 1,000 meters (3,281 feet) in the water column.

The MMS has contracted with CICESE to conduct a 4-year study in the Mexican EEZ. The study, "Current Measurements in the Yucatan-Campeche Area in Support of Loop Current Dynamics Study," will provide data about the upstream conditions in the Loop Current and help improve forecasting of Loop Current eddy shedding and intrusions.

Working as partners with the Mexican colleagues is more fruitful for all parties than contracting with a U.S. group, who would then hire the Mexican group as subcontractors, because it enhances relations between the two nations and also leads to better science.

The collaboration also leverages ongoing measurements by Mexican scientists of the Yucatan-Loop Current in the Mexican EEZ. For

example, CICESE's Canek project, initiated in 1996, maintains an array of buoys across the Yucatan Channel from Yucatan to Cuba.

The Yucatan-Campeche study is the companion to "Dynamics of the Loop Current in U.S. Waters," being conducted by Science Applications International Corporation (SAIC) and also funded by MMS. Together the two studies—one in the U.S. EEZ and the other in Mexico's EEZ—will fill data gaps about the Loop Current's dynamics.

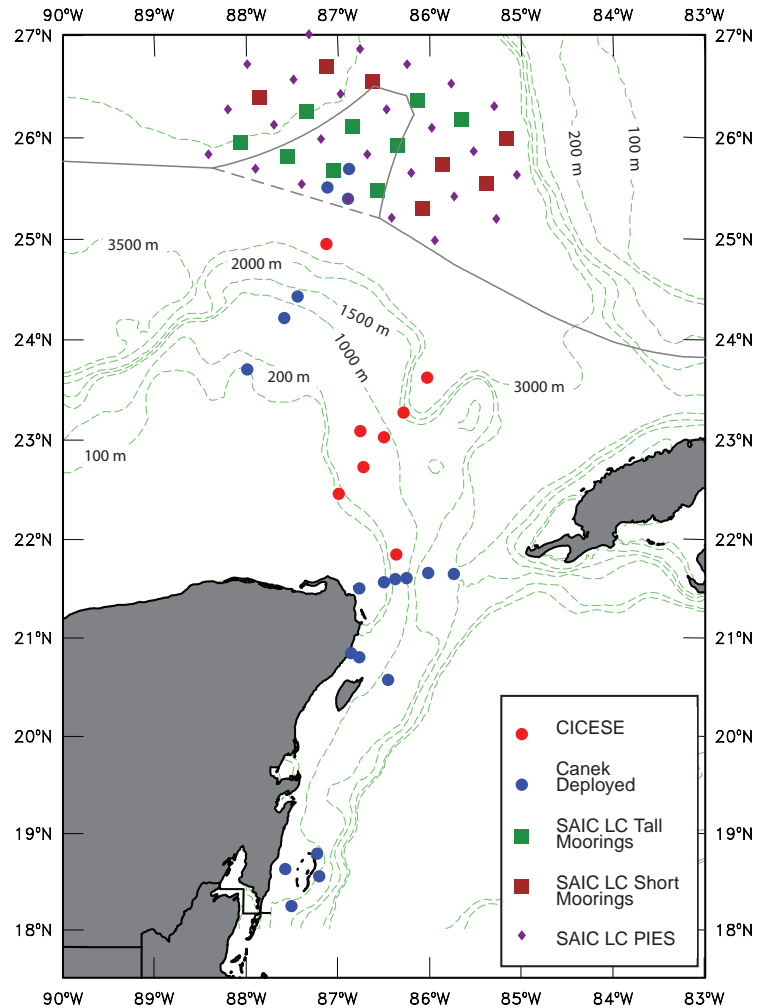
Specifically, the study teams will gather data and measurements to analyze the Loop Current's detachment processes, vertical coupling, and the effects of the Loop Current's frontal eddies in eddy shedding. Data will be collected using moorings,

pressure-inverted echo sounders (PIES, instruments that measure the water column's temperature and salinity), hydrographic surveys, and satellite data. The two teams will also collaborate on data analyses and preparing manuscripts for peer-reviewed journals.

The two teams discussed information gaps and research needs, then agreed on and coordinated locations for the moorings. Next year the Mexican team will deploy moorings in Cuban waters.

The CICESE team has deployed eight moorings in Mexican waters east of the Yucatan Peninsula, where the Yucatan Current is found. The moorings will gather measurements and data for two years. One was deployed in the Yucatan Channel at depths of about 1,000 meters (3,281 ft); six along a transect that ranges from 200 m (656 ft) to over 3,000 m (9,843 ft); and one deeper than 3,000 m (9,843 ft).

The companion studies will give a more integrated picture of the Loop Current's dynamics, and, in turn, improve forecasting to help MMS and industry better prepare for high currents and material fatigue while increasing safety and reducing downtime.



Moorings deployed in the Mexican EEZ (CICESE, Canek) and in the U.S. EEZ (SAIC).

#### FOR MORE INFORMATION

**“Dynamics of the Loop Current in the Eastern Gulf of Mexico,”**  
***Ocean Science*, 2008, Volume 5 Issue 4**

[www.gomr.mms.gov/homepg/regulate/environ/ocean\\_science/2008\\_archive.html](http://www.gomr.mms.gov/homepg/regulate/environ/ocean_science/2008_archive.html)

**T**he Loop Current is the main driving force in the Gulf. It is the main source of water into the Gulf, transporting warm salty water from the Caribbean Sea through the Yucatan Channel (the Yucatan Current). Once in the Gulf, it moves northward, then eastward, and exits (as the Florida Current) through the Straits of Florida. This is the beginning of the Gulf Stream Current, which is part of the circulation of the Atlantic Ocean.

