

# **MIMS** OCEAN SCIENCE

VOLUME 3 ISSUE 1  
JANUARY/FEBRUARY 2006

THE SCIENCE & TECHNOLOGY JOURNAL OF THE MINERALS MANAGEMENT SERVICE



**Ocean  
Observations:  
Keeping the  
World Informed**

**Bowhead Whale  
Migration**

**Monitoring  
Wave Activity**

**Building the  
Integrated Ocean  
Observing  
System (IOOS)**

**Monitoring in  
Alaska, Gulf of  
Mexico, Flower  
Garden Banks**

**Deepwater  
Discoveries**

**Exploration  
Goes Deeper**

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



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#### **ABOUT THE COVERS**

Top: Aerial view of two bowhead whales.  
Photo courtesy NOAA

Bottom: MMS Intertidal Team (MINT) members  
Dr. Ann Bull and Dr. Fred Piltz count motile invertebrates  
at White's Point in Southern California.

Back: Background platform image by Gregory S. Boland

*All photos courtesy of  
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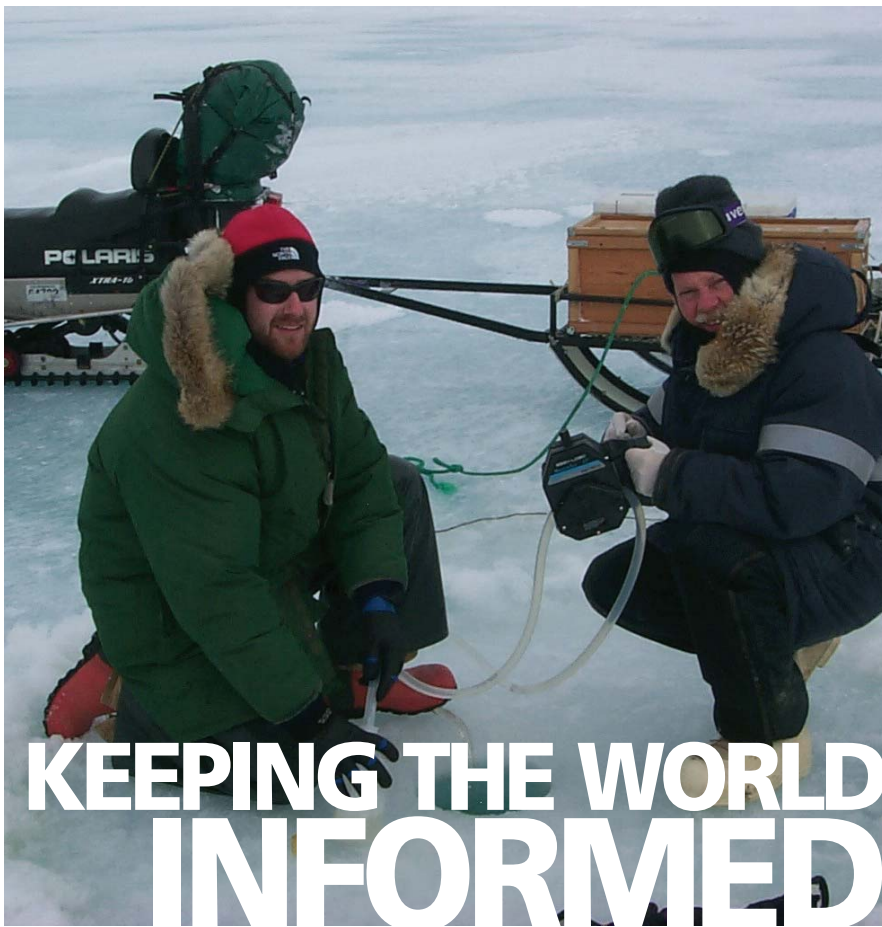
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[www.mms.gov](http://www.mms.gov)

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# KEEPING THE WORLD INFORMED

**S**tanding on the shore, the ocean appears vast and impenetrable, full of mysteries and beyond our ability to understand. Advances in science and technology now allow us to explore the oceans from above, within, and below. Satellites are used to observe and monitor the oceans from space, radar is used to study the surface, manned and unmanned submersibles explore the water depths, and drillships with a host of sensors bore below the seafloor. The Minerals Management Service (MMS) is working with other Federal and international agencies to ensure that coastal and marine waters are being monitored and that the data collected are distributed to those who need it to address marine-related issues.

