

Bureau of Ocean Energy Management | Environmental Studies Program

Quarterly Report FY 2018 Second Quarter

**Latest Reports and Study Profiles Posted to the
Environmental Studies Program Information System (ESPIS)**

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The Environmental Studies Program (ESP) Quarterly Reports include summaries of the Bureau of Ocean Energy Management (BOEM) environmental studies completed each quarter. These studies inform BOEM’s policy decisions on the development of energy and mineral resources on the Outer Continental Shelf (OCS).

Visit ESPIS at <https://marinecadastre.gov/espis/#/>.

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Characterization of the Circulation on the Continental Shelf Areas of the Northeast Chukchi and Western Beaufort Seas

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/26869>

Conducted by: University of Alaska Fairbanks

National Studies List: AK-12-03a (2012–2018)

Study Products (available in ESPIS): Final report, five peer-reviewed articles based on the findings, and two datasets

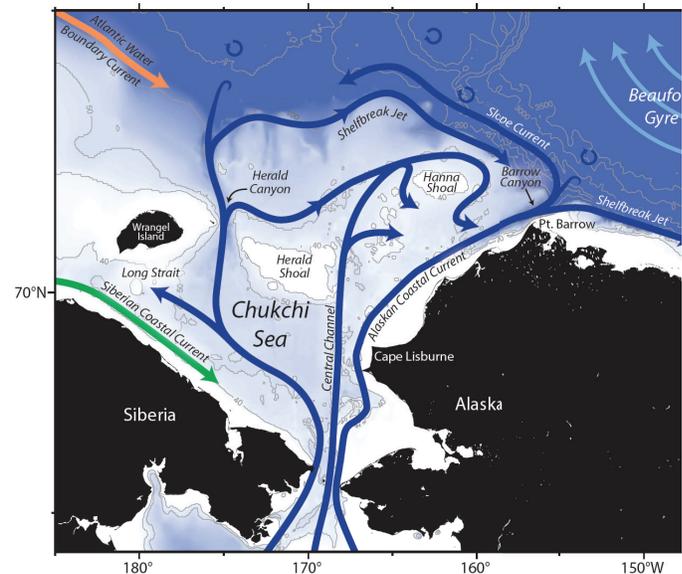
Purpose:

This study improved our understanding of the physical oceanography of the northeastern Chukchi shelf and exchanges between the Chukchi and Beaufort shelves and the adjacent continental slope.

Findings/Results:

- A previous study ending in 2011 collected data from moorings, gliders, and three high frequency radars.
- This study expanded the previous study by integrating a wide variety of observations obtained through several partnerships from moored oceanographic instruments, satellite-tracked drifters, high-frequency radars, meteorological buoys, satellite imagery, and hydrography—both recent (from towed and autonomous underwater vehicles) and historical (from ship measurements).
- By integrating this data, we developed a circulation map of surface and subsurface flow for the northeastern Chukchi and western Beaufort Seas, where we have defined two surface fronts: the meltwater/Bering Sea summer water front surrounding most of Hanna Shoal, and the Alaska coastal water front, which parallels the Alaskan coast from south of the Bering Strait to over the Beaufort Sea shelfbreak.
- We also discovered several important differences from the predictions-based numerical circulation model output.

Final Report: Weingartner TJ, Pickart R, Winsor P, et al. 2017. Characterization of the circulation on the continental shelf areas of the northeast Chukchi and Western Beaufort Seas. Fairbanks (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-065. 221 p.



Visible MODIS Terra image from July 13, 2016, acquired from the University of Alaska Fairbanks Geographic Information Network of Alaska

Exploration and Research of Mid-Atlantic Deepwater Hard Bottom Habitats and Shipwrecks with Emphasis on Canyons and Coral Communities

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/100016>

Conducted by: CSA Ocean Sciences Inc.

National Studies List: AT-10-03 (2010–2016)

Study Products (available in ESPIS): Final report, multibeam and oceanographic data, related publications and a video entitled "Atlantic Canyons: Pathways to the Abyss."

