Bureau of Ocean Energy Management | Environmental Studies Program

Quarterly Report

FY 2018 Fourth Quarter

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

BOEM Bureau of Ocean Energy Management

December 2018

Contents

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/.

ALASKA REGION

PACIFIC REGION

ATLANTIC REGION

Trophic Links: Forage Fish, Their Prey, and Ice Seals in the Northeast Chukchi Sea

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/26797

Conducted by: University of Alaska Fairbanks

National Studies List: AK-08-12-05 (2008–2014)

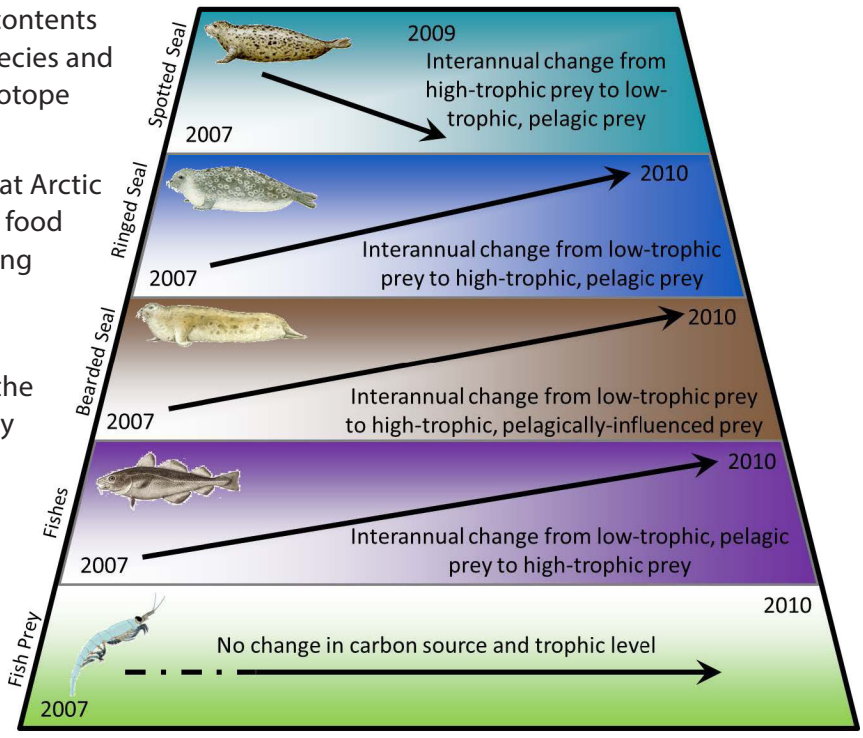
Study Products (available in ESPIS): Final report

Purpose:

This study examined the feeding ecology of Arctic fishes and ice seals in the Northern Chukchi Sea to provide a baseline for assessing how trophic structure (hierarchy in the food web) may vary among years with different ice habitat conditions. Sea ice reduction in the Chukchi and Beaufort Seas may lead to modifications in productivity and/or food-web structure in the Arctic Ocean. Changes in the Arctic ecosystem will likely affect food web connections for Arctic fishes and ice seals, which result from changes to prey resources. However, there may be direct impacts to ice seals because they use the sea ice as a platform for resting, pupping, and molting.

Findings/Results:

- This study documented the stomach contents and stable isotope ratios for 11 fish species and investigated the diets of seals using isotope ratios in muscle tissue and claws.
- The analysis of the food web shows that Arctic fishes and ice seals feed higher up the food chain, with these trends differing among years and environmental conditions.
- As hypothesized, this study indicates that decreases in sea ice may change the dynamics of the food web and the prey ingested by Arctic fishes and ice seals.



Interannual trends in the diet of Arctic fishes and ice seal species.

Final Report: Norcross BL. 2013. Trophic links: forage fish, their prey, and ice seals in the northeast Chukchi Sea. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. BOEM OCS Study 2013-00118. 159 p.

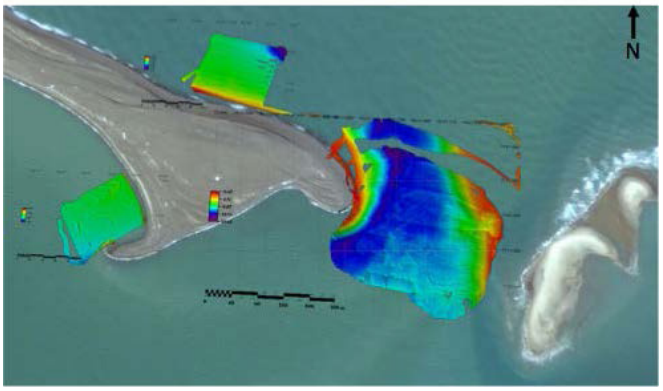
Distribution and Habitat Use of Fish in the Nearshore Ecosystem of the Beaufort and Chukchi Seas

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/26881

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

National Studies List: AK-12-06 (2013–2016)

Study Products (available in ESPIS): Final report



Above: Bathymetry of sample stations at Plover Point in both the Beaufort Sea and Elson Lagoon. Below: Antlered sculpin.