Across the United States, regional and local stations and observatories are integrating their services into the backbone of a national system – the Integrated Ocean Observing System (IOOS). This system will, in turn, integrate with the Global Ocean

# OCEAN OBSERVATIONS

Observing System (GOOS), providing scientists with up-to-date oceanographic information. The goal is to make this information as “user-friendly” as possible and to allow enough flexibility that end users will be able to customize the type and frequency of data they need. The MMS is participating in this effort through monitoring activities that also support its mission.

We are seeing oil exploration go deeper under the ocean than ever before, and researchers are going deeper to get answers with a study of the chemosynthetic and hard-bottom biological communities in the Gulf of Mexico, exploring depths up to 10,000 feet. Ocean currents are monitored by using

radar and acoustics; the information is being used to design stronger structures or predict the movement of potential spills. At the same time, other researchers are watching for any impacts to whale populations and subsistence hunters who use them to survive.

As the ocean becomes less mysterious, MMS continues to acquire knowledge and understanding through participation in the IOOS and other monitoring activities. This participation will ensure that MMS has the best information available to fulfill its mission of safely recovering mineral resources on the Outer Continental Shelf while protecting the marine environment.

Left: Scientists collect water samples from below the ice in the Beaufort Sea.

Below top: A scientific diver measures coral growth at the Flower Garden Banks in the Gulf of Mexico. Photo by Gregory S. Boland.

Below bottom: A chemosynthetic community with clam shells for the deepwater environment of the Gulf of Mexico.



# BOWHEAD WHALE MIGRATION

In 1978, the predecessor of the Minerals Management Service (MMS), in consultation with the National Marine Fisheries Services (NMFS), determined that insufficient information existed on the potential effects of gas and oil exploration on bowhead and gray whales in the Beaufort Sea. These agencies proposed studies to investigate the issue, as both species of whale were listed as endangered species under the Endangered Species Act. Likewise, Inupiat residents of the North Slope did not want offshore activity to interfere with their bowhead whale subsistence hunt. Numerous studies were initiated to study topics like bowhead feeding areas, migration patterns, tissue archiving, local and traditional knowledge, and subsistence. Since 1979, MMS has conducted an annual survey of migrating bowhead whales. Each fall, the Bowhead Whale Aerial Survey Project (BWASP) takes to the air to provide MMS and NMFS daily reports on the fall migration.

The aerial survey study focuses on the fall bowhead whale migrations in the Beaufort Sea in an area south of 72°N latitude between 140°W and 157°W



Bowhead whale cow and calf.

longitude. Surveys are flown from early September to mid-October. The project attempts to distribute the survey effort evenly across the entire study area. Particular emphasis is placed on regional surveys to assess large area shifts in the migration pathway of bowhead whales and on the coordination of effort and management of the data necessary to support seasonal offshore drilling and seismic exploration regulations.

Whale sightings are logged for latitude, longitude, aircraft altitude and heading, inclinometer angle, and swim direction of the observed whales. Additional data entered into the database include the number of calves present, behavior at the time of the sighting, size, etc., plus weather, sea, and ice conditions at the time of the sighting. The sightings are recorded in a database and plotted on maps to trace the movements of the whales as they migrate west along the Alaska coast. Along with the Bowhead whale observations, sightings of beluga and gray whales, bearded and ringed seals, and polar bears are noted.

Bowhead whales can respond to noise from human activities and there is

concern that the migration may be affected by sounds generated during oil- and gas-related activities. Local bowhead whale subsistence hunters are also concerned about changes in the migration, since the location of the whales are key to their fall hunt. The industry coordinates its activities through the Alaska Eskimo Whaling Commission (AEWC) and will temporarily halt operations so as not to interfere with a nearby hunt. Annually, NMFS, the AEWC, MMS, and industry meet to review any required industry bowhead monitoring studies and upcoming industry activity. The monitoring of the whale migration by MMS contributes to our understanding of the bowhead whale and ways to minimize possible impacts to the whale population and the subsistence hunt.

