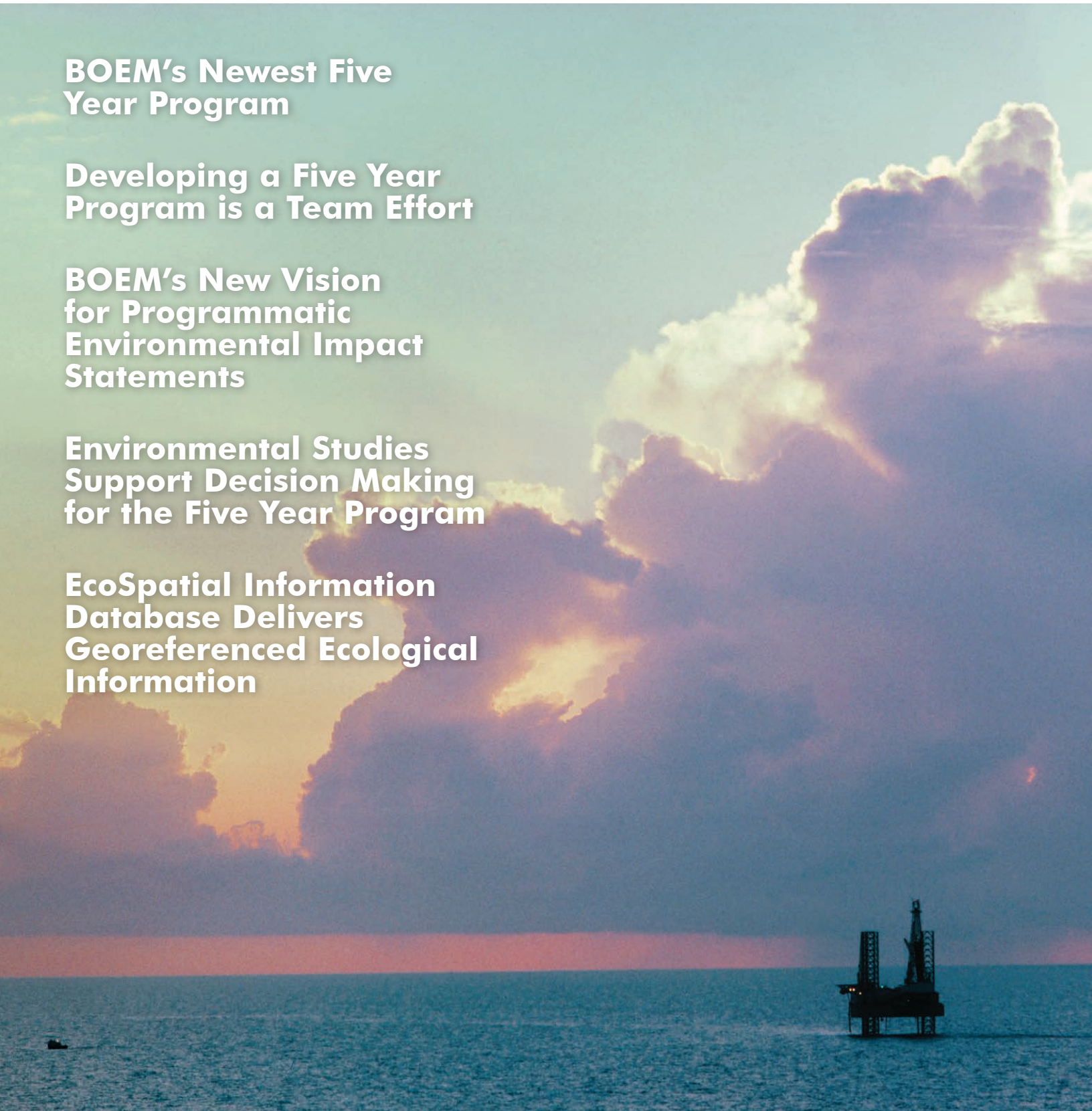
BOEM OCEAN SCIENCE

THE SCIENCE & TECHNOLOGY JOURNAL OF THE BUREAU OF OCEAN ENERGY MANAGEMENT

VOLUME 10 ISSUE 1 • JANUARY/FEBRUARY/MARCH 2013



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BOEM OCEAN SCIENCE is published quarterly by the Bureau of Ocean Energy Management to communicate recent ocean science, technological information, and issues of interest related to offshore energy recovery, marine minerals, and ocean stewardship.

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ON THE COVER
A Triton jackup drilling rig in the Gulf of Mexico. Photo by Jim Olive/Stockyard.com.

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Frequently Used Abbreviations

BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
DOI	Department of the Interior
DWH	*Deepwater Horizon*
EIS	Environmental Impact Statement
ESID	EcoSpatial Information Database
GOM	Gulf of Mexico
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
OCS	Outer Continental Shelf
OCSLA	OCS Lands Act
PEIS	Programmatic Environmental Impact Statement

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Check out the Bureau of Ocean Energy Management website at **www.boem.gov**.

The Director's Message

BOEM is charged with managing the environmentally responsible development of offshore energy and mineral resources on the U.S. Outer Continental Shelf (OCS), which includes the implementation of an efficient offshore oil and gas leasing program. Underlying all of BOEM's management and regulatory activities is a commitment to rigorous environmental reviews and study, and science-based decision making.

Over the past year, the agency completed a new Five Year OCS Oil and Gas Leasing Program for 2012–2017. This issue of *BOEM Ocean Science* will highlight the scientific analysis that leads to the development of a Five Year Program that promotes energy development and supports the economy—while also protecting the ocean environment.

In June 2012, BOEM issued the Five Year Program, which makes all of the areas with the highest oil and gas resource potential available for exploration and development. Together, these areas contain more than 75 percent of the undiscovered technically recoverable oil and gas resources estimated for the OCS. The Program also advances an innovative, regionally tailored approach to offshore oil and gas leasing that is designed to take into account the particular resource potential, environmental and social concerns, and infrastructure conditions of each planning area. The new Program schedules 15 potential lease sales in the Gulf of Mexico and offshore Alaska through 2017, including the Western Gulf of Mexico Sale held in November 2012 and the Central Gulf Sale held recently in March, which drew $1.2 billion in high bids for 1.7 million acres offshore Alabama, Louisiana, and Mississippi. These follow sales held in the Gulf of Mexico in December 2011 and June 2012 that resulted in more than $2 billion in bonuses paid to the Treasury.

BOEM is committed to meeting the challenges related to our Nation's energy future while minimizing adverse impacts on the environment. The research we conduct involves many disciplines, including physical oceanography, atmospheric sciences, biology, analyzing risks to protected species, social sciences and economics, and submerged archaeological resources. These areas of science and extensive stakeholder input have supported the informed decisions and policy behind the Five Year Program. Please enjoy reading this issue of *BOEM Ocean Science*.

Tommy P. Beaudreau, Director

We are an Arctic Nation

As energy exploration unfolds in the Beaufort and Chukchi Seas and BOEM works with the Interagency Working Group on Coordination of Domestic Energy Development and Permitting in Alaska (Executive Order 13580) to minimize potential conflicts between leasing and environmental, social, and cultural considerations during this new Five Year Program, we are reminded that offshore energy is not the only challenge our Nation faces along its northern border. The U.S. is one of a small, but important, cadre of nations addressing a variety of activities in the far north. Changes in ice coverage with potential shifts in weather patterns, sea conditions, and ecosystem components; increases in shipping and tourism; and renewed interest in energy and mineral extraction—among others—bring a plethora of stewardship, economic, emergency preparedness, and national security concerns and the need for new research.

Last year, during the drilling of two exploration wells, the U.S. Coast Guard conducted Arctic Shield 2012 to further identify issues and to determine the best possible solutions to ensure we are protecting our Nation's Arctic interests. Along with other nations of the far north, the U.S. is working to define the full extent of its Extended Continental Shelf, an area off our northern coast roughly the size of the State of California. Our Nation is also a member of the Arctic Council, established to address common issues among Arctic States; a goal clearly resonating with our new National Ocean Policy. So, as our Nation continues to provide the leadership necessary to operate safely and in an environmentally-sound manner in our last frontier, and following on Alaska's State motto, "North to the Future," it is without a doubt that "We Are an Arctic Nation."

