

# Quarterly Reports

FY 2021 First 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).

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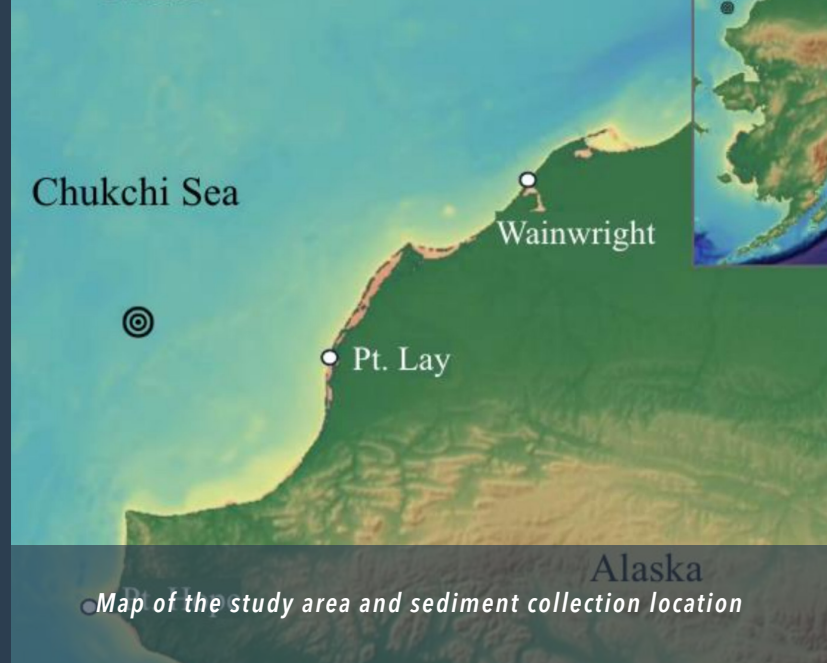
# Microbial Biodegradation of Alaska North Slope Crude Oil in Arctic Marine Sediments

**ESPIS Link:** <https://marinecadastre.gov/espis/#/search/study/100198>

**Conducted by:** University of Alaska Fairbanks

**National Studies List:** AK-13-03-24

**Study Products (available in ESPIS):** Final report, technical summary



Map of the study area and sediment collection location

## Purpose/Information Use:

Due to increasing global temperatures, previously ice-covered waters in the Arctic are becoming more accessible to human activities, increasing the likelihood of contaminant exposure through oil and gas development and the expansion of commercial shipping. Microbial biodegradation is the primary way oil is naturally removed from the marine environment following a spill, and understanding oil biodegradation potential is important for predicting the impact of oil spills. Chemical dispersants, such as Corexit 9500, are commonly used to clean up oil spills, but the interactions between oil and dispersants are not well understood in the Arctic. This study addressed a suite of questions related to the biodegradation of oil and Corexit 9500 in Arctic seawater, the biodegradation of oil in sediments, and the microorganisms and genes involved in these processes. BOEM and other agencies will use this information to better respond to and predict the fate of oil spills in the Arctic marine environment.

## Findings/Results:

- The study found no evidence that Corexit 9500 suppressed crude oil biodegradation or oil-degrading microorganisms.
- Corexit 9500 degraded before the microbes degraded the petroleum hydrocarbons.
- In Arctic seawater, some taxa responded only to the presence of oil, and some responded only to the presence of Corexit 9500.
- Some taxa responded to both oil and Corexit 9500 (when provided separately or together), suggesting that these organisms are capable of breaking down both mixtures.

## Study Products

Leigh MB, Hardy S, Walker A, Gofstein T. 2020. Microbial biodegradation of Alaska North Slope crude oil and Corexit 9500 in the Arctic marine environment. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. 65 p. Report No.: OCS Study BOEM 2020-033.



# Field Evaluation of an Unmanned Aircraft System (UAS) for Studying Cetacean Distribution, Density, and Habitat Use in the Arctic