**FOR MORE INFORMATION:**

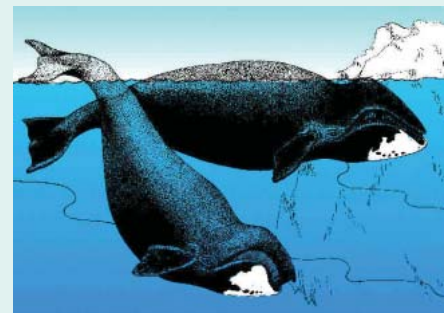
**Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 2002-2004**

Website: [www.mms.gov/alaska/reports/2005rpts/2005-037.pdf](http://www.mms.gov/alaska/reports/2005rpts/2005-037.pdf)

## Information from the Hunt

Each fall, near Cross Island in the Beaufort Sea, subsistence hunters from Nuiqsut hunt bowhead whales as they migrate from the eastern Beaufort to the Bering Sea. With current and future oil and gas activities occurring along this migration route, the hunters are concerned that the whales will migrate farther from shore to avoid these areas. To collect a baseline set of information, a collaborative effort was established between MMS, the subsistence hunters from Nuiqsut, and the Alaska Eskimo Whaling Commission. Together, they developed a system for collecting information that local hunters themselves could adopt, adapt, and maintain. The hunters were asked to record observations and use a global positioning system (GPS) unit to collect daily vessel locations during the hunt. Information from this study is being used to determine if noise from a nearby production facility causes the whales to move farther from shore, which would affect the success of whaling expeditions and the livelihood of local subsistence hunters.

For more information on this project – Website: [www.mms.gov/alaska/reports/2005rpts/2005-025/AnRpt2003.pdf](http://www.mms.gov/alaska/reports/2005rpts/2005-025/AnRpt2003.pdf)



## RECORD-BREAKING DEPTH ACHIEVED

# KNOTTY HEAD DISCOVERY

A significant oil discovery was made on the Knotty Head prospect in the Gulf of Mexico (GOM) in December 2005, after drilling and logging operations were concluded by Weatherford International Ltd. The discovery well is located in approximately 3,500 feet of water, and the total depth is an astounding 34,189 feet (almost 6.5 miles). It is the deepest well drilled to date in the GOM and breaks the previous record of 32,727 feet set earlier in 2005 by Shell. Nexen is operator of the Knotty Head prospect. Partners include Chevron/Unocal, Anadarko Petroleum Corporation, and

BHP Billiton. The well is owned by Chevron/Unocal and partners Nexen, Inc., Anadarko Petroleum Corporation, and BHP Billiton. The well was drilled using the Transocean drillship *Discoverer Spirit*.

Logging equipment used in this operation set a new benchmark for downhole operating temperatures and pressures. The completion of this job opens up more opportunities for non-traditional drilling, not just in the GOM, but around the globe.



The Transocean drillship *Discoverer Spirit* was used to drill to a record-setting depth of 34,189 feet below the seafloor.

## Monitoring Wave Activity in Real-Time

A wealth of data has been collected from the monitoring and assessment of offshore sand resources along the Louisiana coastline over the past 10 years by the Minerals Management Service (MMS). Over \$11 million has been invested in this research, placing MMS at the cutting edge of adopting new technologies to understand these offshore resources.

WAVCIS, or Wave-Current Information System, provides MMS with wave information, such as water level, surge, wave height, and meteorological conditions, on a real-time basis around the Louisiana coast. This monitoring system, and the information it makes available, helps MMS to determine how dredging and sand excavation could alter the local wave patterns.

Two MMS-funded buoys are being used to monitor and collect this information. The buoys will collect the data available on deep and shallow water off the Louisiana coast, and then transmit the data to a base station at Louisiana State University. After going through quality control and archiving, the data will be posted on the Internet and will be accessible to anyone.

As the demand for sand for shoreline protection increases, OCS sand and gravel have become an increasingly important resource. The MMS continues to work with its partners to observe and monitor the environmental impact of dredging and to advance the exploration on the wave activity, as it learns more about the complexity of the ocean ecosystem.

For more information – Website: [www.wavcis.lsu.edu](http://www.wavcis.lsu.edu)