Dr. James (Jim) Kendall, Regional Director, Alaska OCS Region

BOEM's Newest Five Year Program

Our Nation's marine environment holds vast deposits of oil and natural gas that are critical to meeting the country's growing energy needs. According to August 2012 data from the U.S. Department of Energy, resources from the OCS constitute approximately 24 percent of the crude oil and 8 percent of the Nation's natural gas supply. Energy is the lifeblood of the transportation, industrial, commercial, and residential sectors. While renewable energy sources are expected to supply an increasing share of our energy, the U.S. is projected to continue to rely heavily on oil and natural gas to meet its energy needs over the next two decades.

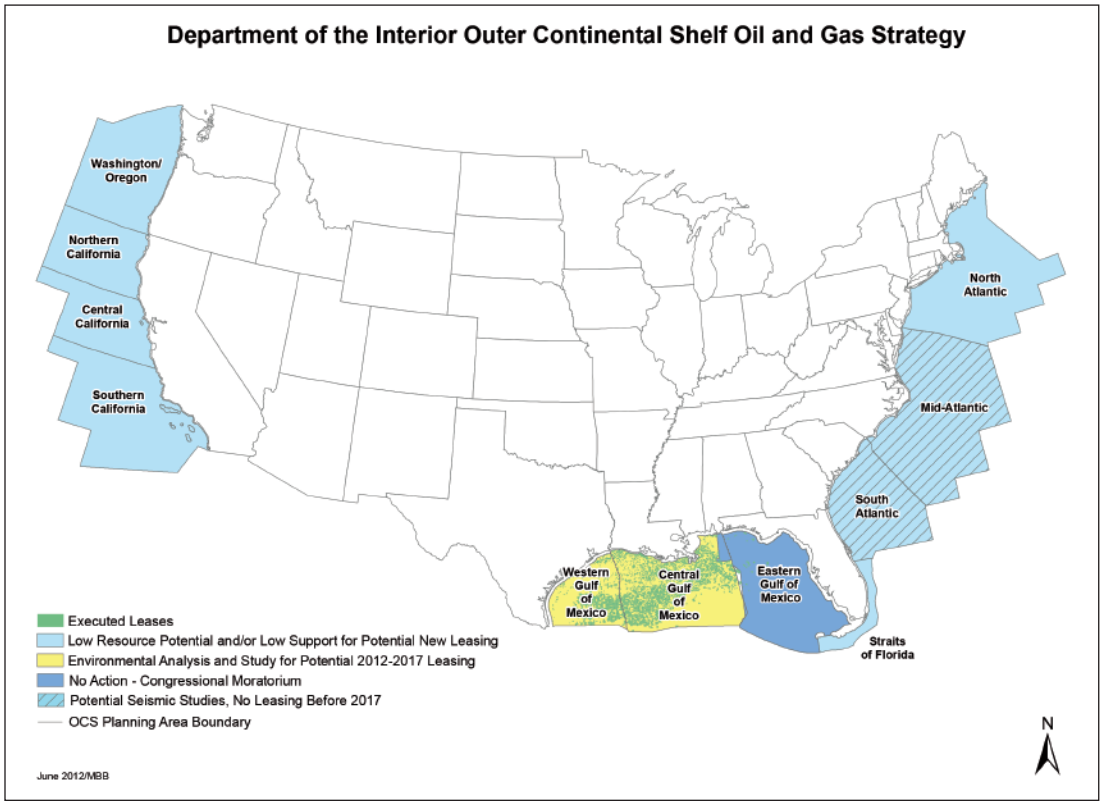
Like any resource—whether natural, human, or capital—it is critical to have a plan for managing it well. Management of the oil and natural gas resources of the OCS is governed by the Outer Continental Shelf Lands Act (OCSLA), which sets forth procedures for leasing, exploration, development, and production of those resources. Section 18 of OCSLA calls for the preparation of an oil and gas leasing program outlining a five-year schedule of lease sales designed to best meet the Nation's energy needs. Based on a variety of factors required under Section 18, a Five Year Program must, to the maximum extent practicable, take into consideration the potential for the discovery of oil and gas, and the potential for adverse environmental impacts.

To assist the Secretary of the Interior in assessing each decision option, BOEM conducts a cost-benefit analysis that includes estimates of net economic value of the oil and gas resources, the environmental and social costs, and the consumer benefits likely to result from production under that option. The analysis also considers the environmental and social costs of pursuing other energy sources (including reduced consumption) to replace OCS production should the Secretary decide not to offer leases for that area. The Secretary prepares and periodically revises the leasing program, which consists of a schedule of proposed lease sales indicating the size, timing, and location of leasing activity to best meet national energy needs.

In conjunction with preparation of the Five Year Program, BOEM prepares a Programmatic Environmental Impact Statement (PEIS) that is consistent with the requirements of the National Environmental Policy Act (NEPA) and which analyzes potential environmental, social, and economic impacts associated with the program. The analyses adopt a broad regional perspective; more detailed and geographically-focused analyses are conducted as the program progresses from the planning stage to leasing, exploration, development, and production.

The 2012–2017 Five Year Program

The final program reflects Secretary Ken Salazar's stamp on the Proposed Final Program (PFP), which he announced and submitted to the President and Congress with supporting analyses on June 28, 2012, for a minimum 60-day review, as required under Section 18. On August 27, 2012, the Secretary gave final approval to the schedule of lease sales for the next five years, expiring on August 26, 2017. The PFP decision document was the last of three proposed program documents issued since January 2009, and evolved as the process moved along and considered stakeholder input.



The new program schedules 15 potential lease sales in six OCS planning areas with high resource potential—the Chukchi Sea, Beaufort Sea, and Cook Inlet offshore Alaska; the Western and Central Gulf of Mexico Planning Areas; and a small portion of the Eastern Gulf of Mexico that is not currently under Congressional moratorium. Approval of a five-year leasing schedule is not necessarily a decision to hold lease sales, issue specific leases, or to authorize any drilling or development. Further analyses will be conducted before final decisions are made throughout implementation of the program.

Guiding Principles for the Five Year Program

The courts have stated that the Secretary of the Interior has discretion as to the weight assigned to the various Section 18 factors in balancing decisions. In exercising this discretion, Secretary Salazar focused on a handful of guiding principles.

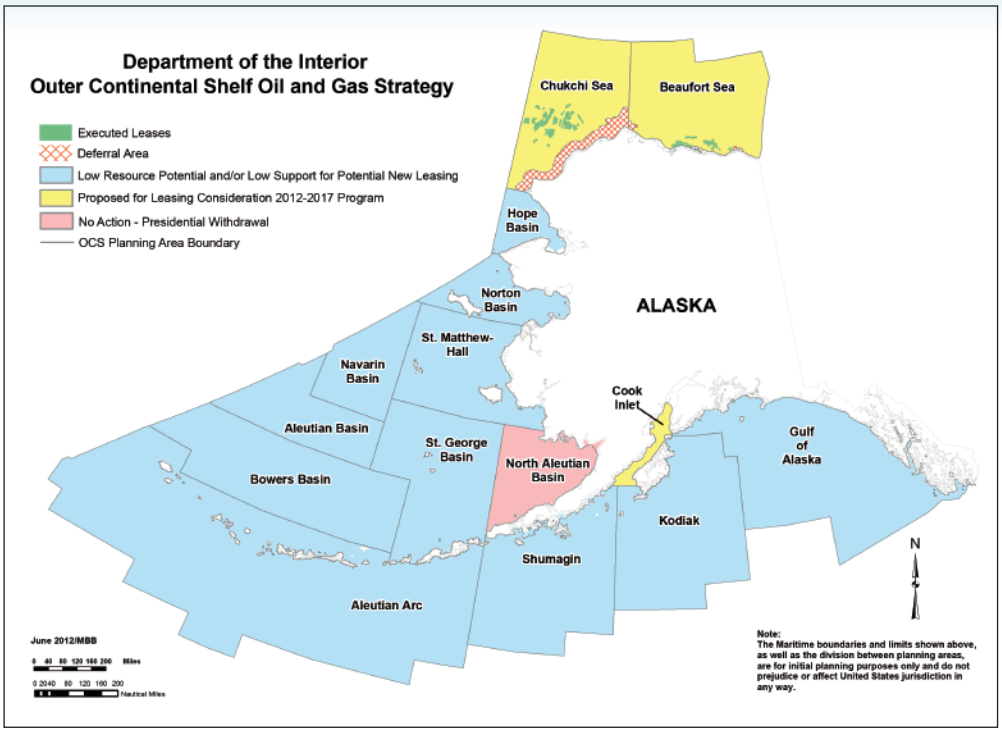
They include giving priority leasing consideration to areas where the combination of previous experience, local, state, and national laws and policies, and expressions of industry interest indicate that potential leasing and development activities could be expected to proceed in an orderly and productive manner.