**ESPIS Link:** <https://marinecadastre.gov/espis/#/search/study/100077>

**Conducted by:** Alaska Fisheries Science Center, NOAA Fisheries, Naval Surface Warfare Center Dahlgren Division

**National Studies List:** AK-15-07

**Study Products (available in ESPIS):** Final report, technical summary



*ScanEagle® on launch at Naval Surface Warfare Center  
- Dahlgren Division*

## Purpose/Information Use:

BOEM and NOAA Fisheries require information on marine mammal density, abundance, and distribution to effectively manage species under the Marine Mammal Protection Act and the Endangered Species Act. Marine mammal surveys are routinely conducted by a team of human observers in a small aircraft. Unmanned aircraft systems (UAS) have been identified as technology that could revolutionize the way aerial surveys for cetaceans are conducted to collect information on distribution, density, or abundance. This study compared manned and unmanned aircraft surveys for cetaceans near Utqiagvik (formerly Barrow), Alaska. The goal of this study was to evaluate the ability of UAS technology to collect data detecting cetaceans, identify species, estimate group size, identify calves, and compare those results to conventional aerial surveys conducted by human observers in fixed-wing aircraft. The results of the study will inform BOEM about how UAS can be used to meet cetacean study objectives currently and in the future.

## Findings/Results:

- Using UAS to collect data to estimate cetacean density or abundance in large areas is promising, but it is logistically complicated and currently considerably more expensive than a comparable manned aerial survey.
- To ensure the safety of manned aircraft flying in close proximity to UAS, precise relative position information on UAS location is essential.
- Until accurate and reliable software for automatically detecting cetaceans in imagery is developed, imagery collected by UAS must be processed manually, which decreases the efficiency and increases the cost of post-processing.
- The smaller area effectively sampled by the cameras on the UAS limits the usefulness of UAS technology. Additional flight time or wider camera angles would be required to improve sampling area.

## Study Products

Angliss R, Ferguson M, Kennedy A. 2019. Arctic Aerial Calibration Experiments (Arctic ACEs): Comparing manned aerial surveys to unmanned aerial surveys for cetacean monitoring in the Arctic. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. 125 p. Report No.: OCS Study BOEM 2019-032.



# Aerial Surveys of Arctic Marine Mammals (ASAMM); Personnel and Aircraft Needs

**ESPIS Link:** <https://marinecadastre.gov/espis/#/search/study/100113>

**Conducted by:** Alaska Fisheries Science Center, NOAA Fisheries

**National Studies List:** AK-16-01

**Study Products (available in ESPIS):** Final report, technical summary



*Pair of gray whale cow-calf pairs sighted approximately 20 km west of Wainwright, Alaska, 17 July 2019*

Image No. M17P0000311

## Purpose/Information Use:

BOEM and NOAA's Alaska Fisheries Science Center initiated the Aerial Surveys of Arctic Marine Mammals (ASAMM) project in 2011. These surveys are a continuation of aerial surveys that were conducted from 1982–2010 and use a similar methodology—Aero Commander 690A and deHavilland Twin Otter aircraft flying along predetermined line transects. Aerial surveys remain the only practical means of assessing marine mammal distribution, population density, and habitat use in large study areas. The goal of this study is to investigate the distribution and relative abundance of marine mammals in the western Beaufort and eastern Chukchi seas during the open water (ice-free) months of July–October in 2016–2019, when various species were undertaking seasonal migrations through the study area to and from seasonally occupied habitats both within and adjacent to the study area. Improving the understanding of marine mammal distribution, abundance, behavior, and migration timing in this region will assist BOEM in minimizing impacts from oil and gas development and other anthropogenic activities.

## Findings/Results:

- In 2016, the study conducted 108 survey flights. There were 4,286 sightings of 37,430 marine mammals during all (transect, search, and circling) survey modes. A record number of bowhead whales was observed in 2016 (950 sightings of 1,859 bowhead whales).
- In 2017, the survey conducted 97 survey flights, with 4,588 sightings of 98,823 marine mammals.
- In 2018, the survey conducted 99 survey flights, with 3,249 sightings of 192,333 marine mammals.
- In 2019, the survey conducted 131 survey flights, with 5,561 sightings of 105,301 marine mammals.

## Study Products

Clarke JT, Brower AA, Ferguson MC, Willoughby AL, Rotrock AD. 2020. Distribution and relative abundance of marine mammals in the eastern Chukchi Sea, eastern and western Beaufort Sea, and Amundsen Gulf, 2019 Annual Report. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. 603 p. Report No.: OCS Study BOEM 2020-027.

Annual Reports for 2016–2018 are also available.