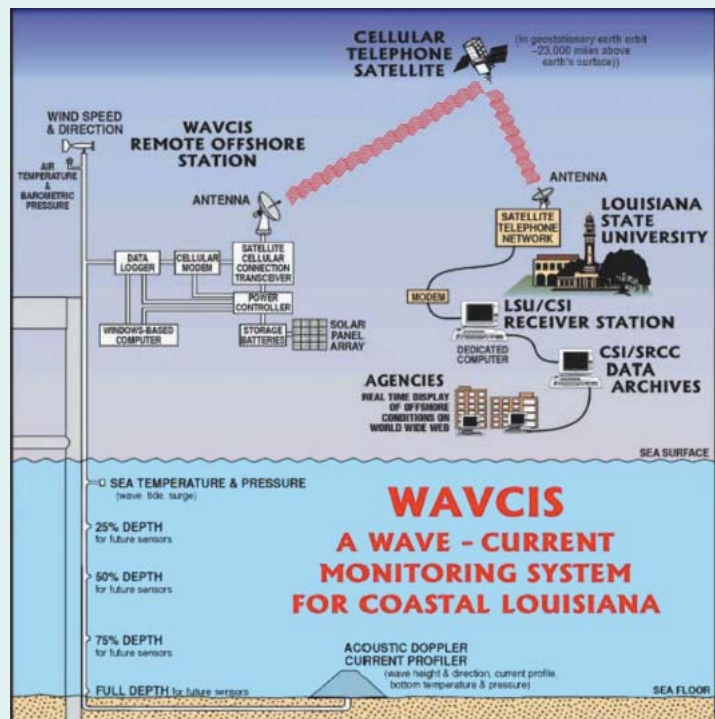


Diagram courtesy of Greg Stone, LSU.

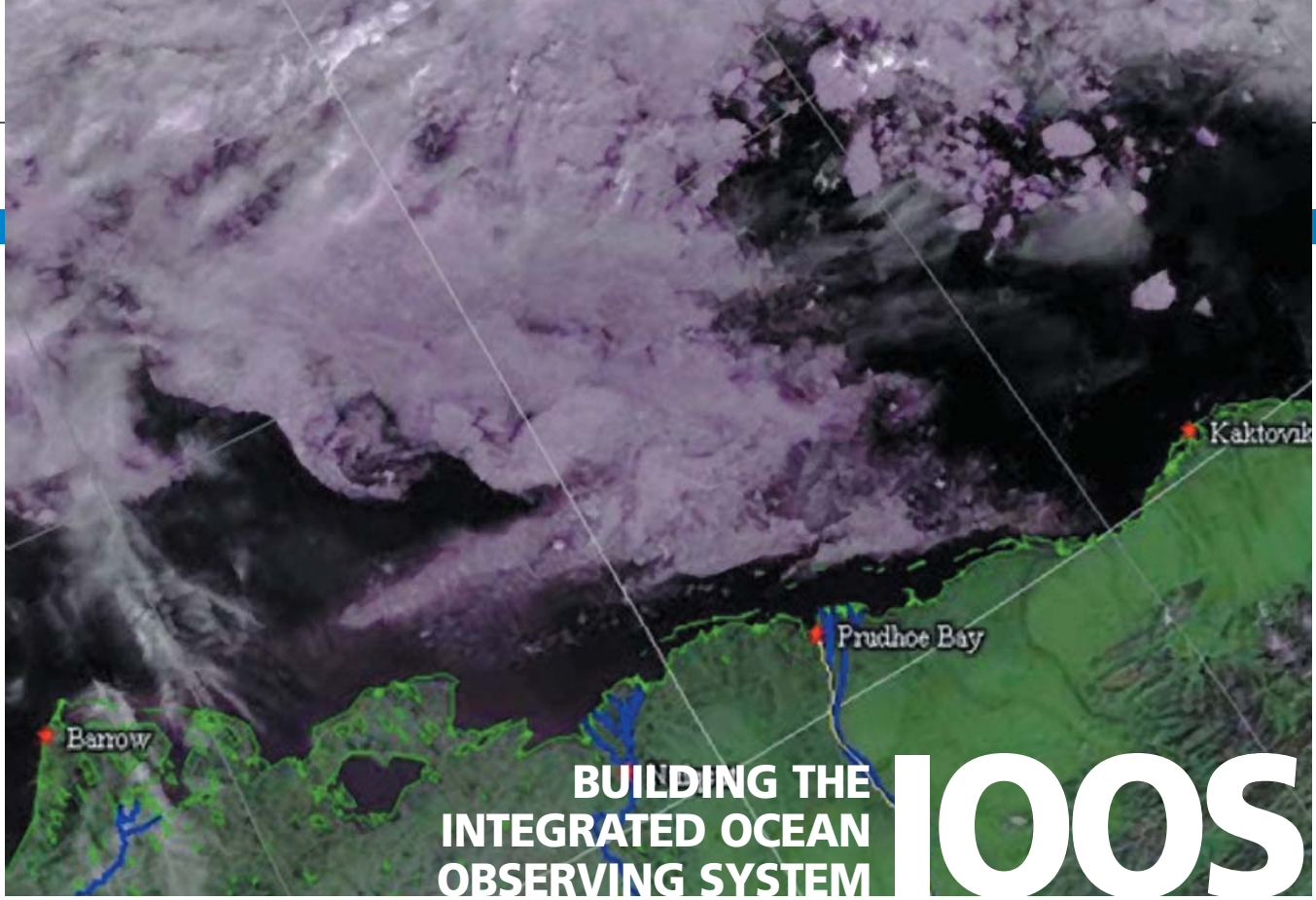


Image courtesy of University of Alaska - CINA [www.gina.alaska.edu](http://www.gina.alaska.edu) from NOAA-17 satellite.