During its north-south incursion cycle, the Loop Current sheds large warm or anticyclonic eddies, or rings, with diameters of 200-400 kilometers

(124-249 miles), that then propagate to the western Gulf at speeds of 3-4 knots (3.4-4.6 miles per hour), 4-8 kilometers (2-5 miles) per day. These eddies drift to the west, driving deep circulation almost everywhere in the Gulf.

This powerful current dominates the oceanographic variability of the Gulf, especially in deep waters where it may influence the current field through frontal eddies. The Loop Current is also thought to be the source of topographic Rossby waves and near-bottom trapped eddies.

# ALEXIS LUGO-FERNÁNDEZ

**T**he Minerals Management Service (MMS) is proud of the people whose work helps protect our Nation's resources. This quarter, *Ocean Science* talked with Dr. Alexis Lugo-Fernández, Physical Oceanographer in MMS's Gulf of Mexico Outer Continental Shelf Region.

**OS: Tell us about your background and how you came to work for MMS.**

**AL-F:** I did my B.S. in Physics and my M.S. in Marine Sciences at the University of Puerto Rico, then went to Louisiana State University for my Ph.D. in Marine Sciences. Near the end of my Ph.D., my major professor ran out of funding for my assistantship. The MMS was looking for an oceanographer, and I needed a job. A lucky confluence of needs brought me to MMS 20 years ago.

**OS: To you, what makes your work meaningful and interesting?**

**AL-F:** Being at MMS puts me in contact with the most recent observations and ideas about the circulation of the Gulf of Mexico, and that's exciting. Specifically: interacting with oceanographers across agencies and scientific disciplines; working on cutting edge projects in physical oceanography of the Gulf; and I'm encouraged to pursue my own scientific ideas and publish in peer-reviewed journals. Here I can let my curiosity fly .... An example is our analysis of the routes of Spanish galleons in the Gulf; I never dreamed that they navigated the way they did back then!

**OS: What do you do, specifically?**

**AL-F:** I identify information needs and data gaps in physical

oceanography and propose studies to meet those needs. The last thing I want to know is that an accident occurred because we did not know something or didn't have some oceanographic data. Because I interact with other groups I also have to be an administrator, a kind of "politician," and promote a coherent vision of where the research must go. So far ... so good.

**OS: What project or projects are most exciting to you?**

**AL-F:** I have three pet projects. First, I recently co-edited a monograph that updated our knowledge of physical oceanography of the Gulf of Mexico. Second, unraveling the dynamics of the Loop Current intruding into the Gulf and its associated eddy shedding, and, third, understanding the implications of Gulf circulation on the health of the Flower Garden Banks coral reefs.

Right now I'm focused on two studies in cooperation with our Mexican colleagues. The first, a study of the Loop Current in both U.S. and Mexican EEZ's, will help us understand this large current and will help hurricane forecasting. The second is a study of the Gulf's circulation using submerged drifters.

**OS: You probably work with some interesting people.**

**AL-F:** I work with some of the leading oceanographers in the country, MMS coral reef biologists, a group of German oceanographers working in the



Dr. Alexis Lugo-Fernández

Gulf, air quality scientists, and oceanographic engineers from private industry. Each gives me a new perspective on my job and the science of oceanography. But my most cherished acquaintances are the Mexican oceanographers; as a Spanish speaker, I learned the technical jargon quickly and we are all learning about our cultural idiosyncrasies.

**OS: What's coming up next?**

**AL-F:** My ultimate vision is to have ocean current measurements over almost the entire Gulf and at several depths, and a much-improved understanding of its 3-D circulation. With the programs undertaken by Mexico and MMS, and help from other groups, this should be nearly achieved by the time I retire. I'd like to leave the next generation of oceanographers a series of observed mean current maps and better knowledge of the Gulf's circulation.

## FOR MORE INFORMATION

***Circulation in the Gulf of Mexico: Observations and Models. 2005. Geophysical Monograph Series 161.***

[www.agu.org/cgi-bin/agubooks?topic=OS&book=OSGM1614262&search](http://www.agu.org/cgi-bin/agubooks?topic=OS&book=OSGM1614262&search)

Since the time of the dinosaurs, 150 million years ago, sea turtles have lived in the Earth's oceans. All five Gulf of Mexico species are listed as either threatened or endangered under the Endangered Species Act.

The Kemp's ridley (*Lepidochelys kempii*) is the smallest and the most endangered marine turtle in the world. In the U.S., Federal jurisdiction over the Kemp's ridley is shared by the U.S. Fish and Wildlife Service (beaches) and by the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (waters).

Adults average 24-28 inches (60-70 centimeters) long and weigh about 100 pounds (45 kilograms). Adults reach sexual maturity when they are between 10 and 15 years old. Hatchlings and juveniles are dark gray, but, as they mature, their carapace (top shell) becomes dark olive green and their plastron (bottom shell) becomes a pale yellow or cream.