Other guiding principles are:

- For areas with known or anticipated estimated hydrocarbon resources, the Secretary may consider leasing if, from a national and regional perspective, anticipated benefits from development substantially outweigh estimated environmental risks.
- Seek to accommodate the recommendations of governors of coastal States and of State and local agencies.
- Tailor a leasing strategy to specific regions to best achieve the dual goals of promoting prompt development of the Nation's oil and natural gas resources and ensuring that this development occurs safely and with the necessary protections for the marine, coastal, and human environments. This region-specific approach accounts for such issues as available knowledge of resource potential, adequacy of infrastructure including oil spill response capabilities, accommodation of regional interest and concerns, and the need for a balanced approach to the use of natural resources.

The Secretary may time the sales in frontier areas to make use of information from exploration on existing leases to: 1) minimize impacts to the environment and coastal areas; 2) evaluate monitoring data; 3) better assess infrastructure needs; 4) enhance financial return in future lease sales; and 5) better define areas of greatest interest to industry.

While oil and natural gas resource development in the Gulf of Mexico is a mature industry with extensive amounts of information and data, there is a continuing need for new research into how the ecosystem functions. With the Alaska OCS as a frontier area, the later scheduling of the potential sales in the Cook Inlet, Chukchi Sea, and Beaufort Sea Planning Areas in 2016 and 2017 represents a strategic approach to leasing in the Alaska region. It is structured to allow time for additional work in critical areas such as scientific study and environmental assessment, information collection on the geologic conditions and resource potential in the area through exploration under existing leases, and further development of oil spill response preparedness and infrastructure capabilities.



Program Implementation

A Five Year Program is a schedule of proposed lease sales. The table below shows the proposed lease sales for the Gulf of Mexico and Alaska OCS Regions for the 2012–2017 program. BOEM has held two lease sales since announcing the new Five Year Program: November 28, 2012 for the Western Gulf of Mexico, and March 20, 2013 for the Central Gulf.

The full table is available at http://www.boem.gov/Oil-and-Gas-Energy-Program/Leasing/Five-Year-Program/Lease-Sale-Schedule/2012---2017-Lease-Sale-Schedule.aspx

2012–2017 Program Lease Sale Schedule

OCS Planning Area	Lease Sale Year
Western Gulf of Mexico	One sale each year beginning in 2012 (November), then August through 2016
Central Gulf of Mexico	One sale each year beginning in 2013 through 2017 (March)
Eastern Gulf of Mexico	2014, 2016
Cook Inlet	2016
Chukchi Sea	2016
Beaufort Sea	2017

For More Information:

Proposed Final Program (PFP)

www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Five_Year_Program/2012-2017_Five_Year_Program/PFP%2012-17.pdf

Developing a Five Year Program is a Team Effort

Development of a Five Year Program for oil and gas leasing on the OCS is a monumental task requiring the efforts of many people. It usually takes from two-and-a-half to three years to develop. In order for the Secretary of the Interior to make the final program decision, he or she relies on teams of specialists from throughout BOEM and parts of the Bureau of Safety and Environmental Enforcement (BSEE) to develop and analyze proposals setting forth the schedule of lease sales using the eight factors set out in Section 18 of the OCSLA. Engineers, economists, scientists, attorneys, and policy makers in all regional and headquarters offices are called upon for valuable input, analyses, and decision making at each step.

For the oil and gas programs, BOEM relies on its Strategic Resources and Environmental Assessment/Sciences teams. Their work intersects at key decision points throughout the life of the program—from the national program stage to assessing specific areas for energy development. The analyses performed by each team, provided to management for oversight and decision making, will have impacts lasting 40 to 50 years, the average lifespan of oil and natural gas wells. This long-term relationship is fed by an ongoing stream of scientific research, from baseline information to long-term monitoring.

OCSLA Section 18 Factors in Balanced Decision Making

- Existing information on OCS regions
- Equitable sharing of benefits and risks
- Regional and national energy markets
- Multiple uses of the sea and seabed
- Interest of oil and gas producers
- Laws and policies of affected States
- Environmental sensitivity and marine productivity
- Environmental and predictive information

Alaska Regional Director James Kendall at a public meeting.

The Strategic Resources team consists of three groups of specialists. Resource evaluation experts identify the geological characteristics of an area. Economists analyze a range of economic data including energy supply and demand projections of bonus, rent and royalty payments to the Treasury, and the costs and benefits of each decision option. Multidisciplinary leasing experts develop and manage the leasing timetable and activities, oversee additional qualitative analyses, and assure proper coordination throughout the Bureau.

On the Environmental Sciences team, scientists conduct and oversee a wide range of biological, physical, and social science research related to the OCS, and provide ongoing input and real-time science to the teams conducting NEPA analyses and reviews. The subject matter includes broad areas such as marine ecosystem sensitivity; air and water quality; the acoustic environment; marine, coastal, and estuarine habitats; marine and terrestrial animals, plants, and other

Anchorage public hearing with Kendall.

life forms; and socio-economic and other impacts of energy development on communities, fisheries, tourism, environmental justice, and archaeological resources.

The BOEM Strategic Resources and Environmental Program offices work in sync to keep new knowledge flowing, accelerate research if needed sooner, and share new knowledge with others in real-time to safeguard the marine, coastal, and human environments. This culminates in ecosystem-based adaptive management.

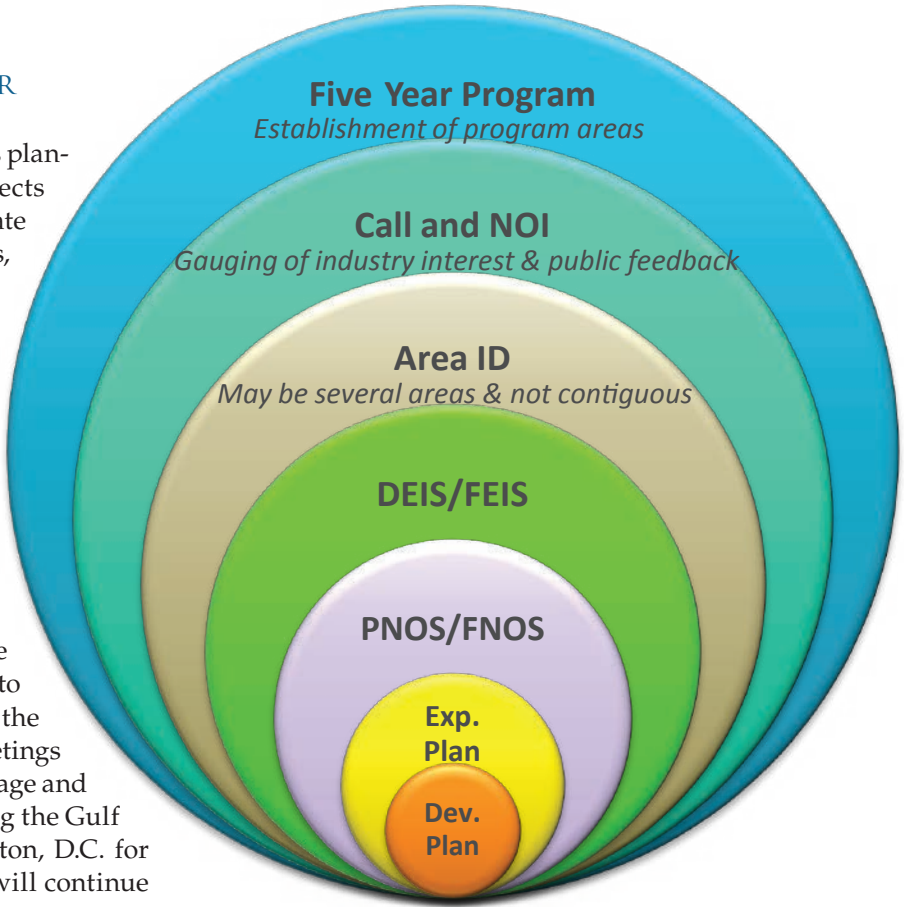
Stakeholders are Key to Five Year Program Planning

Stakeholder input is an important part of this planning process. Their dynamic involvement reflects the views of public interest organizations, State and local governments, individual citizens, tribes, energy and non-energy industries, scientists, and other interested stakeholders. As required by OCSLA and NEPA, BOEM provided several robust public commenting opportunities beginning in August 2008 with the Request for Information, and ending several months after the Proposed Program and Draft EIS were issued in November 2011. Together, BOEM received almost 1 million comments during the multiple comment periods, and a nearly equal amount related to the environmental impact statements. The Secretary hosted meetings on the Atlantic, Pacific, and Gulf Coasts and in Alaska to enhance opportunities for elected officials and the public to comment. The BOEM held scoping meetings and public hearings on the Draft EIS in Anchorage and on Alaska's North Slope, several locations along the Gulf Coast from Florida to Texas, and in Washington, D.C. for the national perspective. Public involvement will continue throughout program implementation.