**D**ramatic changes in the ocean or coastal areas and their ecosystems – whether local, regional, or global – can have a devastating effect on our economy, environment and national security, as vividly highlighted by Hurricanes Katrina and Rita. What was also highlighted was the critical need for a coordinated effort to monitor, collect, and disseminate vital marine and coastal information about such changes to those whose lives, livelihoods, and environments will be affected. The Integrated Ocean Observing System (IOOS), when fully implemented, will provide such a data collection and distribution “warehouse” for local, regional, and global stakeholders. The Minerals Management Service (MMS) is participating as a contributor and user of this information.

According to *The First U.S. Integrated Ocean Observing System (IOOS) Development Plan*, IOOS is a coordinated national and international network of observations and data transmission, data management and communications, and data analyses and modeling that systematically and efficiently acquires

and disseminates data and information on past, present, and future states of the oceans, including U.S. coastal waters. “Coastal” includes the U.S. Exclusive Economic Zone and territorial sea, the Great Lakes, and semi-enclosed bodies of

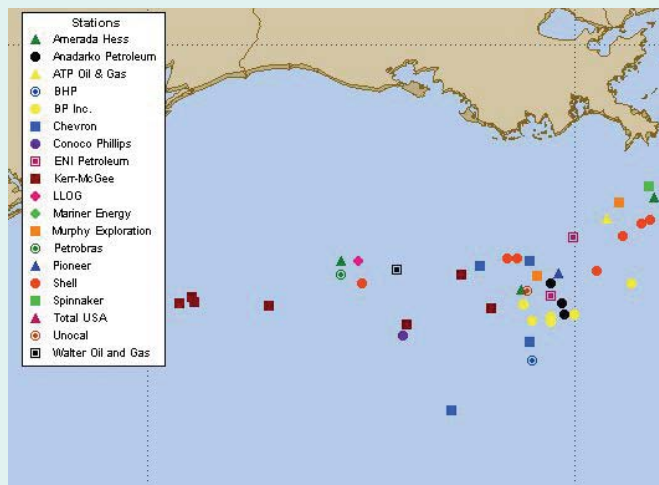
water and tidal wetlands connected to the coastal ocean. Outlined in the plan is a statement of IOOS’ seven goals to gather and distribute data, both observational and modeled, which enables the Nation to

### Alaska Monitoring

In October 2004, the University of Alaska Fairbanks Sea-Air-Land Modeling and Observing Network (SALMON) Project and Coastal Ocean Dynamics Applications Radar (CODAR) Ocean Sensors embarked on a program to understand patterns of surface currents in Alaska’s Beaufort Sea and Cook Inlet. The program is studying the spatial and temporal variability of the currents by using high-frequency Doppler radar. This program is sponsored by the Minerals Management Service (MMS), the National Ocean and Atmospheric Administration, and the National Oceanographic Partnership Program and is conducted in cooperation with the Alaska Ocean Observing System, one of the regional systems in the nationwide Integrated Ocean Observing System. To accomplish this task, the team installed two Doppler radar stations onshore of the central Beaufort Sea; these recorded surface currents during open water and mixed ice periods in June 2005. The data collected through this study will contribute to the baseline oceanography of these two locations. Additionally, the data will be used by MMS in oil-spill risk analyses for offshore oil and gas operations. The radar equipment will remain in operation through October 2006. The units will then be moved to Cook Inlet to record surface currents for one full year beginning in October 2006 and ending in November 2007.

For more information – Website: <http://halibut.ims.uaf.edu/SALMON/CIBS-MAP/index.htm>

## Current Monitoring in the Gulf of Mexico Region



Western Gulf of Mexico MMS ADCP recent marine data. This program was recognized by the President in his U.S. Ocean Action Plan as an example of a government-industry partnership helping to ensure safe offshore operations. Map courtesy NOAA.

In response to recent reports of high offshore currents, both on the surface and at depth in the Gulf of Mexico, the Minerals Management Service (MMS) has requested the cooperation of operators to help monitor currents from mobile offshore drilling units (MODU's) and floating production platforms. The MMS regulations require a thorough assessment of all design and operating environmental conditions expected to occur at the platform site over the life of the platform, as well as the use of the best available and safest technology during all exploration, development, and production operations to avoid equipment failure that would have a significant effect on safety, health, or the environment.