Purpose:

This National Oceanographic Partnership Program (NOPP) study, known as the Atlantic Deepwater Canyons study, conducted an extensive multidisciplinary investigation of habitats and archaeological sites in and around Baltimore and Norfolk Canyons offshore Maryland and Virginia. The study was a collaborative effort between BOEM, the National Oceanic and Atmospheric Administration, the U.S. Geological Survey, CSA Ocean Sciences Inc., 11 academic institutions, and other organizations. The Federal agencies sponsoring the study will use the findings to better understand ocean resources and to develop management measures for sensitive seafloor habitats, biota, and cultural resources in an area that is under consideration for future energy development and supports intensive fisheries. The study's four research cruises included a preliminary mapping cruise, two sampling cruises (2012 and 2013), and an instrument retrieval cruise in 2013.

Findings/Results:

- Baltimore and Norfolk Canyons are centers for organic material deposits, including sediments, anthropogenic contaminants, and marine detritus.
- Researchers discovered significant differences in sedimentology, turbidity, and physical oceanography within and between the two canyons.
- The study also investigated significant areas containing methane seeps and chemosynthetic benthic communities, corals, sponges, anemones, microbiomes, invertebrate megafauna, and fish communities.
- Archaeological studies located and documented World War I-era German warships sunk during aerial bombing tests in 1921. The study examined eight 20th century shipwrecks and two non-shipwreck sites that are being nominated to the National Register of Historic Places.

Final Report: CSA Ocean Sciences Inc, Ross S, Brooke S, Baird E, Coykendall E, Davies A, Demopoulos A, France S, Kellogg C, Mather R, et al. 2017. Exploration and research of Mid-Atlantic Deepwater hard bottom habitats and shipwrecks with emphasis on canyons and coral communities: Atlantic deepwater canyons study. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-060. 1,000 p + appendices.



Muzzle of the 5.9 in (15 cm) gun toward the stern of the USS Frankfurt with the turret in the background as observed during the 2012 sampling cruise

Habitat Mapping and Assessment in Atlantic Outer Continental Shelf Wind Energy Areas

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/100140>

Conducted by: National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center

National Studies List: AT-13-02 (2013–2017)

Study Products (available in ESPIS): Final report

Purpose:

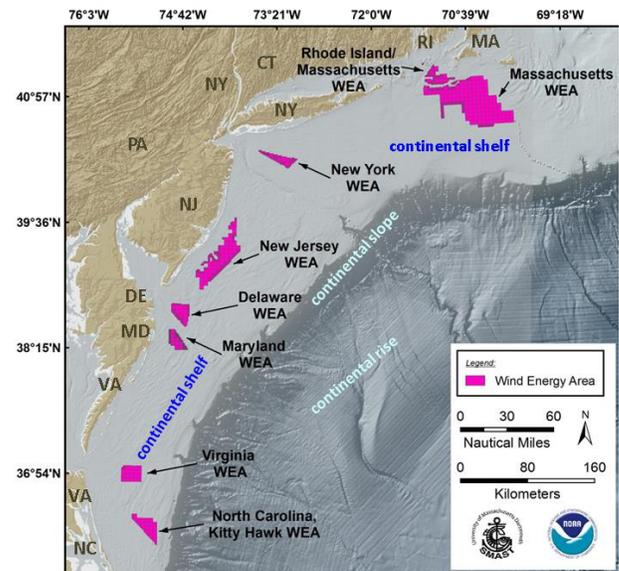
BOEM has issued leases in eight Wind Energy Areas along the Northwest Atlantic Outer Continental Shelf (OCS) from Massachusetts to North Carolina. Responsible development of Atlantic OCS renewable energy must consider ecological impacts to fisheries resources. To help understand these impacts, BOEM partnered with the National Oceanic and Atmospheric Administration (NOAA) to develop a comprehensive multi-scale benthic assessment.