Kemp's ridleys are found throughout the Gulf and along the U.S. Atlantic coast, but they nest only on particular coastal beaches in Mexico and Texas. Juveniles are probably carried by currents up along the Atlantic coast. Adults favor the near and inshore waters of the northern Gulf and are often found in neritic (sandy or muddy bottom) habitats where they feed mainly on crabs but also eat fish, jellyfish, and mollusks.

Synchronized nesting, seen only in the Kemp's ridley and the olive ridley, is one of the most unique behaviors in the natural world. Large groups of Kemp's ridleys gather off the main nesting beach near Rancho Nuevo, in Tamaulipas, Mexico. From May to June, aggregations of females come ashore and nest, an event called an *arribada* (Spanish for "arrival"). Some also nest on the coastal beach of the Mexican state of Veracruz and at Padre Island National Seashore, Texas. Females typically nest twice a year, returning each year to the same beach.

The Kemp's ridley population dropped precipitously from the late 1940's to the mid-1980's because of intensive egg collection, killing of nesting females, and incidental capture and drowning in shrimp trawls. In 1947, one *arribada* had an estimated 40,000 nesting females; 40 years later, one entire nesting season saw fewer than 250 nesting females.



Nesting female Kemp's ridley sea turtle. Photo courtesy of National Park Service.

Last year marked the 30th anniversary of Mexico-U.S. cooperative conservation to prevent the extinction of Kemp's ridleys. Since the 1960's the Kemp's ridley has been legally protected in Mexico; conservation efforts there are ongoing. Since 1977, the Rancho Nuevo nesting beach has been part of a reserves system for sea turtles; in 2002 it was designated a Natural Protected Area. At Padre Island National Seashore, the National Park Service and the U.S. Geological Survey work with volunteers in a "head start" program to locate and collect nests before predators can reach them. Eggs are incubated, then hatchlings are released on the beach.

Today the primary threat to Kemp's ridleys is incidental capture and drowning in fishing gear, especially shrimp trawls and gill nets. But the Kemp's ridley—like all sea turtles worldwide—faces many threats.

Kingdom:	Animalia
Phylum:	Chordata
Class:	Reptilia
Order:	Testudines
Family:	Cheloniidae
Genus:	<i>Lepidochelys</i>
Species:	<i>kempii</i>

## FOR MORE INFORMATION

**Kemp's Ridley Turtle, Office of Protected Resources, NOAA Fisheries**

[www.nmfs.noaa.gov/pr/species/turtles/kempstridley.htm](http://www.nmfs.noaa.gov/pr/species/turtles/kempstridley.htm)

**Kemp's Ridley Sea Turtle, Padre Island National Seashore, National Park Service**

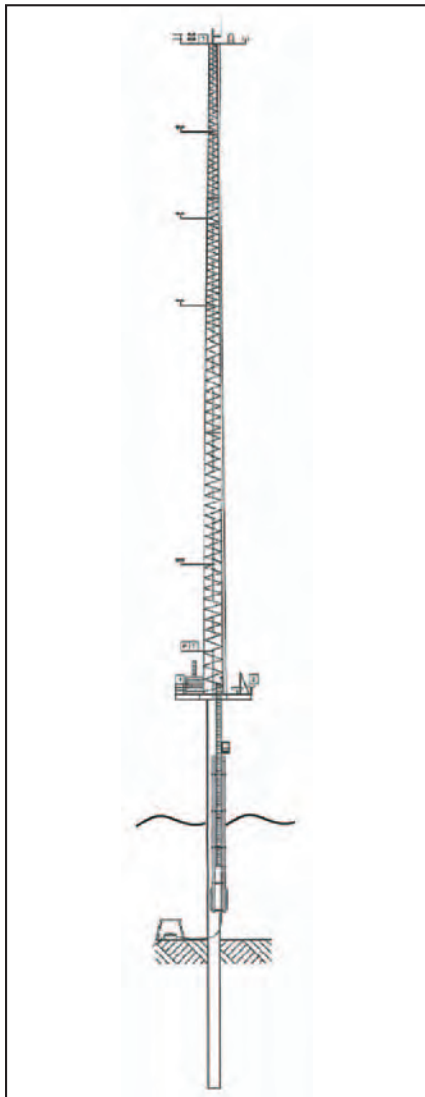
[www.nps.gov/pais/naturescience/kridley.htm](http://www.nps.gov/pais/naturescience/kridley.htm)

# MMS ISSUES FIRST OFFSHORE WIND DEVELOPMENT EXPLORATORY LEASES

*“The summer wind came blowin’ in from across the sea...”*

When Frank Sinatra sang those lyrics in 1965, he probably wasn’t thinking of wind turbines off the coasts of New Jersey and Delaware.

But on June 23, 2009, the first steps were taken in developing offshore wind turbine projects when the Minerals Management Service (MMS) issued five exploratory leases for renewable energy production on the Outer



Meteorological tower, lattice-type mast on a monopile foundation. Photo courtesy of Fishermen’s Energy of New Jersey.

Continental Shelf (OCS) offshore Delaware and New Jersey. These are the first Federal leases in support of offshore wind power.