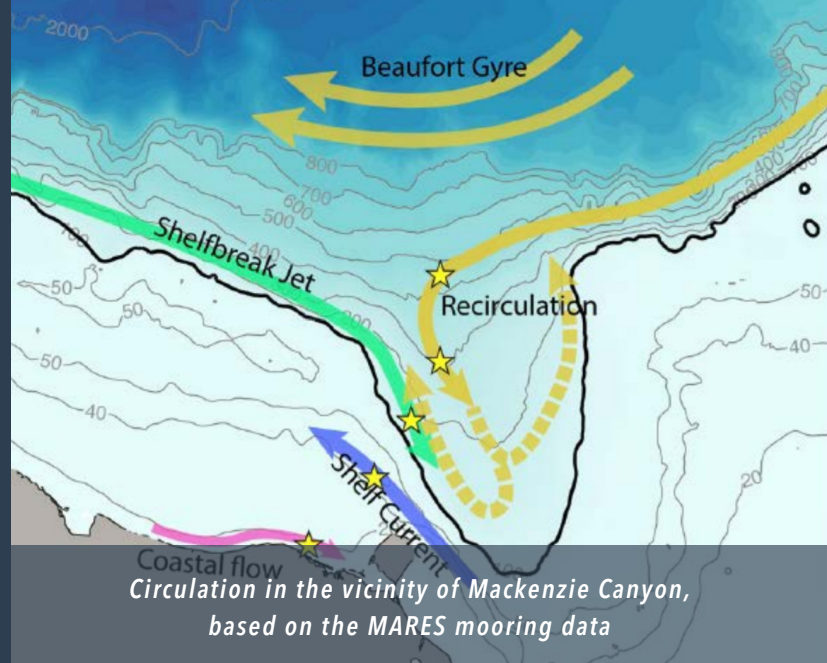
# Marine Arctic Ecosystems Study (MARES) Program; Biophysical and Chemical Observations

**ESPIS Link:** <https://marinecadastre.gov/espis/#/search/study/100236>

**Conducted by:** Stantec Consulting Services Inc.

**National Studies List:** NT-13-05-04 and NT-13-05-05

**Study Products (available in ESPIS):** Final report, technical summary



## Purpose/Information Use:

The Marine Arctic Ecosystem Study (MARES) was designed to advance knowledge of the Arctic marine ecosystem, with a focus on the area out to 3,300 feet deep on the eastern Beaufort Sea shelf from Kaktovik to Canada's Mackenzie Delta coastline. The study goal was to maintain and retrieve four moorings, which were deployed in the eastern Beaufort Sea from October 2016 to October 2018, then analyze and interpret the data collected. To better understand the influence of the Mackenzie outflow on the marine ecosystem, the moorings collected data ranging from physical oceanography to marine mammal vocalizations. Overall, MARES contributed continuous records of physical, chemical, and biological parameters in the eastern Beaufort Sea, providing invaluable data to better understand the ecosystem and its drivers and to build further programs. BOEM will use the results of the study to provide important context for economic development, environmental protection, sustainability of local communities, and health and safety.

## Findings/Results:

- High-speed currents were observed even in winter when ice was present. The largest events were in November, early in the season when sea ice is rapidly forming in the region.
- Nitrate concentrations were lowest over the summer months when organisms such as sea ice algae and phytoplankton are most active in consuming nitrates. Concentrations were renewed starting in the fall. Substantial seasonal variation in zooplankton was observed.
- Juvenile Arctic cod were present near the surface from end of May through October. The bulk of adult Arctic cod abundance was detected between September and April below 650 feet depth.
- Bowhead and beluga whales were detected in the summer and fall during both the 2016–2017 and 2017–2018 deployment periods. Bearded and ringed seals were both detected in the first year of deployment, but no ringed seals were detected in year two.

## Study Products

Wiese FK, Ashjian C, Asplin MG, Borg K, Fabijan M, Fissel D, Gryba RD, Gong D, Harvey R, Lin P, et al. 2020. Marine Arctic Ecosystem Study (MARES): Moorings on the Beaufort Sea shelf (2016–2018) and Program Synthesis. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. 286 p. Report No.: OCS Study BOEM 2020-029.

## Continued Archiving of Outer Continental Shelf Invertebrates by the Smithsonian Institution National Museum of Natural History

**ESPIS Link:** <https://marinecadastre.gov/espis/#/search/study/100073>

**Conducted by:** Smithsonian, National Museum of Natural History

**National Studies List:** NT-14-01

**Study Products (available in ESPIS):** Final report, technical summary, related publications, data



*Lady crab, *Ovalipes ocellatus*, on display at the NMNH Sant Ocean Hall*

### Purpose/Information Use:

For over 35 years, the National Museum of Natural History (NMNH), Department of Invertebrate Zoology has worked with BOEM to archive marine invertebrates from the Outer Continental Shelf (OCS). These specimens represent one of the most extensive collections of marine organisms from U.S. waters and provide an invaluable national resource to support baseline assessments as well as taxonomic, evolutionary and ecological research. The goals of this study were to (1) continue the documentation of marine invertebrate diversity in Federal waters across BOEM's four OCS regions (Alaska, Pacific, Gulf of Mexico, and Atlantic); (2) expand the vouchering program (which stores evidence of species presence) to include genomic-grade tissues and DNA extractions; and (3) generate reference DNA barcodes for species unrepresented in public repositories and databases. The results of this study enable BOEM to enhance its marine monitoring activities by using less invasive and less destructive sequence-based surveys that include eDNA and similar environmental sampling protocols.