Findings/Results:

- This assessment used a contemporary and comprehensive benthic habitat database that NOAA's Northeast Fisheries Science Center created for this study in collaboration with the Woods Hole Oceanographic Institution and the University of Massachusetts-Dartmouth School for Marine Science and Technology.
- The database characterizes physical habitat features, such as topography and sediment texture, and the distributions of biota, such as species of concern and other benthic fauna.
- The database aided in summarizing habitat information for each of the Atlantic lease areas and understanding the relationships between habitat and fauna in support of ecosystem-level assessments and cumulative impact analyses.

Final Report:

Guida V, Drohan A, Welch H, McHenry J, Johnson D, Kentner V, Brink J, Timmons D, Estela-Gomez E. 2017. Habitat mapping and assessment of Northeast Wind Energy Areas. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. 312 p.



Virginia WEA bathymetry

EMF (Electromagnetic Field) Impacts on Elasmobranch (Sharks, Rays and Skates) and American Lobster Movement and Migration

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/100067>

Conducted by: University of Rhode Island

National Studies List: AT-14-04 (2014–2018)

Study Products (available in ESPIS): Final report

Purpose:

Electromagnetic fields (EMF) are produced by offshore renewable energy infrastructure (such as submerged power transmission cables), and they have the potential to cause ecological effects or impacts on marine organisms. This study investigated the effects of EMF of the Cross Sound Cable on the behavior and foraging movement of two model organisms—the American lobster and the little skate (a member of the most electro-sensitive taxa). Field surveys of EMF employed novel 3D acoustic telemetry to track animal movements around three subsea power cables: two high voltage direct current (HVDC) cables and one alternating current (AC) cable. The researchers observed lobster and skate individuals placed in large enclosures in close proximity to the cross sound cable (HDVC) and compared their movements with individuals placed in control enclosures.



Deploying the animal enclosure at the Cross Sound Cable study area (photo by David Robinson, used with permission)

Findings/Results:

- Field-deployed animal enclosures and acoustic telemetry methods successfully allowed the collection of high frequency, three-dimensional positional data of individual animals.
- The American lobster exhibited a statistically significant but subtle change in behavioral activity when exposed to the EMF of the cross sound cable.
- The little skate exhibited a strong behavioral response to the EMF from the Cross Sound Cable.
- EMF associated with the Cross Sound Cable did not constitute a barrier to movements across the cable for either lobsters or skates.

Final Report: Hutchison ZL, Sigray P, He H, Gill AB, King J, Gibson C. 2018. Electromagnetic field (EMF) impacts on elasmobranch (shark, rays, and skates) and American lobster movement and migration from direct current cables. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-003. 254 p.

Atlantic Offshore Wind Energy Development: Public Attitudes, Values, and Implications for Recreation and Tourism

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/100061>

Conducted by: University of Delaware

National Studies List: AT-12-04 (2014–2018)

Study Products (available in ESPIS): Final report

Purpose:

The first offshore wind power project in the United States began operation in 2016 near Block Island, Rhode Island. As policymakers consider more projects, these projects could cause potential conflict with recreational beach use. To estimate the potential effect of offshore windpower on recreational beach use in this area, the study surveyed of 1,725 beachgoers in a sample representative of the beachgoing population on the U.S. East Coast. This study surveyed people about their reaction to wind power projects from distances ranging from 2.5 to 20 miles offshore.

Findings/Results:

- Offshore wind power projects would affect many beachgoers' experience/enjoyment on beach trips, change trip behavior, and generate curiosity trips.
- Wind power projects near shore (closer than 7.5 miles) negatively impacted survey responses in economic terms, especially on larger, more popular beaches.
- At farther distances (between 12.5 and 20 miles), the negatives are largely washed out by trip enhancement and curiosity trips, which, in many instances, resulted in a net positive experience.

Final Report: Parsons G. Firestone J. 2018. Atlantic offshore wind energy development: values and implications for recreation and tourism. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-013. 52 p.