Although each Five Year Program is reviewed annually, BOEM is increasing the transparency of the process by posting to its public website the status of the program and any changes. BOEM has developed several new tools, including a mitigation/program tracking table and regionally-tailored interactive maps that can be viewed on the Five Year Program website.

Strategic Leasing in the 2012–2017 Proposed Final Program

The process moves from the broad to the narrow, i.e. Five Year Program to lease sale steps to exploration plans and then development plans.



Abbreviations used in figure include: Notice of Intent (NOI), Draft Environmental Impact Statement (DEIS), Final Environmental Impact Statement (FEIS), Proposed Notice of Sale (PNOS), and Final Notice of Sale (FNOS).

For more information:

Mitigation/Program Tracking Table
www.boem.gov/5-year/2012-2017/Tracking-Table/

Interactive Map
www.boem.gov/5-year/2012-2017/Interactive-Maps/

Five Year Program Website
www.boem.gov/5-year/2012-2017/

Applied Science for Informed Decisions on Ocean Energy

As BOEM implements the Five Year Program, applied science will play a key role at each step. The article on pg. 11 in this issue describes select environmental studies and issues that resonate in the development of future Alaska and Gulf of Mexico OCS energy resources. In each, we will identify the questions we are trying to answer through our research and why the information is important to BOEM.

Spotlight on a Scientist: Bill Shedd

What do you do?

After attending the University of Rochester and Louisiana State University (LSU) and working as a geoscientist in the oil industry for 20 years, I came to MMS in 1997 to work as a geophysicist in the Office of Resource Evaluation (RE) evaluating bid blocks for fair market value. In 1998, I noticed a dramatic increase in 3-D seismic amplitude response on the seafloor in two blocks I was evaluating in Garden Banks. After further investigation, I realized that three amplitude anomalies on the rest of the survey corresponded directly to areas that had been confirmed to be seep sites by Drs. Harry Roberts of LSU and Ian MacDonald (then of Texas A&M University). What the seismic instrument was "seeing" was authigenic carbonates formed by bacterial consumption of hydrocarbon, which provided substrate and food for chemosynthetic communities. RE management was very enthusiastic about continuing to map the rest of the deepwater GOM, which is ongoing today.

How does your work contribute to BOEM's mission?

Mapping deep water hydrocarbon seep anomalies has contributed to BOEM's mission in several ways.

1. The bid evaluation process requires geoscientists to have a good idea of the probability of the presence of hydrocarbons in an area being evaluated—the presence of seep anomalies on the seafloor increases the probability of hydrocarbons being present in the subsurface.
2. The chemosynthetic and coral communities that have been found to populate the carbonate hardgrounds are protected by BOEM from oil industry impacts such as drilling, platform anchoring, and pipeline placement. The polygons that we draw around the probable hardground sites are used by BOEM to restrict industry from operating too close to potential benthic community sites.
3. The presence of seafloor seep anomalies have directly led to the discovery of natural gas hydrates on the seafloor and in the subsurface of the GOM. One major study undertaken by RE is estimating the technically recoverable gas hydrate in the OCS. The presence of active hydrocarbon flux through the shallow subsurface in deep water where gas hydrates are stable is a critical input into the model used to estimate gas hydrate volume. Additionally, while mapping the seafloor, we have found over 150 areas in the GOM where the geophysics indicates the presence of gas hydrates. At least once a month over the past several years, especially after the *Deepwater Horizon* (DWH) spill, we are contacted by the Bureau of Safety and Environmental Enforcement (BSEE), the U.S. Coast Guard, or the National Oceanic and Atmospheric Administration (NOAA) about an oil slick report and asked to assess the probability of it being natural or from a leak. In conjunction with our slick database, we determine if the slick is associated with one or more of our geophysical anomalies.
4. After the DWH spill was contained, we used our geophysical anomaly database to identify probable hardground habitats in the vicinity of the Macondo well to survey for potential oil impacts on deepwater benthic communities. Five Natural Resource Damage Assessment (NRDA)-funded cruises utilized our maps and found eight new coral/chemosynthetic sites, two of which found impacted corals. Our maps were also used by soft sediment sampling NRDA cruises to avoid hardgrounds.

Senior Geophysicist Bill Shedd.

What continued research is needed to advance our knowledge of oil and gas seepage in the GOM and elsewhere on the U.S. Outer Continental Shelf?

Though our seafloor mapping has identified over 25,000 potential seep sites in the deepwater GOM, the actual flux rate of oil and gas from those that are active (many are dormant, "historic" sites) has not been quantified. During the Fall of 2011 and the Spring of 2012, the NOAA ship *Okeanos Explorer* surveyed over 24,000 square miles of seafloor using its hull-mounted multibeam sonar to map bathymetry and to identify water column gas plumes coming from natural seeps and infrastructure. Over 300 plumes were found with many of them coming from BOEM's amplitude anomalies (135 amplitude anomalies were confirmed to have active gas flux). For several days, scientists using the ROV *Little Hercules* collected video of plumes and conducted bubble counts to estimate flux rate, which will be correlated to the backscatter of those plumes. The goal is to eventually be able to use the backscatter of the sonar response to estimate total flux from the plumes identified in the past and future. After the DWH spill, there is a lot of interest in knowing the background level of oil in the GOM and this research will contribute greatly to our knowledge base.

Economics Division Chief, Marshall Rose

Why did you decide to work for BOEM?

I started my career with DOI working in the Office of Policy Analysis (OPA), which is part of the Office of the Secretary. This was well before MMS was formed; at that time several different offices and bureaus ran the offshore oil and gas program, including OPA, the Bureau of Land Management (BLM), and U.S. Geological Survey (USGS). I had other offers to work elsewhere, but found the opportunity to design offshore energy lease sales irresistible from both an analytical and policy perspective. I was also very impressed with both the DOI managers and staff that I met during the interview process. They were smart, well educated, friendly, and dynamic. The first OCS lease sale that I helped design was Sale 35 in California in December, 1975. Decades later, I am still involved in designing offshore lease sales, and worked most recently on Central Gulf of Mexico sale 227 in March, 2013.

Marshall Rose.

What do you do, exactly?

I manage the Economics Division in BOEM. Our office works on a variety of policy issues related to oil and gas lease sales, and is in the process of designing the fiscal terms and auction format for initial offshore competitive sales of wind energy. We conduct the economic analyses which support the Five Year Program; develop criteria to accept or reject bids in our lease sales to ensure receipt of fair market value; lead the review of company appeals of bid rejections; conduct studies on the performance of various policies related to fiscal terms and fair market value considerations; forecast OCS receipts for inclusion in the President's Annual Budget Request; prepare regulations on fiscal issues, safety considerations and legislative requirements; conduct cost-benefit studies in support of leasing and drilling policy initiatives; develop software models to assist in policy analysis; conduct ad hoc studies at the request of the White House Office of Management and Budget (OMB), the Congressional Budget Office (CBO), and the Congress; provide economic inputs for resource assessment and evaluation of bids in lease sales; and prepare the BOEM portion of the DOI Economic Report to the Secretary. Personally, my role as manager involves setting priorities and goals, hiring and mentoring staff, assigning projects, tracking progress, offering advice on methods of analysis, projecting resource, manpower and extramural study needs, and assisting in the briefing of senior managers on the results of our work.

What is your educational background and experience and how does it enable you to do your job?