Current data collected by the operators are sent to the National Oceanic and Atmospheric Administration (NOAA) National Buoy Data Center, where they are stored and posted on a website and may be viewed in almost real-time mode. The ocean current information will be used by the oil and gas industry in improving the design, operation, and function of MODU's and production platforms.

For more information on monitoring in the Gulf of Mexico Region –  
Website: [www.gomr.mms.gov/homepg/regulate/environ/ocean\\_current\\_monitor.html](http://www.gomr.mms.gov/homepg/regulate/environ/ocean_current_monitor.html)

1. Improve predictions of weather and climate change and their effects on coastal communities and the Nation;
2. Improve the efficiency and safety of marine operations;
3. More effectively mitigate the effects of natural hazards;
4. Improve national and homeland security;
5. Reduce public health risks;
6. More effectively protect and restore healthy coastal ecosystems; and
7. Enable the use of ocean and coastal resources.

To achieve these goals, a network must be established that routinely, reliably, and continuously provides data and information on oceans and coasts. More importantly, data that are observed and monitored must be made available to all who rely on it, in the form they need, and at the time and place they need it. This requires an efficient two-way flow of information from the

## MINT – the MMS Intertidal Team

The MMS Intertidal Team, or MINT, is one of nine monitoring teams that collect data for MARINE, the Multi-Agency Rocky Intertidal Network. The MINT biologists team up with biologists from five university campuses (UC Santa Cruz, UC Santa Barbara, UCLA, UC Davis, and California State University Fullerton) to monitor mussels, sea stars, algae, and other intertidal plants and animals along the coast.



Mary Elaine Dunaway holds quadrat for photo of goose barnacle plot at Paradise Cove, Malibu, California. Inset: Closeup of goose barnacle/mussel plot at Paradise Cove.

Initially, in 1991, nine shoreline inventory sites were established along the California Coast. Today, MMS funds 24 sites from San Luis Obispo County to Orange County. MINT, along with university biologists, monitors turf algae, rockweed, acorn and goose barnacles, mussels, surf grass, sea stars, black abalone, limpets, and motile invertebrates like crabs and snails. In addition to providing field support twice a year at MMS-funded sites, MINT leads special projects for MARINE, including reviews of protocols, development of new techniques, equipment development, and sponsoring an annual Taxonomic Workshop for MARINE field teams.

For more information – Website: [www.mms.gov/omm/pacific/enviro/mint.htm](http://www.mms.gov/omm/pacific/enviro/mint.htm)

observational site – remote and *in situ* – through data management and communication, to data analysis and modeling, and back again.

One of the first steps taken in the establishment of IOOS is to institute, enhance, and integrate data management and communications. Once communications and management systems are established and operational, a national network of observational and analytical systems, augmented by regional coastal ocean observing systems (RCOOS) can be further developed to meet the common requirements of the regional associations (RA) or groups that will gather, develop, and use the information in their own locality, while achieving the national goals as well. This component of IOOS is a collaborative project between Federal agencies,

including MMS, and these local components such as the Gulf of Mexico Coastal Ocean Observing System (GCOOS) and the Alaska Ocean Observing System (AOOS), two RA's already coordinating with MMS.

Data and information gathering are conducted not only locally and regionally, but nationally and globally as well. This aspect of the IOOS is being developed by Federal agencies.

Education, training, and public outreach are important components of the IOOS development. Ocean science is an exciting frontier of study that can attract the minds of the young and old. Informing educators of the wealth of data available, teaching them how to access that data and enabling them to produce a more scientifically literate

populace and a more skilled workforce are of utmost importance to the future well-being of ocean environments. Education initiatives for young scientists are outlined in the President's 2004 Ocean Action Plan.

As IOOS builds its "national backbone," it will continue to document systems and assets that are already in place, engage regional stakeholders to discuss and define what needs to be developed or improved, and to integrate past, present, and future data research capacities into a viable, flexible, and above all, useful data management and distribution system. As a developer, contributor, and user of the system, MMS is in a unique position to provide insight into the usability of the system and to assist with the goals of the IOOS.

## Monitoring in the Flower Garden Banks

**T**he East and West Flower Garden Banks lie beneath the waters of the northern Gulf of Mexico, approximately 100 miles south of the Texas-Louisiana border. These Banks are the northernmost coral reefs on the continental shelf of North America. The salt domes under these banks have furnished the framework for coral reef development and provide a reservoir for oil and gas resources.