*Recreational fishing near the Block Island Wind Farm
(photo by Brian Krevor, BOEM)*

Environmental Justice: A Comparative Perspective in Louisiana

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/98>

Conducted by: Louisiana State University

National Studies List: GM-92-42-106 (2003–2005)

Study Products (available in ESPIS): Final report

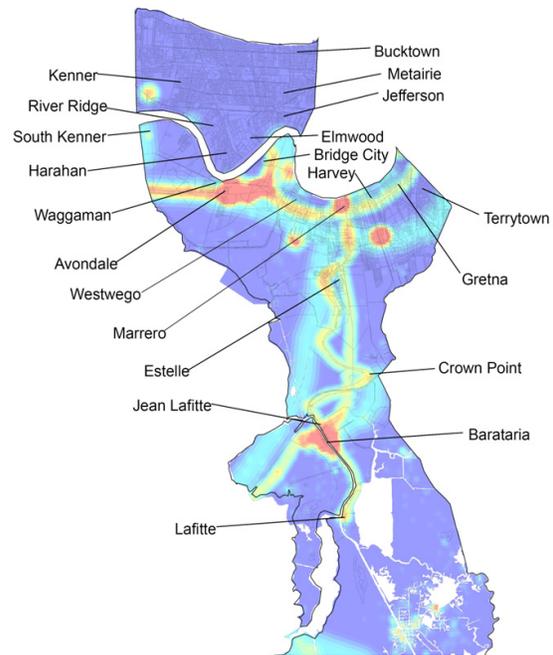
Purpose:

The petroleum industry includes three sectors: onshore production, offshore production, and petroleum refineries. Each of these sectors produces hazards and potential impacts to the human environment. When minority or low income populations are disproportionately impacted by, or at risk of, environmental hazards, there is an environmental justice problem. This study focused on the historical period before Hurricane Katrina in the early 2000s and used an innovative, geographic methodology to identify and compare the relative degree of environmental justice impacts to minority and low-income populations from three Louisiana parishes.

Findings/Results:

- Over time, demographics in the impacted areas shifted in response to historical developments in each sector of the petroleum industry.
- Although there is very little evidence of systematic environmental injustice in the siting procedures of various petroleum-related industries, the fact that minority residents moved into communities with potential hazards presents other environmental justice problems.
- Government agencies must ensure that vulnerable population segments have access to accurate and up-to-date information about neighborhood health risks in order to make informed decisions about their residence.
- A more inclusive environmental justice agenda also acknowledges and protects the health and safety of the environmental resources on which a wide variety of people depend for subsistence, traditional, cultural, and religious purposes.

Final Report: Hemmerling SA, Colten CE. 2017. Environmental justice: a comparative perspective in Louisiana. New Orleans (LA): U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. OCS Study BOEM 2017-068. 197 p.



Risk-based hazardscape of Jefferson Parish, Louisiana

Assessing Vulnerability of Sectors and Regions to OCS Oil and Gas Industry Volatility

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/100034>

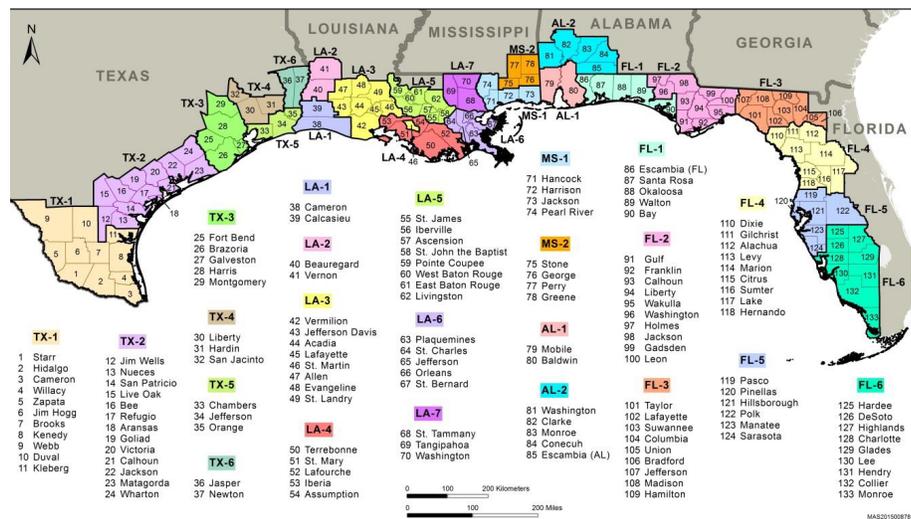
Conducted by: Louisiana State University