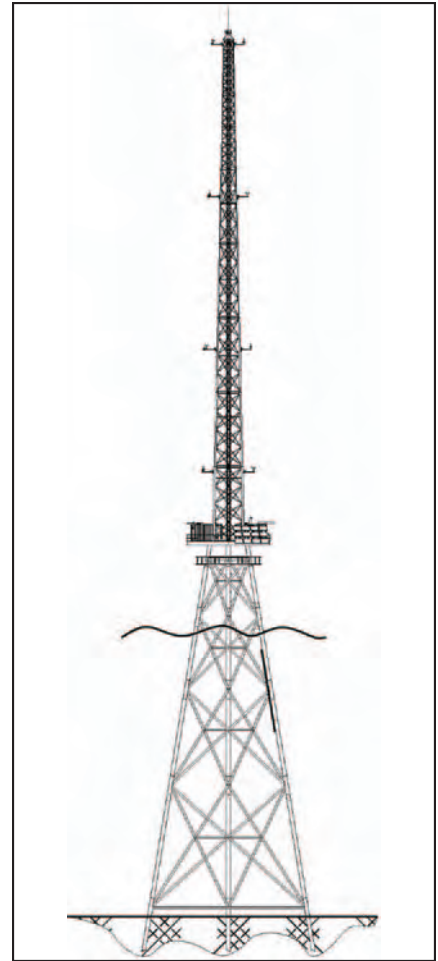
The leases, developed under an Interim Policy, authorize data gathering activities and allow for the construction of meteorological towers on the OCS from 6 to 18 miles (9.65 to 29 kilometers) offshore to collect site-specific data on wind speed, intensity, and direction.

Leases were issued to Bluewater Wind Delaware, Bluewater Wind New Jersey, Deepwater Wind, and Fisherman’s Energy of New Jersey.

New Jersey actively pursues offshore wind development through State incentive programs such as grant solicitations, reimbursement programs, and renewable energy portfolio standards. To expedite the progress of offshore wind energy development, the New Jersey Board of Public Utilities established a meteorological tower reimbursement program that provides \$4 million for each company.

Delaware ratified a power purchase agreement in 2008 between Delmarva Power Company and Bluewater Wind Delaware for up to 200 megawatts (enough to power 1.2-1.5 million homes).

Currently, most data comes from sea-level buoys, but what is needed is data about wind speed throughout the course of a year, measured at the height of a wind turbine’s hub, which may be as high



Meteorological tower with a lattice-type mast on a steel jacket foundation. Photo courtesy of Deepwater Wind.

as 100 meters (328 feet) in some cases. Data will be shared with MMS to support future renewable energy projects and to help coastal States meet renewable energy portfolio standards.

## FOR MORE INFORMATION

**Fact Sheet: Proposed Outer Continental Shelf Renewable Energy Limited Leases Off the Shores of Delaware and New Jersey, MMS**

[www.mms.gov/ooc/press/2009/FactSheet.htm](http://www.mms.gov/ooc/press/2009/FactSheet.htm)

**MMS Renewable Energy Program**

[www.mms.gov/offshore/renewableenergy/regulatoryinformation.htm](http://www.mms.gov/offshore/renewableenergy/regulatoryinformation.htm)





# GULF STATE PARK PIER: ALABAMA'S FIRST CIAP GRANT PROJECT

Fishing from the new Gulf State Park Pier, Gulf Shores, Alabama. Photo courtesy of Alabama State Parks.

**A**fter wreaking havoc in the Caribbean, Hurricane Ivan, a Category 3 hurricane, struck near Gulf Shores, Alabama, on September 7, 2004. Ivan washed away as much as 164 feet (50 meters) of beach, and the average shoreline erosion was 42 feet (13 meters). The Gulf State Park Pier in Gulf Shores was virtually destroyed. It had served almost 200,000 visitors annually.

But 5 years later, a new, more resilient public pier has been constructed a few hundred feet from the site of the original pier. The former pier is being relocated to create artificial marine reefs.

The reconstruction is the first of Alabama's Coastal Impact Assistance Program (CIAP) projects to receive CIAP funding. In June 2009, the Minerals Management Service awarded Alabama's Department of Conservation and Natural Resources (ADCNR) an \$8 million CIAP grant.

Like its predecessor, the new pier provides formal and interactive education programs focusing on coastal conservation, dune protection and ecology, and threats to the marine fishery and endangered species. It also provides public fishing and managed access to the beach and dunes. The pier is also a data collection point for the

National Marine Fisheries Service's fishery survey and an attachment point for a saltwater intake pipeline for the nearby Claude Peteet Mariculture Center, which supports ADCNR research on the declining red snapper fishery.

Gulf State Park is habitat for the endangered Alabama beach mouse and for three endangered sea turtles: the green, Kemp's ridley, and the loggerhead.

At 1,512 feet (461 meters), the new pier is the longest in the Gulf. Fishing along the railings is also wheelchair accessible.

The new pier opened July 23, 2009. The total cost of the project is over \$16 million; the CIAP funds are allocated to certain construction elements: pilings, stringers, restrooms, and the wooden boardwalk. Other project costs will be covered by the Federal Emergency Management Agency, insurance, and a State park bond issue.



Constructing the new Gulf State Park Pier, Gulf Shores, Alabama. Photo courtesy of Alabama State Parks.

## FOR MORE INFORMATION

**Coastal Impact Assistance Program, MMS**  
[www.mms.gov/offshore/CIAPmain.htm](http://www.mms.gov/offshore/CIAPmain.htm)

**Gulf State Park Pier, Alabama State Parks**  
[www.alapark.com/parks/park.cfm?parkid=22](http://www.alapark.com/parks/park.cfm?parkid=22)

**Alabama Department of Conservation and Natural Resources**  
[www.outdooralabama.com/public-lands/stateLands/landsCoastal/CIAP/](http://www.outdooralabama.com/public-lands/stateLands/landsCoastal/CIAP/)

# MIGRATORY BIRD CONSERVATION AND INTERAGENCY COLLABORATION

**A**s we diversify our Nation's energy portfolio with new technologies, such as wind turbines, we need the best available science to guide our understanding of potential effects. Federal agencies' responsibilities apply to those new ventures, as well.