Purpose:

Changing sea ice conditions, coastal erosion, increased ship traffic and infrastructure, and offshore oil and gas development are expected to impact Arctic nearshore habitats. Understanding how environmental conditions impact nearshore fish communities is critical in predicting future scenarios. This study characterized nearshore fish communities in three converging waterbodies in the area adjacent to Point Barrow, Alaska, including the Chukchi and Beaufort Seas and Elson Lagoon, to the east of Point Barrow (now known as Utqiavik). Researchers sampled fish at 12 sites on a weekly basis throughout the summers of 2013 and 2014. In 2015, with extra funding from the North Slope Borough, they expanded the study to use a fully integrated ecosystem survey approach. This allowed them to take additional measurements of offshore oceanography and zooplankton.

Findings/Results:

- Species composition, species richness, and abundance are different in the three waterbodies surrounding Point Barrow: Chukchi Sea, Beaufort Sea, and the extensive Elson Lagoon.
- The researchers found that nearshore Arctic habitats are dominated by juvenile fishes and therefore function as nursery areas similar to other nearshore areas in the rest of the globe.
- Arctic nearshore areas are set again every year through ice scouring.
- Annual differences in fish communities were associated with changes in water temperature and pervasive storm conditions.

Final Report: Vollenweider JJ, Heintz RA, Boswell KM, Norcross BL, Li C, Barton MB, Sousa L, George C. 2017. Arctic coastal ecosystems: evaluating the functional role and connectivity of lagoon and nearshore habitats. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. BOEM OCS Study 2016-066. 269 p.

ANIMIDA III: Contaminants, Sources, and Bioaccumulation

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/26860

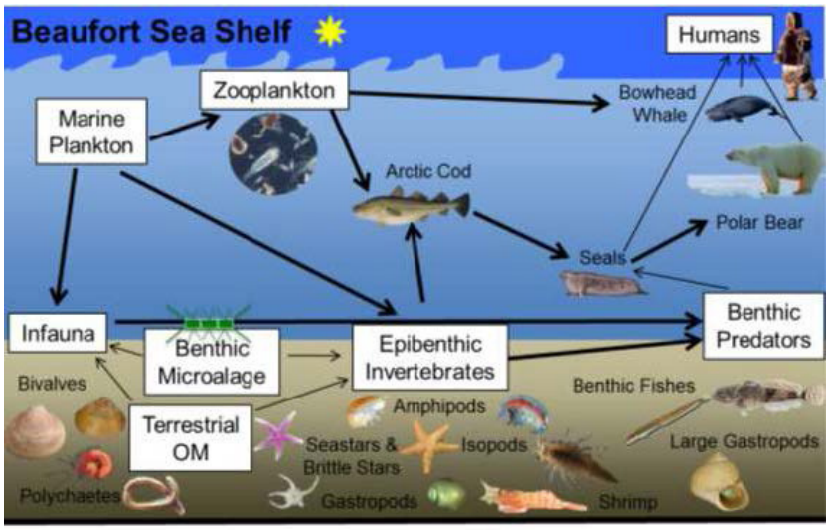
Conducted by: Olgoonik Fairweather, LLC

National Studies List: AK-11-14b (2014–2017)

Study Products (available in ESPIS): Final report

Purpose:

ANIMIDA is the acronym for the Arctic Nearshore Impact Monitoring in Development Area study, a long-term project. In its third installment, this study documented concentrations of metals and hydrocarbons introduced naturally by river runoff and coastal erosion into the coastal Beaufort Sea and found in sediments and biota. The study updated baseline information from previous BOEM environmental studies relevant to offshore oil and gas exploration and production in this area.



Conceptual diagram of food web in a Beaufort Sea Shelf ecosystem.

Findings/Results:

- This study included sampling performed during the open-water periods in 2014 and 2015 (late July through early August in both years) and during the 2015 spring-freshet (melt) to describe (1) physical oceanography; (2) the distributions of trace metals in bottom sediments, suspended sediments, and biota; (3) the characteristics of petroleum hydrocarbons in the sediments and benthic organisms; (4) benthic infauna, carbon resources, and trophic structure; and (5) epibenthic communities and demersal fish communities.
- Researchers measured concentrations of 17 trace metals from bottom sediments, suspended sediments, and biota collected across the region.
- The study documented a benthic species inventory of 353 taxa collected from 126 individual samples at 42 stations and identified 3 hotspots in mid-shelf locations in the western Beaufort (Harrison Bay), the central Beaufort (including Stefansson Sound), and the eastern Beaufort (from Barter Island east to Icy Reef).