The Minerals Management Service (MMS) began monitoring the banks in the early 1980's and was joined by National Oceanic and Atmospheric Administration in 1996, after the banks became a National Marine Sanctuary in 1992. The monitoring effort was designed to assess the health of the coral reefs, evaluate changes in coral population levels, measure coral and algae cover and growth rates, and investigate other community characteristics. The MMS maintains a no activity zone for the oil and gas industry around the Banks to protect the delicate reefs. The monitoring is used to verify that these protective measures are working as the industry activities continue just outside the zone. Results to date indicate that the coral reefs continue to be healthy and vibrant.



Tube sponges and very healthy cover of more than 50 percent live coral at the Flower Garden Banks, considered by many the healthiest reefs in the western hemisphere! Photo by Gregory S. Bolland.

For more information on the Flower Garden Banks – Website:  
[www.gomr.mms.gov/homepg/regulate/envirom/flow\\_gar/flowgard.html](http://www.gomr.mms.gov/homepg/regulate/envirom/flow_gar/flowgard.html)



# DEEPWATER DISCOVERIES

**N**ine deepwater (greater than 1,000 feet) oil and gas discoveries were announced by operators and lessees in the Gulf of Mexico during 2005. "The deepwater discoveries to date represent a strong continuing success story in the Gulf of Mexico," stated Chris Oynes, Minerals Management Service (MMS) Regional Director for the Gulf of Mexico. "Discoveries like BP's Stones represent a continuing favorable development in the new Paleogene play in the Walker Ridge area."

Compared with the seven drilling rigs in the same period one year ago, there are nine rigs drilling in 5,000 feet of water or greater – the ultra deepwater



The Holstein oil and gas development is located approximately 150 miles south of New Orleans. The field is being developed using a Production Drilling and Quarters (PDQ) truss spar, permanently moored in 4,350 feet of water. Photo courtesy of BP Exploration & Production.

zone. In addition, a new drilling record in the Gulf of Mexico – 34,189 feet – was reached at the Knotty Head prospect.

The announced deepwater discoveries in 2005 demonstrate that active exploration in the deepwater Gulf of Mexico will continue to help America meet its energy needs.

## 2005 Announced Deepwater Discoveries, Gulf of Mexico

Prospect	Operator	Area/Block Number	Water Depth (ft)
Stones	BP	Walker Ridge 508	9,576
Jubilee Extension	Anadarko	Lloyd Ridge 309	8,774
Mondo NW Extension	Anadarko	Lloyd Ridge 1	8,340
Q	Spinnaker	Mississippi Canyon 961	7,925
Big Foot	Chevron	Walker Ridge 29	5,286
Genghis Khan	Anadarko	Green Canyon 652	4,300
Wrigley	Newfield	Mississippi Canyon 506	3,700
Knotty Head	Chevron/Unocal	Green Canyon 512	3,557
Clipper	Pioneer	Green Canyon 299	3,452
Anduin	Nexen	Mississippi Canyon 755	2,400

# FINDING MORE ANSWERS

**E**xploration in the Gulf of Mexico (GOM) doesn't always involve oil and gas. As more becomes known about the Gulf from the Outer Continental Shelf down to depths of 3,280 feet, scientists are beginning to explore and study even deeper areas. Of special interest in the deepest part of the Gulf are rare hard-bottom areas of the seafloor and the possibility of additional

dense chemosynthetic communities or deep coral habitats.

Most of the Gulf deepwater sea bottom studied to date is soft sediment, which is a mixture of mostly silt and clay. But less is known about the rare hard-bottom areas, especially in ultra-deepwater. A few chemosynthetic communities have already been discovered at depths close to 10,000 feet. Even though they look similar in many

ways to communities in shallower water, we already know there are very few of the animals that are the same in both habitats. Questions about how the differences in salt structures, water temperature, pressure, and hydrate stability might affect chemosynthetic communities at deeper depths have yet to be answered. Will they be more – or less – abundant? Do they develop in the same way and at the same rate? What

## Remarkable Seabed Life at 9,000 feet

Chemosynthetic Communities as seen by a Remotely Operated Vehicle operated by Chevron.