The Minerals Management Service (MMS) regulates the development and production of oil and gas and other mineral resources on the Outer Continental Shelf (OCS). It also administers renewable energy development on the OCS. This includes ensuring the safety and protection of the coastal, marine, cultural, and human environments.

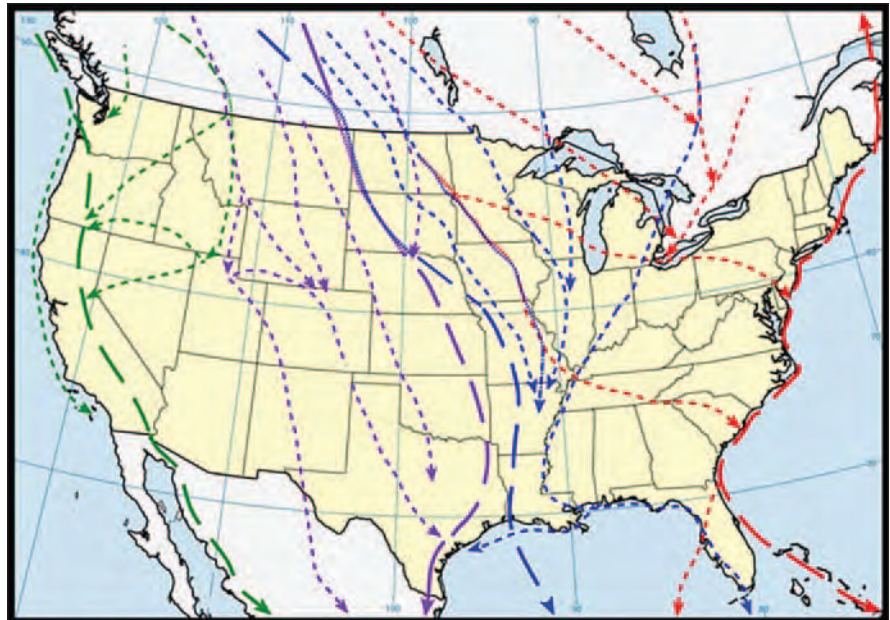
The mission of the U.S. Fish and Wildlife Service (FWS) is to work with others to conserve, protect, manage, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people.

Both agencies are responsible for ensuring that the Nation's development of resources on the OCS is carried out in a way that protects the natural environment.

On June 4, 2009, to strengthen migratory bird conservation through interagency collaboration, FWS and MMS signed a Memorandum of Understanding (MOU) that outlines actions that will further implement the Migratory Bird Treaty Act.

Hundreds of species of migratory birds make regular, seasonal journeys for nesting, breeding, and wintering, typically flying north to breeding areas in the temperate or Arctic summer and returning to winter in the southern U.S. or Central or South America.

Collisions with wind turbines, communication towers, oil platforms, and power lines can cause



North American flyways. Photo courtesy of [www.birdnature.com](http://www.birdnature.com).

KEY	
Atlantic Flyway	—
Mississippi Flyway	—
Central Flyway	—
Pacific Flyway	—

mortality, especially among migratory birds. Habitat destruction is also a major threat. Wetlands and coastal areas, which are stopover, feeding, and wintering sites, are particularly threatened by human use.

Under the MOU, FWS and MMS will promote and share research and information about migratory bird conservation, such as data, inventorying, monitoring, studies, and management practices that may impact migratory birds. The two agencies will work together and with other partners to identify, protect, restore, enhance, monitor, and manage migratory bird areas that may be affected by agency actions and projects. The agencies will also collaborate on research

protocols for better methods of evaluating impacts.

The MMS will integrate migratory bird conservation principles and measures into MMS approvals, procedures, and practices consistent with Council of Environmental Quality regulations. Before issuing authorizations, MMS will consider guidelines and relevant conservation measures for proposed projects.

Collaboration among Federal agencies and other partners provides the best available science to help better understand any potential environmental impacts.

## FOR MORE INFORMATION:

### Memorandum of Understanding

[www.mms.gov/offshore/RenewableEnergy/PDFs/MMS-FWS\\_MBTA\\_MOU\\_6-4-09.pdf](http://www.mms.gov/offshore/RenewableEnergy/PDFs/MMS-FWS_MBTA_MOU_6-4-09.pdf)

### Migratory Bird Program, U.S. Fish and Wildlife Service

[www.fws.gov/migratorybirds/AboutUS.html](http://www.fws.gov/migratorybirds/AboutUS.html)

### The State of the Birds 2009

[www.stateofthebirds.org/](http://www.stateofthebirds.org/)

One of the most promising areas for wind farms is the Atlantic Outer Continental Shelf (OCS). But, some of these areas have long been necessary stopovers for several species of migratory birds, including the red knot (*Calidris canutus*).

A recent Department of the Interior report, *The State of the Birds 2009*, states that at least 39 percent of migratory bird species are declining and are in need of immediate conservation measures.