National Studies List: GM-11-08 (2012–2017)

Study Products (available in ESPIS): Final report

Purpose:

Coastal regions provide economic support to the offshore oil and gas industry in terms of labor markets, physical inputs, infrastructure, distribution channels, and post-extraction product markets. BOEM needs rigorously defined sampling units to help social scientists understand the socioeconomic impact from normal oil and gas market volatility, natural disasters (such as hurricanes), and environmental challenges (such as oil spills).



Counties and parishes by Economic Impact Area

Findings/Results:

- This study created groupings of alike coastal counties and parishes of the Gulf of Mexico Region, building upon earlier work and improved the definition of BOEM's Economic Impact Areas (EIAs).
- The study created 23 Gulf Coast EIAs, which were developed using more statistically rigorous methods than previous EIAs to allow for more appropriate future statistical analyses that use these regions.
- This study also presented various statistical measures of the economic structures of the EIAs.
- Statistical analyses that use these EISs should be better suited to address BOEM's information needs.

Final Report: Varnado DA, Fannin JM. 2018. Finalizing and describing new Economic Impact Areas for the Gulf of Mexico Region. New Orleans (LA): U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. OCS Study 2018-014. 235 p.

Oil /Dispersed Oil-Sediment Interactions in Deepwater Environments

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/100035>

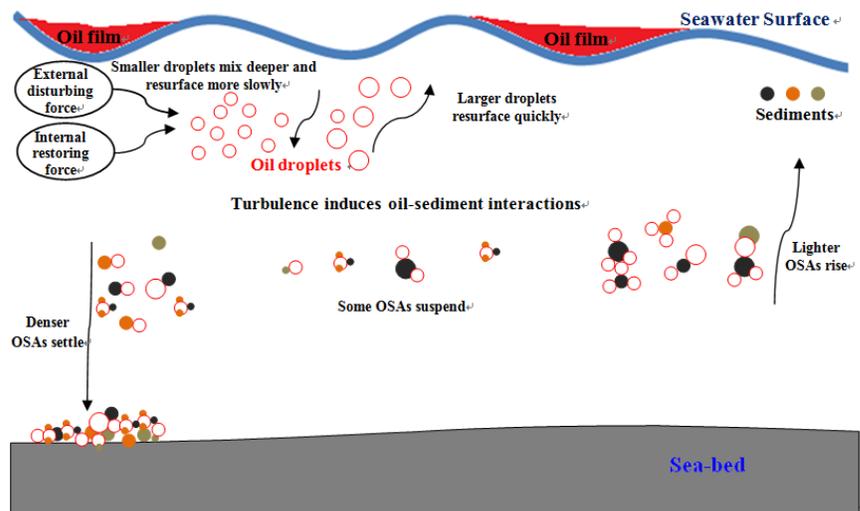
Conducted by: Auburn University

National Studies List: GM-11-13 (2012–2016)

Study Products (available in ESPIS): Final report and 17 published articles on the study findings

Purpose:

The 2010 Deepwater Horizon oil spill released an estimated 4.9 million barrels of South Louisiana sweet crude oil into the Gulf of Mexico, resulting in the largest marine oil spill in the U.S. history. During the spill, BP applied approximately 2.1 million gallons of oil dispersants Corexit EC9500A and Corexit EC9527A. In this study, the investigators conducted a series of laboratory experiments to characterize the interactions among oil, dispersants, and sediments in the marine environment. These findings help BOEM understand possible environmental fate and transport of key oil compounds from a spill when combined with the effects of dispersants.