I'm trained in economics and operations research. Before coming to DOI, I first worked at the Center for Naval Analyses, where I developed a resupply system for the F-4 aircraft, which became the basis for my doctoral dissertation. I next worked at the Xerox Corporation, helping to design high speed copying machines having the optimal configuration of printing features. Once I started work in the Office of the Secretary here at DOI, I was pretty well-grounded in applying analytical theory to real world problems—just what was needed at the time the offshore program was about to accelerate following the passage of the amendments to the OCSLA in 1978. In fact, one of my earlier major projects involved carrying out the requirements of the OCSLA, as amended, to structure lease sales to include various mandated leasing systems, and then to evaluate how these systems operated in these experiments with regard to various measures of performance.

What role do you play in the development of BOEM's Five Year Program?

Our office is responsible for almost all of the economic analysis and much of the risk assessment associated with activities in every planning area included for consideration in the program. We conduct a cost-benefit analysis for each area, perform an option value assessment to determine whether, when, and what size geological fields should be considered for leasing, and undertake an evaluation of the risks and costs of catastrophic oil spills.

What do you find most exciting or rewarding about your work?

The most exciting parts of the job relate to addressing intellectually challenging and programmatically important policy problems, managing an all-star cast of staff members to help solve those problems, and working for a highly supportive group of senior managers. And, it can be exhilarating to meet presidents, secretaries, chairmen of the Council of Economic Advisors, Nobel Prize winners, and yes, even Robert Redford one time in the Secretary's conference room. The most rewarding part involves working on a program that contributes so significantly to both the Nation's crucial energy supplies and to its revenue receipts. And, because we are occasionally able to have some helpful influence on how the goals of these parts of our program are achieved, one could say that I've played in a big arena, enjoyed the job of a lifetime, and hopefully represented the program well.

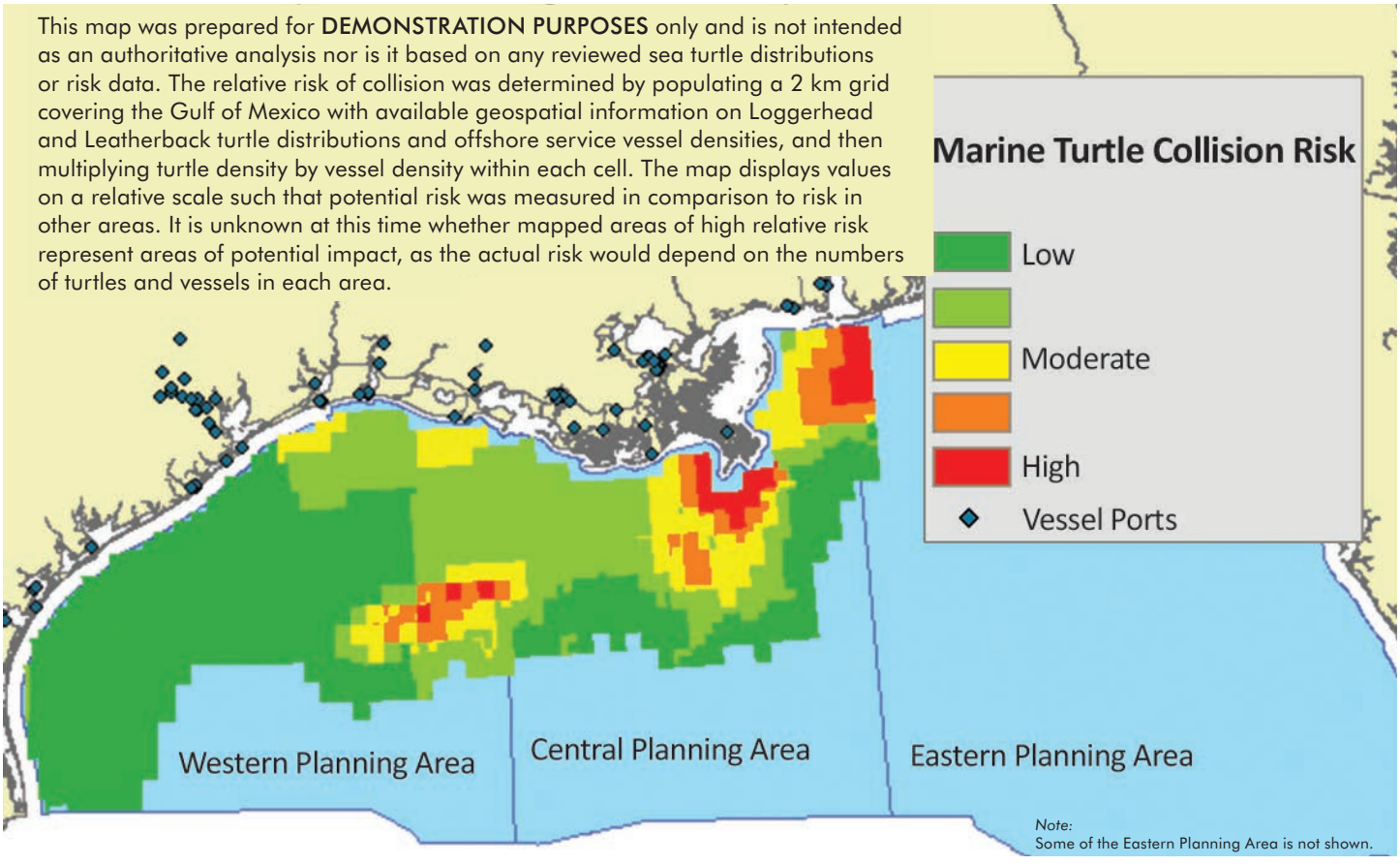
BOEM's New Vision for Programmatic Environmental Impact Statements

Since 1975, BOEM (previously MMS) has prepared eight Programmatic Environmental Impact Statements (PEIS) to support the development and planning of each Five Year Oil and Gas Leasing Program that has occurred. The great value of a programmatic NEPA document is to present a concise and clear assessment of environmental issues and lay out a vision to address these issues throughout program implementation. These objectives have been difficult to realize using the traditional five-year PEIS approach that has become a challenging, expensive, and time-consuming process, resulting in the delivery of large, text-filled descriptive documents to decision makers, stakeholders, and program planners.

Consequently, BOEM's Office of Environmental Programs, Division of Environmental Assessment (DEA) is developing a modernized approach for preparing the next five-year PEIS that will be based on spatially referenced areas where environmental resources (such as marine turtles and commercial fisheries) occur and where exploration and development activities may occur, as well as geospatial analyses and protocols to determine areas of high potential impact. The map below was created to demonstrate the type of product that would be included in the modernized PEIS. The map shows the relative risk of collisions between Leatherback and Loggerhead marine turtles and offshore service vessels in the Gulf of Mexico.

The map shows three distinct areas with a higher risk of collision. In an actual PEIS this information would be used in a Gulf of Mexico lease sale EIS through the NEPA process of tiering. The lease sale EIS would evaluate the collision risk in more detail to determine whether a real threat to marine turtles exists, and if so, what mitigation measures would be needed to reduce the risk. In this way, the modernized PEIS has the potential to become a discovery tool that proactively identifies environmental impact hot spots at the start of a program so that necessary mitigations to protect resources can be developed by the time that actual exploration and development activities begin there. This capability will more effectively fulfill NEPA's vision of the EIS as a proactive planning tool.

DEA is currently developing a prototype PEIS that will apply the modern approach to a limited set of environmental resources and impacting agents. This effort, which will be completed in March 2014, will determine the extent to which this approach can be implemented for the next five-year PEIS. The ultimate objective is to develop a concise and coherent PEIS that presents the results of impact analyses in an intuitive and accessible way through the use of highly effective graphics accompanied by focused textual discussions.



Environmental Studies Support Decision Making for the Five Year Program

In each Five Year Program, the Secretary decides the size, timing, and location of possible lease sales over the next five years. This decision is a considerable challenge, and the economic and environmental stakes are high—a single lease sale could result in exploration and development activities over a 50-year period. It is possible to have sales in each of the 26 OCS planning areas, from the Gulf of Mexico to the Arctic, with each planning area having vastly different resource potential and ecosystem characteristics. The Secretary must weigh a host of competing values—economic, social, political, and environmental—in making a decision. To ensure the DOI's mission of environmental protection and stewardship, the Secretary considers not only possible environmental impacts from OCS activities, but the environmental sensitivity and productivity of OCS planning areas. In this context, productivity generally refers to the capacity of biological resources—from microorganisms to plants and animals—to reproduce and thrive.