“... shorebirds that rely on coastal habitats for breeding and refueling on migration are besieged by human disturbance and dwindling food supplies. ... Half of all coastally migrating shorebirds have declined; for example, red knots have declined by an alarming 82 percent. Because of their relatively small and highly threatened global populations, shorebirds are of high conservation concern” (*The State of the Birds*, 2009; 5).

To better protect migratory bird species that depend on coastal environments, the Minerals Management Service is funding studies of species most at risk from wind farm development.

One such study, being carried out by Pandion Systems, includes gathering data about red knots' use of the Atlantic OCS. This will ascertain their locations and the timing of the migratory routes of both long- and short-distance migrant populations.

In May 2009, near Delaware Bay, 50 red knots were captured and tagged with light-sensitive data loggers. This is the first time that these birds have been tagged with



Dr. Joanna Burger (Rutgers University) and Dr. Larry Niles (Conserve Wildlife Foundation of New Jersey) tagging red knots. Photo courtesy of Dr. Joanna Burger.



A red knot shows off its data logger. Photo courtesy of Dr. Joanna Burger.

devices that collect information about their movements. In the fall, red knots along coastal Massachusetts and Quebec will be tagged.

Retrieving the data requires resighting and re-trapping the birds, a task eased by the extensive volunteer-based programs at stopover locations along the Atlantic Coast; Florida's Gulf Coast; Tierra del Fuego, Chile; and Canada.

The data loggers, which weigh only 1.5 grams (0.05 ounces), will yield light and time data to calculate latitude and longitude from

sunrise to sundown and to characterize knots' spatial and temporal use of the Atlantic OCS.

The tracked birds' migratory paths will be mapped using GIS-based geospatial statistical methods to help researchers model exposure and potential risk.

## THE RED KNOT

The red knot (*Calidris canutus*) makes one of the longest annual migrations of any bird. Most travel 9,300 miles (14,967 kilometers) from their Arctic breeding grounds to Tierra del Fuego in South America. Short-distance migrants go only as far south as Florida. Outside of breeding season, they are found mainly in intertidal marine habitats, near coastal inlets, estuaries, and bays.

Delaware Bay is an important red knot staging area, where huge flocks gather during their spring migration. Knots feed on the eggs of spawning horseshoe crabs, which provide the nutrients the knots need to survive their journey.

Red knot numbers are declining. From the mid-1980's to 2003, the populations that winter in South America dropped 50 percent. One factor in their decline is a reduction in horseshoe crab eggs, a result of overharvesting of horseshoe crabs for fishing bait.

### FOR MORE INFORMATION

**Red Knot, All About Birds, The Cornell Lab of Ornithology**

[www.allaboutbirds.org/guide/Red\\_Knot/id](http://www.allaboutbirds.org/guide/Red_Knot/id)

**The State of the Birds 2009**

[www.stateofthebirds.org/](http://www.stateofthebirds.org/)

# Making Waves:

## RENEWABLE ENERGY TESTING AT OHMSETT



Preparing UNAM's Model 1 hydrodynamic generator for testing in the Ohmsett test tank.

**T**he Minerals Management Service (MMS) maintains and operates Ohmsett, the Nation's only facility equipped for full-scale, oil-spill-response equipment testing, research, and training in a marine environment with oil under controlled environmental conditions (waves, temperature, oil types).

Now MMS and Ohmsett are moving to the forefront of marine renewable energy testing.

In 2008, MMS issued a broad agency announcement soliciting proposals on specific topics of interest, including Ohmsett testing and evaluation of new and innovative technologies for wave energy systems.

These systems include point-source buoys that capture energy from wave movement. Another type of device is a tethered or moored segmented serpentine system, known

as a wave attenuator. As it undulates in passing waves, it captures energy. Also of interest were devices that extract energy from water currents, usually by a turbine or paddle wheel. Ideally, the dynamic reaction of these devices could be modeled by towing.

Four groups were selected from among the respondents.

In March 2009, Ohmsett conducted its first tests of a marine renewable energy conversion device. Three more devices will be tested in November 2009, after an upgrade of Ohmsett's wave generator system.

In March, engineers from the Universidad Nacional Autónoma de México (UNAM) tested the performance and sea-keeping characteristics of two devices that convert marine current energy into electricity.

The tow tests assessed the capability of the two hydraulic generators to produce power under varying

conditions, such as water current velocity, applied torque, trim and ballast conditions, and calm surface versus waves.

The two UNAM prototype hydraulic generators featured an improved turbine system design to capture the kinetic energy of tidal current flow and convert it to electrical energy. The generators were vertical axis, floating devices with conducted flow. However, they differed in scale and internal baffle design. The smaller one was designed to a nominal output of 100 watts and was fitted with straight turbines; the larger was designed to a nominal output of 500 watts and was fitted with helical turbines.

With the 100-watt generator, the straight turbine would not rotate unless it was given a kick-start in the right direction, so it was eliminated from further testing. The 500-watt generator was tested for sea-keeping

ability and angle of attack. Ballast, tow angle, and scope were adjusted accordingly.

Data is being analyzed, and both models require further design; however, early observations suggest that they are amenable to external ballasting, as well as various towing angles and scopes.

### **Wave Generator System Upgrade Expands Renewable Energy Testing**

Ohmsett's wave generator system is being upgraded to more closely mimic ocean waves. After the improvements, Ohmsett will have the unique capability of generating infinitely different wave conditions and also continuing to produce previously-used wave types.