Formation and movement of various types of OSAs in marine systems.

Findings/Results:

- Oil dispersants enhance settling of suspended sediment particles in marine water, promote formation of oil-mineral aggregates in seawater, and facilitate transfer of oil and polycyclic aromatic hydrocarbons (PAHs) to marine sediment.
- These experiments also addressed the effects of dispersants on oil weathering due to photochemical degradation and surface-level ozone oxidation.
- This study also engineered technology for treatment of future oil spills that could help enhance the natural weathering of persistent oil components.

Final Report: Zhao D, Cai Z, Liu W, Gong Y, Fu J, Ji H, Duan J, Zhao X, Xie W. 2016. Oil and dispersed oil-sediment interactions in the marine environment and impacts of dispersants on the environmental fate of persistent oil components. New Orleans (LA): U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. OCS Study BOEM 2017-042. 280 p.

Using Dredge Plant Operational Data to Measure Cumulative Use and Cumulative Impacts

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/100070>

Conducted by: National Dredging Quality Management Program (DQM) U.S. Army Corps of Engineers

National Studies List: NT-14-x11 (2014–2018)

Study Products (available in ESPIS): Final report

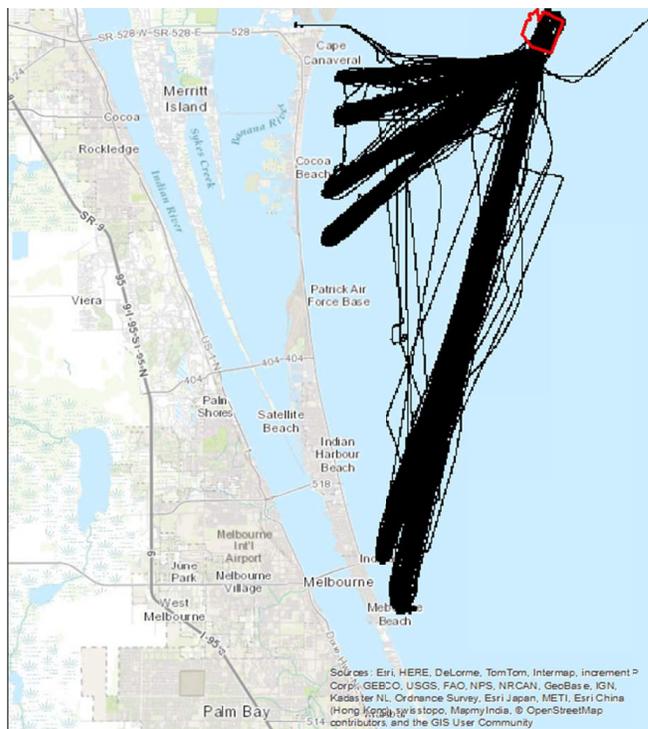
Purpose:

BOEM's Marine Minerals Program is tasked with ensuring that the removal of any mineral resources from the outer continental shelf is done in a safe and environmentally sound manner, including the extraction of "non-energy minerals" (primarily sand and gravel) via dredge plants for use in beach nourishment and coastal restoration projects. The USACE Dredging Quality Management (DQM) Center maintains a database of dredge plant operational data at a high temporal and spatial resolution, dating back several years. This inter-agency agreement aims to leverage the DQM database to improve leasing, monitoring, and environmental impact assessments completed by BOEM.

Findings/Results:

- The study developed a mathematical module (the Intensity and Exposure Characterization Algorithms [IECA]) to look at how much time is spent by hopper dredge plants dredging and/or transiting in the vicinity of borrow areas.
- The resulting dataset is designed to support geospatial analysis and will help BOEM analyze hopper dredging activities and support more informed analysis of environmental impacts.
- The initial research phase of the study delivered the IECA user tool, and BOEM analysts used and tested it in the process of moving the new tool to BOEM operations.
- A second phase of this study refined the graphical user interface so the new tool could be seamlessly integrated into BOEM MMP's business processes.