Evaluating Relative Environmental Sensitivity

Accurately characterizing a region's environmental sensitivity is a considerable challenge, as sensitivity is not a well-defined concept in ecology or policy. Sensitivity can be viewed in the context of the vulnerability of an environmental resource to an impact, as well as the ability to resist or to recover from change. Sensitivity as a concept is not limited to environmental resources, but can relate to human systems, communities, and climates in frontier areas.

At the earliest stages of the five-year process, BOEM compared the environmental impacts and sensitivity of the various planning areas where oil and gas activities could take place. BOEM considered the vulnerability of habitats (from rocky shorelines to coral communities), animals (from endangered migratory birds or whales to resident fishes), and even unique ways of life (from Louisiana Cajuns to Alaska Natives) to stresses caused by oil and gas exploration and development, such as oil spills, noise, and physical disturbance. BOEM must also consider global stressors, for example climate change and ocean acidification. These various environmental factors were analyzed and planning areas were scored on their relative sensitivity. Some planning areas analyzed were noticeably more productive and potentially sensitive; however, this is a daunting analysis to interpret as all planning areas have unique environmental characteristics that complicate across-the-board comparisons.

This sort of analysis is not without uncertainty and scientific disagreement. BOEM receives ample and frequent input on the science and assessment used to support decisions from all manner of internal and external parties. In response, BOEM constantly seeks to improve the rigor of its methods for conducting environmental assessments. For example, the Bureau is funding a study to develop a more quantitative approach to define and measure OCS environmental sensitivity to BOEM-regulated activities and satisfy this important requirement of the OCSLA. This includes better integrating concepts of resilience, biodiversity, ecosystem boundaries, and looking at abundance and rarity as additional measures of sensitivity. The study will result in a new tool that BOEM can use to prepare the relative environmental sensitivity analysis, accounting for the variability of resources in space and time and do so within a comprehensive ecosystem framework.

The environmental reviews, whether through an EIS or supporting program analyses, incorporate the best available science and identify areas of incomplete information and issues that must be considered later in the phased OCSLA process. This phased process offers distinct opportunities for adaptive management practices to re-enforce or re-orient the program with decisions about individual lease sales and exploration and development plans. These decisions may include what mitigation is necessary to avoid or minimize impacts, or identify areas that should be avoided because of their environmental sensitivity.

Grouping of OCS Program Areas by Relative Environmental Sensitivity to Impact as a Measure of Environmental Sensitivity[†]

Most Sensitive to Impact	• Central GOM • Eastern GOM
More Sensitive to Impact	• Beaufort Sea • Western GOM
Less Sensitive to Impact	• Chukchi Sea • Cook Inlet

† OCS program areas are listed in alphabetical order within each grouping.

Source: www.boem.gov/uploadedFiles/BOEM/Oil_and_Gas_Energy_Program/Leasing/Five_Year_Program/2012-2017_Five_Year_Program/PFP%2012-17.pdf

For more information:

Evaluation of the Relative Environmental Sensitivity and Marine Productivity of the Outer Continental Shelf (OCS)

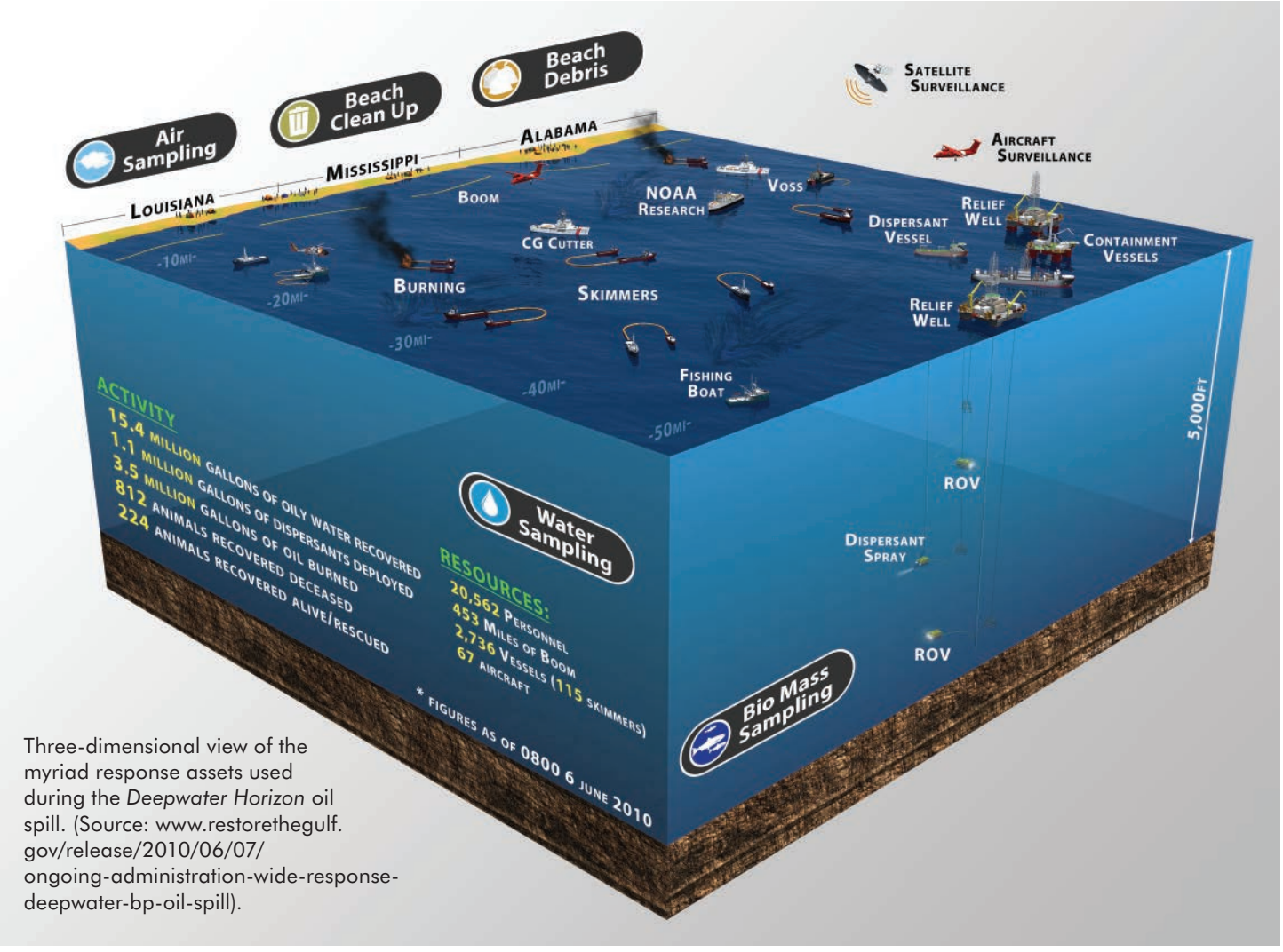
www.boem.gov/uploadedFiles/BOEM/Environmental_Stewardship/Environmental_Studies/National/Fates_and_Effects/NT-11-01%20EnvSensitivity.pdf

Improved Understanding of Oil Spill Transport and Fate in the Gulf of Mexico

One priority informing the new Five Year Program has been to learn from the lessons of the *Deepwater Horizon* (DWH) tragedy in the GOM. This involves analyzing a wealth of environmental information and identifying knowledge gaps. Since DWH, BOEM has launched several environmental studies that examine the movement and behavior of oil, especially in deepwater and near major ocean currents. These studies should improve detection and prediction of where and how oil travels through the ocean after a spill, improve our understanding of oil plume behavior, and help us understand the impact of dispersants on oil droplet size distributions, variable weathering processes, and deep circulation of the Gulf.

BOEM has contracted with Applied Science Associates, Inc. to develop and apply an integrated three-dimensional oil spill model that incorporates the processes unique to deep oil spills. The study, titled "Simulation Modeling of Ocean Circulation and Oil Spills in the Gulf of Mexico," will simulate dispersed oil transport and fate at different depths in the water column. Researchers will model scenarios to explore the transport characteristics of different types of oil, oceanographic conditions, and spill responses after a deepwater blowout. For example, model experiments will consider how spilled oil changes in the ocean over time, including its potential impacts, given variable dispersant use and different blowout locations. An important aspect of the intended work will be model validation and development using real-world oil observations. Results will be used to refine mitigation and oil spill response planning, as well as to inform BOEM's Oil Spill Risk Analysis modeling.