The existing wave generator system uses two wave flaps that are hinged at the bottom of the test basin, moved by a speed of a hydraulically-powered flywheel. The flywheel's rate of change is computer-controlled. Wave amplitude is varied manually by adjusting the flywheel's eccentricity. Wave reflection is controlled using a system of "beaches" at the opposite end of the wave tank. The system can create two types of wave forms: a Harbor Chop (random) wave, and a Sinusoidal wave.

This system is quite sufficient for testing oil-spill-response equipment. However, testing wave energy conversion devices calls for more specifically simulating ocean waves.

Ohmsett engineers and wave spectra experts who reviewed the wave generator and design drawings determined that the present generator can be enhanced.



Ohmsett's testing facility.

The improvements include replacing the drive mechanism with dual action hydraulic actuators to drive the wave flaps, reprogramming the computer to create wave spectra, and improving the effectiveness of the "beach" system.

The hydraulic actuators, which will be custom designed and fabricated, will make it possible to control and vary the wave spectra (amplitude and frequency) in a programmable operational environment through the computer-based controller and hydraulic actuator drive system.

The upgraded system will be able to produce wave spectra (frequency and amplitude) by varying the stroke acceleration and speed instantaneously.

Three groups' wave energy conversion devices are scheduled for November testing in the newly-upgraded tank.

Resolute Marine Energy's one-degree-of-freedom heaving buoy converts wave energy into com-

pressed air via a direct-drive dual-stage air compressor. The device is intended for eventual deployment as a power source for offshore aquaculture operations.

The "Rho-Cee" wave energy converter of Float Inc. is based on the principle of input impedance matching to that characteristic of the incident waves. Power is taken off pneumatically or hydraulically above the sea surface.

The EGWaP (Electricity Generating Wave Pipe) developed by Able Technologies is a point-source, bottom-standing vertical tube that uses tuned fill-and-vent movement of water to capture the hydrokinetic energy of passing waves via a vertical float system. It is intended for eventual deployment in arrays.

Ohmsett's expanded testing capabilities encourage innovative ideas for renewable energy products and offer exciting new opportunities for responsibly developing our Nation's offshore renewable energy sources.

#### FOR MORE INFORMATION

##### **Renewable Energy Testing Capabilities at Ohmsett**

[www.ohmsett.com/Summary\\_of\\_Activities/Ohmsett%20Renewable%20Energy%20Fact%20Sheet.pdf](http://www.ohmsett.com/Summary_of_Activities/Ohmsett%20Renewable%20Energy%20Fact%20Sheet.pdf)

##### **Ohmsett Gazette**

[www.ohmsett.com/Publications/Ohmsett%20Gazette%20Spring-Summer%202009.pdf](http://www.ohmsett.com/Publications/Ohmsett%20Gazette%20Spring-Summer%202009.pdf)

# ICE PROTECTION TECHNOLOGIES



A view of Alaska's Bering Sea and the ice-coated National Oceanic and Atmospheric Administration (NOAA) vessel *Miller Freeman*. Photo courtesy of NOAA.

Ice and icicles may be lovely when viewed from the safety of a warm living room or ski lodge, but these natural beauties can be extremely dangerous on bridges, roads, power lines, and other infrastructure. Equally dangerous is ice on offshore platforms, marine vessels, helicopters, and other equipment used in icy marine environments like the Beaufort and Chukchi Seas.

In fact, managing ice is one of the most unique challenges of operating in an arctic offshore environment. To improve the safety of operators and the effectiveness of equipment in arctic waters, the Minerals Management Service's (MMS) Technology Assessment and Research (TA&R) program contracted with the U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, to evaluate the types

of superstructure ice protection technologies that are commonly used in nonmarine environments.

TA&R Project 597, "Assessment of Superstructure Ice Protection as Applied to Offshore Oil Operations Safety," evaluated ice protection technologies currently in use on marine structures and those either in use or under development in other industries, such as highway, aviation, and electric power transmission.

One aim of the project was to compile a resource for offshore oil and production operators who have ice-related safety requirements. The project assesses possible ways of improving safety on drilling and production platforms and vessels that operate in the Beaufort and Chukchi Seas and other Alaskan locations and that undergo superstructure icing.

A variety of deicing and anti-icing technologies have been tested on offshore platforms and boats, but with little overall success. New technologies and modern versions of old technologies, now used successfully in aviation, the electric power industry, and on transportation systems in general, may be transferable to the offshore environment.

The final report explains how each type of icing event affects offshore structures. It includes information about the applicability, readiness, and safety impacts of available ice technologies that are used mainly in nonmarine applications. It also suggests how these technologies may be transferred to use in offshore marine environments.