### Findings/Results:

- Twenty percent (N=361) of the missing families were added to public repositories and comparative reference databases, improving taxonomic coverage from 12% to 31% for all known marine groups. These additions included 558 previously unsampled genera.
- Representation of marine invertebrates in cryogenic and tissue collections, as well as voucher-based DNA barcodes for missing families and genera of marine invertebrates from U.S. waters, was increased substantially across most invertebrate phyla.
- These collections and comparative DNA sequence data significantly improve the ability to identify marine species from environmental samples and enhance ongoing efforts to employ sequence-based approaches to characterize marine diversity of the OCS.

### Study Products

Strong E, Moser B, Meyer C, Ahlfeld K, Barnes V, Boyd M, Bush S, O'Mahoney M, Pecnik S. 2018. Sample strategy plan; outer continental shelf (OCS) genomic sample strategy for the Bureau of Ocean Energy Management (BOEM) to archive OCS invertebrates. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 10 p. Report No.: OCS Study BOEM 2019-003.



# Managing Dredge Impacts by Optimizing the Use of Sand Resources

**ESPIS Link:** <https://marinecadastre.gov/espis/#/search/study/100097>

**Conducted by:** U.S. Army Corps of Engineers, Engineering Research and Development Center

**National Studies List:** NT-15-03

**Study Products (available in ESPIS):** Final report



*Location of Ship Shoal, offshore Terrebonne shoreline*

## Purpose/Information Use:

A typical beach nourishment project using Outer Continental Shelf (OCS) sand comprises an initial large-scale construction phase followed by smaller regularly scheduled maintenance cycles, potentially causing dredging of the same or adjacent seafloor multiple times during 50-year period or longer. Alternatively, a sand source could also be used by multiple stakeholders for different projects, which can lead to rapid sand resource depletion. Existing dredging approaches are not conducive to sustainable long-term sand management. This study uses multi-criteria decision analysis (MCDA) to evaluate and quantify technical, environmental, economic, and societal factors in conjunction with potential management and monitoring measures to facilitating sediment source management. BOEM and its partners will use the results of the study to help address the challenge of balancing various engineering requirements, environmental considerations, and stakeholder needs for more sustainable management of sand resources and reduced environmental impacts.

## Findings/Results:

- This study produced a sand source selection tool (SSST) that looks at a combination of factors (sediment characteristics, future site usability, borrow site controls, stakeholder and community opinion, and environmental and physical concerns) to optimize the use of a given frequent or multiple-use sand source.
- The study applied the SSST to develop and document individualized sand source management plans for Canaveral Shoals II, FL, and Ship Shoal, LA, and create a planning process and associated work-flow manual. Additionally, the study generated a literature review and data factor dictionary.

## Study Products

Coor JL, Bates M, Fox-Lent C. 2017. Managing dredge impacts by optimizing the use of sand resources. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 174 p. plus appendices. Report No.: OCS Study BOEM 2018-062.

# Use of Satellite Data for Offshore Air Quality Applications

**ESPIS Link:** <https://marinecadastre.gov/espis/#/search/study/100183>

**Conducted by:** NASA Goddard Space Flight Center

**National Studies List:** NT-17-01

**Study Products (available in ESPIS):** Final reports, technical summaries



## Purpose/Information Use:

BOEM is required to conduct impact assessments to ensure its authorized activities do not significantly impact air quality. To improve BOEM's ability to characterize the impacts of offshore pollutant dispersion, NASA's Atmospheric Chemistry and Dynamics Laboratory at Goddard Space Flight Center examined the feasibility of using satellite data to (1) estimate offshore ground level concentrations of pollutants; and (2) give BOEM a toolbox for using satellite data for offshore air quality management. The first part of the study compared the total column nitrogen dioxide (NO<sub>2</sub>) satellite data with observational Pandora (ground-based air quality monitors) data to see if satellite data can be used for offshore air quality management. The second part, the toolbox, produced three case studies that demonstrate the current capabilities of these resources and discuss how they may be integrated into BOEM's standard operating procedure for assessing offshore air quality. BOEM will use the results of the study to improve offshore air quality management.