BOEM also recognizes the need for improved understanding of the processes by which oil can be moved in surface waters of the GOM, including by the Loop Current. Some scientists and the public are concerned that a large spill near this major ocean current could result in the oil rapidly spreading over the Gulf and into the Atlantic Ocean along southern Florida. A new BOEM study considers the characteristics of oil on the sea surface, based on its remote sensing signatures (i.e., airplanes and satellites), and uses this imagery along with modeling to better understand spilled oil's interaction with winds, weathering processes, ocean currents, and wave mixing. This study is titled "Remote Sensing Assessment of Surface Oil Transport and Fate During Spills in the Gulf of Mexico." An expert team led by Florida State University started the study in mid-2012 and is analyzing data collected *in situ* and through remote observations of oceanic conditions and surface oil distribution during the DWH oil spill. One specific task is



Three-dimensional view of the myriad response assets used during the *Deepwater Horizon* oil spill. (Source: www.restorethegulf.gov/release/2010/06/07/ongoing-administration-wide-response-deepwater-bp-oil-spill).

to identify the mixing processes that influence oil transport, such as the role the Loop Current and other types of frontal zones play as a barrier or a conduit.

For more information:

Simulation Modeling of Ocean Circulation and Oil Spills in the Gulf of Mexico (GM-11-02)

http://boem.gov/uploadedFiles/BOEM/Environmental_Stewardship/Environmental_Studies/Gulf_of_Mexico_Region/Ongoing_Studies/GM-11-02.pdf

Remote Sensing Assessment of Surface Oil Transport and Fate during Spills in the Gulf of Mexico (GM-12-02)

http://boem.gov/uploadedFiles/BOEM/Environmental_Stewardship/Environmental_Studies/Gulf_of_Mexico_Region/Ongoing_Studies/GM-12-02.pdf

Monitoring Impacts and Synthesizing Research in the Arctic

There is a strong interest in pursuing offshore energy development in the Arctic. At the same time, BOEM recognizes the necessity of protecting important subsistence activities and areas of environmental concern as we prepare for potential lease sales late in the 2012–2017 Five Year Program. Highlighted below are just two of the nearly 70 ongoing Alaska studies designed to help inform the decision-making process.

Impact Monitoring for Offshore Subsistence Hunting in the Chukchi Sea

BOEM initiated a study being performed by Stephen R. Braund & Associates to monitor the hunt for bowhead and beluga whales, walruses, polar bears, and seals over a four-year period. This study is an outgrowth of a planning workshop sponsored by BOEM in November 2006 with a broad array of stakeholders. At that time, there was very little information about offshore subsistence activities along the Chukchi Sea coast. The investigators are studying harvest patterns, composition of hunting parties, and location and duration of hunts relative to conditions such as weather and ice. These data will serve as a baseline reference to evaluate any significant changes in subsistence activities that may occur relative to future oil and gas activities. Community participation is an essential aspect of this research. The results of the study will be available for the analyses in the EIS for the proposed Chukchi Sea Lease Sale scheduled for 2016.

Beluga whales.

Photo by Amelia Brower, NOAA

Walruses on ice.
Photo by Amelia Brower, NOAA

Synthesis of Arctic Research (SOAR) Physics to Marine Mammals in the Arctic

Between 2005 and 2015 BOEM's Environmental Studies Program (ESP) will have invested approximately $60 million in new marine mammal and related oceanographic studies in the western Arctic. The *SOAR* project provides a mechanism to synthesize and integrate environmental analyses and data across projects and disciplinary boundaries. Led by the NOAA Pacific Marine Environmental Laboratory, the study brings together a multidisciplinary group of scientists and Arctic residents to integrate information from completed and ongoing marine research in the Arctic. BOEM anticipates it will result in an improved scientific understanding of the relationships among oceanographic conditions (ocean currents, upwelling, and ice), benthic organisms, lower trophic prey species (forage fish and zooplankton), seabirds, and marine mammal distribution and behavior. The study area includes the Beaufort, Chukchi, and northern Bering seas. The results will be available for the environmental analyses in the Chukchi and Beaufort Seas Lease Sales scheduled for 2016 and 2017, respectively.

These studies provide specific examples of how the ESP works to satisfy information needs from the 2012–2017 Final Programmatic EIS, which calls for more research prior to conducting lease sales. They may lead to better identification of sensitive areas and possible area exclusions.

For more information:

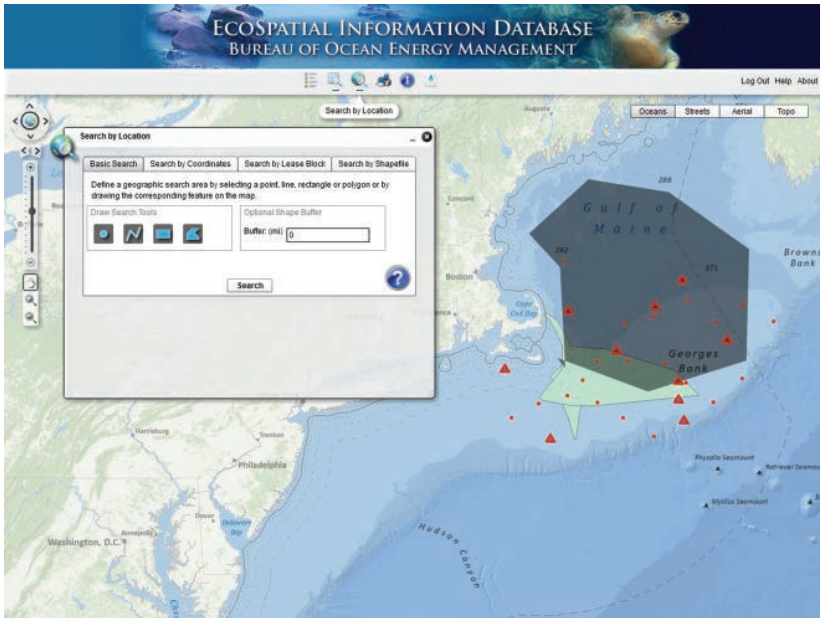
Synthesis of Arctic Research (SOAR) Physics to Marine Mammals in the Arctic (AK-11-05)

www.boem.gov/uploadedFiles/BOEM/Environmental_Stewardship/Environmental_Studies/Alaska_Region/Alaska_Studies/PSPO_1105.pdf

EcoSpatial Information Database Delivers Georeferenced Ecological Information

On March 5th, 2013, the EcoSpatial Information Database (ESID, pronounced "ee-sid") project was honored for outstanding contributions to ecological mapping. The project earned the American Council of Engineering Companies of Tennessee (ACEC) Engineering Excellence Grand Award in the Survey and Mapping Technology category. BOEM's Environmental Studies Program is proud of the ESID's contributions to advancing web-based information cataloguing, while supporting the Bureau's science-based decision-making process related to offshore energy development.

In 2009, through a contract with AMEC Environment & Infrastructure, Inc., work began on this impressive new electronic library featuring a map interface complete with full text and geographic search options. The database has been designed to house ecological and environmental information (referred to as "resources") for all marine and coastal areas of the United States, beginning with the east coast region to inform renewable energy development. ESID's goal is to supply BOEM with a full understanding of ocean habitats and marine organisms by centralizing access to and georeferencing literature resources that were previously found in various locations.



The ESID map interface allows the user to search graphically by drawing an outline on the map for their area of interest, or the user can choose among numerous options for the spatial search.

The ESID provides the foundation for an ecosystem-based approach to management. In one location, ecological and spatial information is organized and easily accessible to BOEM for decision making and regulation of offshore energy activities with proper environmental assessment. The ESID currently contains a variety of resources for the U.S. Atlantic region, including geology, water quality, pelagic ecology (plankton, nekton, sargassum), infauna/meiofauna, demersal fishes, coral and hardbottom communities, and seagrass. Each resource includes an annotated bibliographic entry, geographic information systems (GIS) files that show the study areas (or sampling sites), metadata, the resource itself (searchable PDF or other file types), and any other associated files.

Public access is now available through a cloud-based website, with thousands of full text resource documents for the Atlantic obtainable through immediate downloads. The full text resources allow users to conduct keyword searches; the ESID map interface allows users to search graphically because every resource is georeferenced. In addition to full text reports, users can generate reports of search results for bibliographic information and download associated files, such as data files and GIS files, when available. For copyright restricted documents, public users are directed to the copyright owners.