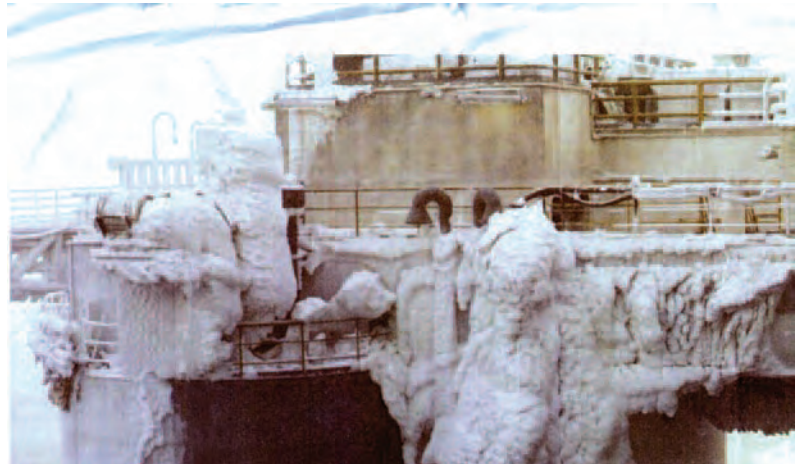
The report concludes that, in nearly all cases, a technology that is

chosen for use on an offshore platform or vessel must be tested and, most important, such testing should take place in an actual offshore marine environment by teaming up operational and ice protection expertise to consider optimal solutions for icing safety threats specific to offshore operations.

FOR MORE INFORMATION

**TAR Project 597: Assessment of Superstructure Ice Protection As Applied to Offshore Oil Operations Safety**

[www.mms.gov/tarprojects/597.htm](http://www.mms.gov/tarprojects/597.htm)



A close up of ice on the semisubmersible *Ocean Bounty* in Cook Inlet, Alaska.

## KUDOS TO DR. ANN JOCHENS: 2009 MMS OFFSHORE LEADERSHIP AWARD

**O**n May 7, 2009, Dr. Ann Jochens was honored with a Minerals Management Service (MMS) Offshore Leadership Award. The award recognizes individuals whose work has improved environmental protection, resource conservation, inspired innovation and outstanding performance, and whose exemplary service helps MMS meet its mission.

Dr. Jochens is a research scientist in the Department of Oceanography at Texas A&M University and is Regional Coordinator for the Gulf of Mexico Coastal Ocean Observing System Regional Association. She holds a B.S. in mathematics and statistics, a J.D. with a specialization in ocean law, and an M.S. and Ph.D. in oceanography.

As program manager and a principal investigator on the 6-year, MMS-funded Sperm Whale Seismic Study (SWSS), Dr. Jochens demonstrated exceptional leadership and professional integrity in a collaboration of scientists from over 15 Federal and State agencies, universities, and organizations. The SWSS collected and synthesized valuable data about Gulf of Mexico sperm whale biology and behavior, their habitat, and



Dr. Ann Jochens and students review maps during a research cruise.

changes in their behavior when they are exposed to noise from industry-related activity.

Dr. Jochens has made significant contributions to MMS's scientific objectives for almost 20 years. She has been principal investigator or program manager on several physical and chemical oceanography studies in the Gulf of Mexico, motivating others to apply their expertise in MMS-sponsored studies.

In addition to being a scientific ambassador for MMS, Dr. Jochens volunteers as a judge/moderator for the National Ocean Science Bowl, sponsored by MMS and the National Ocean Partnership Program.

FOR MORE INFORMATION

**2009 MMS Industry Awards Program and Luncheon**

[www.mms.gov/awards/2009/OLAWinnerAnnJochens.htm](http://www.mms.gov/awards/2009/OLAWinnerAnnJochens.htm)

**Sperm Whale Seismic Study (SWSS)**

[www.gomr.mms.gov/PI/PDFImages/ESPIS/4/4444.pdf](http://www.gomr.mms.gov/PI/PDFImages/ESPIS/4/4444.pdf)

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# **MMS: A steward of the ocean environment**

## **NEW WAVES**

**Late-Breaking News & Information**

### ***New Geospatial Data Viewer: The Multipurpose Marine Cadastre***

**D**iscerning the interrelated issues that bear on decisions about ocean activities has become more efficient. The Minerals Management Service (MMS), with Federal partners such as the U.S. Fish and Wildlife Service, the National Park Service, the National Oceanic and Atmospheric Administration, and others, has created the Multipurpose Marine Cadastre (MMC).

The Energy Policy Act of 2005 directed the Secretary of the Interior, in cooperation with the Secretary of Commerce, the Commandant of the Coast Guard, and the Secretary of Defense, to establish an Outer Continental Shelf (OCS) Mapping Initiative to help in decisionmaking related to alternative energy uses on the OCS. The goal is to identify OCS locations of federally-permitted activities; obstructions to navigation; undersea cables; and areas designated for the purpose of safety, national security, environmental protection, or conservation and management of living marine resources.

The MMC is a web-based geospatial data viewer. Users can view and query information about offshore and nearshore areas and their

spatial extents. Integrated data layers include maritime and legislative boundaries, OCS blocks, leases, pipelines, marine and coastal protected areas, obstructions to navigation, military use areas, geologic, oceanographic, ecological and physical data layers, and more.

The MMC helps users answer many questions, such as: What rights exist in a marine context? What laws define those rights? How do these rights interact? What impediments are there or where is the best location for a renewable energy site?

The MMC is regularly updated. Input among MMS, its partners, and MMC users help improve and expand the usability of the MMC, increasing its value to all stakeholders.

#### **FOR MORE INFORMATION**

##### **MMS Mapping and Cadastral Data**

[www.mms.gov/offshore/mapping/Viewer.htm](http://www.mms.gov/offshore/mapping/Viewer.htm)

##### **Federal Geographic Data Committee Marine Boundary Working Group Data Portal**

[www.csc.noaa.gov/mbwg/html/boundary\\_summary2.htm](http://www.csc.noaa.gov/mbwg/html/boundary_summary2.htm)