## Findings/Results:

- Nitrogen dioxide (NO<sub>2</sub>) is the target pollutant for which BOEM conducts regular emissions surveys. Under cloud-free conditions, satellites detected elevated column NO<sub>2</sub> amounts near isolated large platforms and from clusters of smaller operations.
- Satellite total column NO<sub>2</sub> is comparable (within 11-18%) to traditional air quality monitors.
- In general, NO<sub>2</sub> is greater over coastal Louisiana than over the Outer Continental Shelf. However, the extent to which Pandora or satellite measurements correlate with surface NO<sub>2</sub> is highly variable.

## Study Products

Thompson AM. 2020. Evaluation of NASA's remote-sensing capabilities in coastal environments. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 33 p. Report No.: OCS Study BOEM 2020-047.

Duncan BN. 2020. NASA resources to monitor offshore and coastal air quality. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 32 p. Report No.: OCS Study BOEM 2020-046.

# Cross-shelf Habitat Suitability Modeling

**ESPIS Link:** <https://marinecadastre.gov/espis/#/search/study/100171>

**Conducted by:** National Oceanic and Atmospheric Administration (NOAA) National Centers for Coastal Ocean Science (NCCOS) and Oregon State University (OSU)

**National Studies List:** PC-15-07

**Study Products (available in ESPIS):** Final reports, technical summary



*Stylaster californicus* with a Blacksmith (*Chromis punctipinnis*) and many Squarespot (*Sebastes hopkinsi*) at 41 m depth on Farnsworth Bank

## Purpose/Information Use:

This study expanded knowledge of seafloor habitats of the U.S. West Coast to inform planning for offshore wind energy development. One part of the study, conducted by NOAA NCCOS, developed maps of the modeled spatial distributions of deep-sea corals, sponges, and benthic (seafloor) macrofauna (e.g., crustaceans, snails, worms, clams) to a depth of 4,000 feet. The maps identify areas where these organisms are more and less likely to occur. Another part of the study, conducted by OSU, (1) addressed how physical factors affect the distribution of macrofauna across the continental shelf and upper slope; and (2) classified sedimentary benthic habitats according to the macrofaunal organisms found in those habitats. BOEM is using this information to contribute to regional ocean planning efforts and assessments for offshore energy, ground fishing, conservation, and other activities potentially impacting benthic biota in deeper waters.

## Findings/Results:

- Occurrence data for deep-sea corals, sponges, and macrofauna and spatial environmental predictors depicting seafloor topography, substrate, oceanography, and geography were used in statistical models to predict and map suitable habitat for 31 deep-sea coral taxa, 15 sponge taxa, and 43 macrofauna taxa.
- Researchers classified the macrofaunal communities of the Pacific Northwest continental shelf and upper slope soft bottom into 12 habitats representing key depth and sediment-related breaks in macrofaunal community composition.
- The two unique macrofauna-derived habitats in the Pacific Northwest are the mud-based seafloor offshore northern California (207 feet average depth) and the sandy sediments offshore central Oregon (112 feet average depth).

## Study Products

Poti M, Henkel SK, Bizzarro JJ, Hourigan TF, Clarke ME, Whitmire CE, Powell A, Yoklavich MM, Bauer L, Winship AJ, et al. 2020. Cross-shelf habitat suitability modeling: characterizing potential distributions of deep-sea corals, sponges, and macrofauna offshore of the US West Coast. Camarillo (CA): US Department of the Interior, Bureau of Ocean Energy Management. 267 p. Report No.: OCS Study BOEM 2020-021.

Henkel SK, Gilbane L, Phillips AJ, Gillett DJ. 2020. Cross-shelf habitat suitability modeling for benthic macrofauna. Camarillo (CA): US Department of the Interior, Bureau of Ocean Energy Management. 71 p. Report No.: OCS Study BOEM 2020-008.



# Department of the Interior Mission

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

## Bureau of Ocean Energy Management

The mission of the Bureau of Ocean Energy Management is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.

## BOEM Environmental Studies Program

The mission of the Environmental Studies Program (ESP) is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments. The proposal, selection, research, review, collaboration, production, and dissemination of each of BOEM's Environmental Studies follows the DOI Code of Scientific and Scholarly Conduct, in support of a culture of scientific and professional integrity, as set out in the DOI Departmental Manual (305 DM 3).

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