Final Report: Decker L, Whitmont M. 2018. Using dredge plant operational data to measure dredging intensity and cumulative exposure. Sterling (VA): U.S. Dept. of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-019. 185 p.



Location data collected from the Liberty Island

Outer Continental Shelf Carbon Dioxide Transportation and Sub-Seabed Geologic Storage Best Management Practices

ESPIS Link: <https://marinecadastre.gov/espis/#/search/study/27007>

Conducted by: Auburn University, University of Texas at Austin

National Studies List: NT-10-x32 (2010–2016)

Study Products (available in ESPIS): Final report

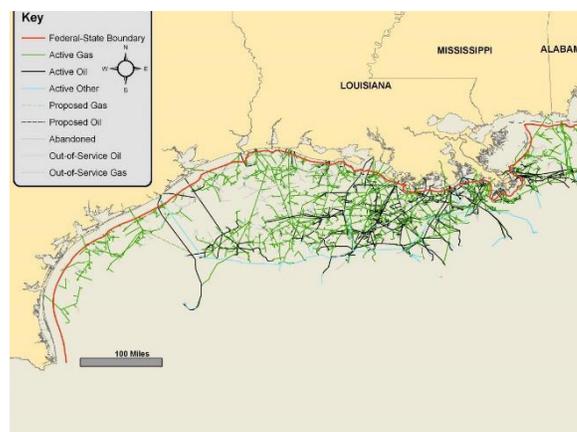
Purpose:

Carbon capture and storage is an emerging technology that captures carbon dioxide (CO₂) from industrial sources and compresses and transports it to a suitable storage site in order to reduce emissions to the atmosphere by permanently isolating it deep underground within geologic formations (geologic storage or GS). Carbon capture, utilization, and storage (CCUS) is a variation that stores captured CO₂ by, for example, enhanced oil recovery (EOR) GS. This study developed potential best management practices (BMPs) for offshore sub-seabed GS and EOR-GS of CO₂. The BMPs discuss activities associated with CO₂ transport and storage in offshore settings. The project reviewed and compiled pertinent international regulatory frameworks and technology applications and summarized the most relevant literature to develop BMPs for the life-cycle of an offshore sub-seabed project.

Findings/Results:

- Offshore geological systems thousands of feet below the seafloor contain reservoir overlain by confining strata with sufficient integrity and capacity to permanently store CO₂ without impacting other subseafloor resources, the ocean environment, or the atmosphere.
- Offshore CO₂ EOR-GS and GS technologies are emerging; fully developed BMPs will require more knowledge gained through offshore pilot-scale projects and additional offshore industry experience.
- Many methodologies and significant knowledge gained from onshore transport and storage of CO₂ can be applied offshore.
- Proper site characterization and selection is the most important BMP for the success of CO₂ storage; it affects all other BMPs.
- Site selection and characterization, risk analysis, and monitoring will need to be iterative. Monitoring data will increase understanding of characterization and risk management, which is integral to project design, execution, and closure.

Final Report: Smyth RC, Hovorka SD. 2017. Best management practices for offshore transportation and sub seabed geologic storage of carbon dioxide. Sterling (VA): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-004.



Risk-based hazardscape of Jefferson Parish, Louisiana



BOEM's Environmental Studies Program

develops, funds, and manages rigorous scientific research specifically to inform policy decisions on the development of energy and mineral resources on the Outer Continental Shelf (OCS).

Research covers physical oceanography, atmospheric sciences, biology, protected species, social sciences (such as economics and submerged cultural resources) and environmental fates and effects of oil and gas in the sea. Mandated by Section 20 of the Outer Continental Shelf Lands Act, the Environmental Studies Program is an indispensable requirement informing BOEM's decisions on offshore oil and gas, offshore renewable energy, and the marine minerals program for coastal restoration.

The ESP has provided over \$1 billion for research to this end since 1973.

Visit our webpage @ www.boem.gov/studies/

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