In October 2012, BOEM and BSEE scientists received hands-on training to inform them of the ESID's capabilities. Scientists were taught to access and identify documents geographically, search by subject, and obtain information relative to their area of interest by filtering documents. Help documentation for ESID can be viewed online at http://esid.boem.gov/Help.aspx.

The ESID application was designed in a flexible manner to easily accommodate future needs related to other regions and resources. This makes it a very useful asset for the Five Year Program, assisting in assessing environmental impacts and

The ESID will contain literature resources of all types and for any relevant subject for the marine environment. Some examples include:

- background GIS layers of bathymetry
- sampling sites
- shoreline
- marine protected areas
- topography
- sediment
- salinity
- temperatures
- currents
- benthic habitats and communities
- pelagic habitats and communities
- spatial and temporal distributions of species
- any resource with information about the ecology of the marine environment

supporting related workshops and outreach. Currently, the Five Year Program period does not include plans for oil and gas leasing areas off the Atlantic coast, but BOEM is preparing to update resource evaluation to support possible future Atlantic leasing decisions, including completing an environmental review that would support decision making in the Mid- and South Atlantic in 2013. As well, the ongoing renewable energy program is currently providing leases for renewable energy projects on the Atlantic seaboard. The ESID provides valuable support for this renewable energy work. The database also contains literature pertinent to future Atlantic planning related to the possibility of new oil and gas activity, which will require BOEM to have comprehensive information about the ecology of the region. The ESID is unlimited geographically and eventually will hold invaluable information resources for the current leasing areas in other parts of the country as continued efforts add a wide range of ecological resources to the geodatabase system.

The ESID will be an important tool in the BOEM/BSEE manager's toolkit, complementing the Environmental Studies Program Information System (ESPIS), which provides access to BOEM-funded studies information. BOEM is working on a prototype for the next generation of ESPIS that will ultimately couple its studies information with georeferenced data (Geo-ESPIS). The ESID can also support marine spatial planning portals such as the Marine Cadastre, managed by BOEM and NOAA, and thus support adaptive management and ecosystem-based management for offshore energy development planning. Although ESID, Geo-ESPIS, and the Marine Cadastre are slightly different tools for different purposes, they share a common goal—the ability to transform data about the marine environment into a mapped format that will help the user better understand the nature and location of ocean resources prior to and over the life span of any ocean resource development. The Internet era and evolving geographic information systems enable a multi-tiered approach that helps agencies meet important goals: securing operations using protected information systems, and heeding calls for the government to provide public access to the results of federally-funded scientific research.

For more information:

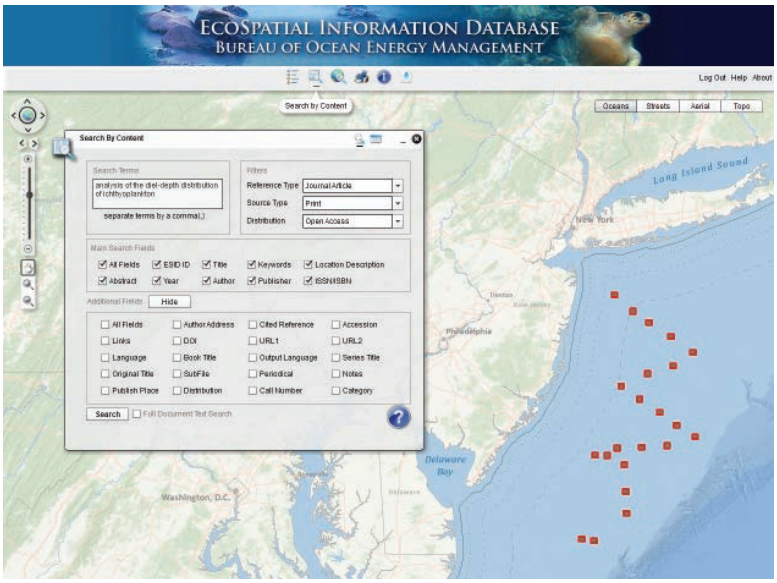
EcoSpatial Information Database Study, Atlantic Region (GM-08-x13)

http://boem.gov/uploadedFiles/BOEM/Environmental_Stewardship/Environmental_Studies/Gulf_of_Mexico_Region/Ongoing_Studies/GM-08-x13.pdf

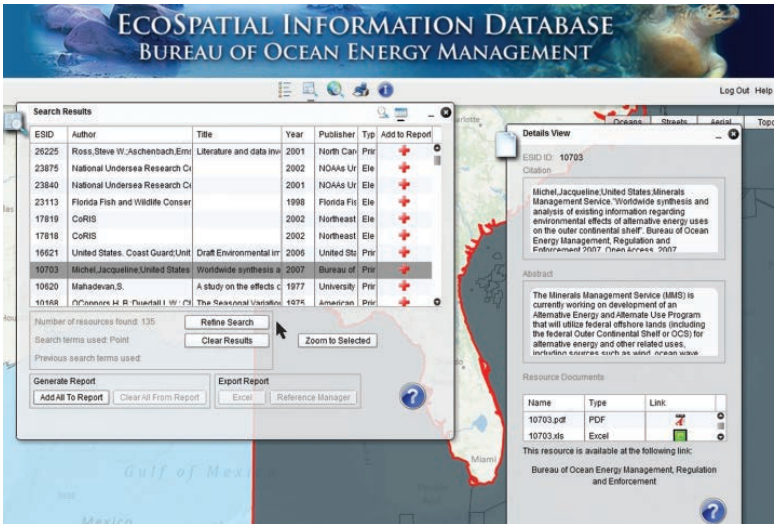
EcoSpatial Information Database

http://esid.boem.gov/

Ecology deals with the interaction of living organisms with their environment. This encompasses both plants and animals and their relations to all aspects of the environment such as sediment, water quality, currents, irradiance, and other factors. It also includes the interaction of organisms with each other. All these components of ecology must be considered in ecosystem-based management and will be incorporated into ESID.



The user can search by keyword and select database fields and filters for the search. This function can perform a full-text search of the database documents.



Searches return results as in the box above. The bibliographic entries can be selected and sent to a downloadable report in Excel or Reference Manager formats. The results can be searched using the "Refine Search" button. Double-click on a single result to get the details view, where the user can see the whole bibliographic entry, the abstract, and download the resource file(s) (PDF report, Excel data file, GIS shapefile, image file, etc.). The details view also includes a link to the source of the information (copyrighted results have only this link).

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New Waves

Late-Breaking News & Information

Central Gulf of Mexico Lease Sale 227

Central Gulf of Mexico Lease Sale 227, held March 20 in New Orleans, drew $1,214,675,536 in high bids for tracts on the U.S. Outer Continental Shelf offshore Louisiana, Mississippi, and Alabama. A total of 52 offshore energy companies submitted 407 bids on 320 tracts, covering more than 1,722,191.42 acres. The sum of all bids received totaled $1,595,397,446.

The sale included 7,299 blocks, covering 38.6 million acres, located from 3 to about 230 nautical miles offshore, in water depths ranging from 9 to more than 11,115 feet (3–3,400 meters). BOEM estimates the areas available for sale could result in the production of up to 890 million barrels of oil, and 3.9 trillion cubic feet of natural gas.

"The Central Gulf of Mexico is one of the cornerstones of the United States' domestic energy portfolio, and is central to meeting the Nation's energy needs and fueling the economy," said Acting Assistant Secretary for Land and Minerals Management and BOEM Director Tommy P. Beaudreau. "BOEM is committed to promoting safe and responsible development of the Nation's offshore energy resources, while safeguarding marine and coastal environments."

The sale builds on a number of recent offshore lease sales, including a November 2012 sale that made more than 20 million acres available, and a sale last June that made more than 39 million acres available. BOEM's Outer Continental Shelf Oil and Gas Leasing Program for 2012–2017 (Five Year Program) makes available for exploration and development all offshore areas with the highest conventional resource potential, including areas that are estimated to hold more than 75 percent of the Nation's undiscovered, technically recoverable offshore oil and gas resources. Sale 227 is the second under the new Five Year Program, and the first of five scheduled Central Gulf of Mexico lease sales.

GOMR Regional Director, John Rodi; Secretary Salazar; and BOEM Director, Tommy Beaudreau at the Central Gulf of Mexico Lease Sale 227 on March 20, 2013.