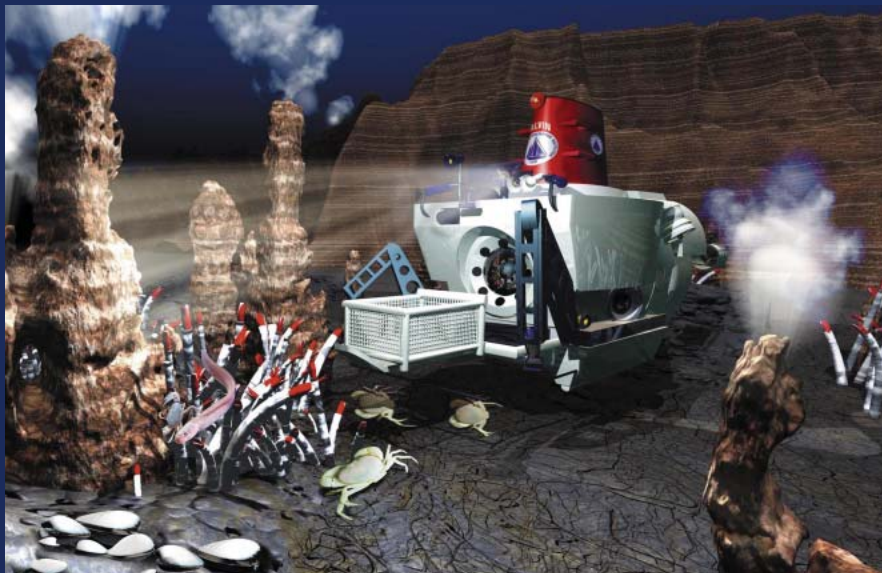
about other hard-bottom fauna, such as deepwater corals?

To answer these questions, the National Oceanic Partnership Program (NOPP) is sponsoring a four-year study of the hard-bottom chemosynthetic and other biological communities below 3,280 feet in the Central and Western GOM. This ground-breaking new study will be funded by the Minerals Management Service (MMS) and the National

Oceanic and Atmospheric Administration's Office of Ocean Exploration (NOAA OE). The NOPP is a collaboration of 15 Federal agencies, including MMS and NOAA, along with academic and industry partners seeking to bring ocean issues to the forefront and encourage a greater synergy among those concerned with such issues.

As this study goes forward, researchers hope to gain a greater insight into the

differences between these deeper communities and those in more shallow locations. A significant part of this project will involve the exploration of new and unknown places in the deep Gulf, where no one has ever looked before. It is likely there will be some remarkable discoveries. The exploration and understanding of these new areas will enable MMS to protect and manage the Nation's resources in the deepwater Gulf better.



Above: University of Delaware artist David Barczak's rendition of the submersible *Alvin* working on the seafloor at a hydrothermal vent site. The *Alvin* will be coming to the Gulf of Mexico for over two weeks to explore new sites for MMS and NOAA in May 2006. Photo courtesy University of Delaware College of Marine Studies.

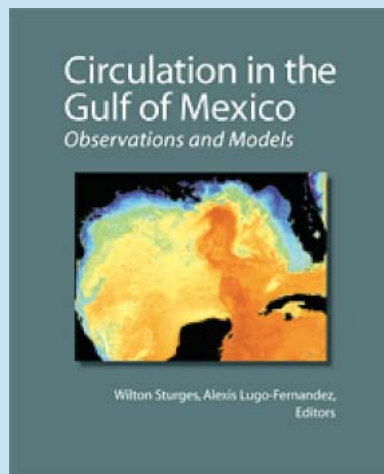
# MMS – A Leader in Securing the Nation's Domestic Energy Supply



Platform in Cook Inlet, Alaska.

## NEW WAVES Late-breaking News & Information

### ***MMS Sponsors Compendium on the Gulf of Mexico***



*Circulation in the Gulf of Mexico: Observations and Models*  
Wilton Sturges and Alexis Lugo-Fernandez, Editors

*The Gulf of Mexico is a jewel among the natural resources of the western hemisphere. Its wetlands are the source of an important seafood and shellfish industry. Offshore waters support rich commercial and sport fisheries. Its oil and gas resources are prime incentives for commercial development. Its coastal beaches provide recreation to millions and are the economic backbone of numerous coastal communities. If we are to understand how to use and manage such resources, it is crucial that we understand the waters that flow in and through the Gulf.*

– from the Introduction

The Minerals Management Service funded the publication of this collection of scientific papers that summarizes the current state of knowledge of the circulation in the Gulf of Mexico. The book offers new information as well as a synthesis of past work. Dr. Wilton Sturges of Florida State University and Dr. Alexis Lugo-Fernandez of the MMS Gulf of Mexico Region are co-editors. The compendium was published by the American Geophysical Union and is available on their website.

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