Final Report: Kasper J, Dunton KH, Schonberg SV, Trefry J, Bluhm B, Durell G, Wisdom S, Blank J. 2017. Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) III: contaminants, sources, and bioaccumulation. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management, Alaska OCS Region. OCS Study BOEM 2017-032. 280 p.

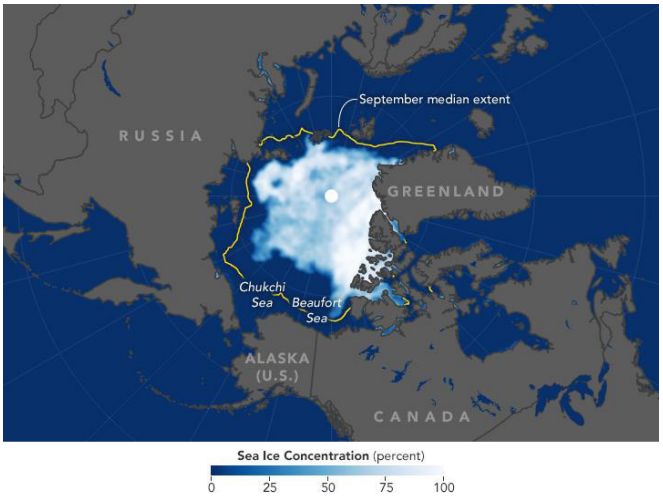
Oil-Spill Occurrence Estimators for the Outer Continental Shelf in the Arctic

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/100225

Conducted by: ABS Group Consulting Inc.

National Studies List: AK-16-04 (2017–2018)

Study Products (available in ESPIS): Reports on the U.S. OCS oil spill causal factors, oil spill statistics, and oil-spill occurrence estimators



Map of Chukchi and Beaufort Sea ice concentration in September 2017 (NASA 2017).

Purpose:

This study estimated oil spill occurrence indicators for a future offshore development and production scenario in the Beaufort Sea outer continental shelf (OCS). To do this, researchers examined causal factors of actual and potential oil spills in the Gulf of Mexico, Pacific, and Arctic OCS, and extrapolated Gulf and Pacific historical oil spill rates to the Arctic. The results included three types of spill occurrence indicators: annual oil spill frequency, annual oil spill frequency per billion barrels produced, and annual spill index. The analysts examined major contributors of offshore oil spills under three scenarios: platform spill, pipeline spill, and loss of well control spill, including a variety of oil spill sizes.

Findings/Results:

- This study completed three main tasks: (1) conducted a literature review and analysis of oil spill causal factors in the Arctic to provide information for the fault tree analysis; (2) updated oil spill statistics for use in the fault tree analysis; (3) developed oil spill occurrence estimators using fault tree methodology for a 70-year exploration and development scenario in the Beaufort Sea.
- The primary Gulf of Mexico and Pacific OCS causal factors include hurricanes, equipment failure, human error, weather, collisions, third-party impacts, operational impacts, and mechanical failure. The conditions and events unique to the Arctic that may be causal factors of oil spills of 50 barrels or more include ice forces, low temperatures, adverse weather, ice gouging, strudel scouring, upheaval buckling, and thaw settlement.

Final Report: ABSG Consulting Inc. 2018. US Outer Continental Shelf oil spill statistics. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-006. 44 p.

ABSG Consulting Inc. 2018. US Outer Continental Shelf oil spill causal factors report. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-032. 36 p.

ABSG Consulting Inc. 2018. Oil-spill occurrence estimators: fault tree analysis for one or more potential future Beaufort Sea OCS lease sales. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-048. 85p.

Crude Oil Infiltration and Movement in First-Year Sea Ice: Impacts on Ice-Associated Biota and Physical Constraints

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/26905

Conducted by: Coastal Marine Institute (University of Alaska)

National Studies List: AK-13-03-06 (2014–2017)

Study Products (available in ESPIS): Final report

Above: incubator tanks. Below: Community of algae in the sea ice near Point Battow, AK.

Purpose:

The Arctic marine environment is facing increasing risks of oil spills due to growing maritime activities such as tourism and resource exploration. Entrainment and migration of oil through the sea ice brine channel system may pose a considerable risk to the living organisms that rely on the ice for food and shelter. These ice-associated biological communities are the base of an Arctic food chain supporting a hugely productive community of polar bears, birds, walruses, whales, and, ultimately, humans. The study grew artificial sea ice that is similar to natural sea ice in an outdoor controlled laboratory setting (mesocosms) to investigate the possible impacts of oil on marine life in actual conditions. These mesocosms were inoculated with biological cultures collected from landfast sea ice near Utqiaġvik (formerly Barrow), Alaska.

Findings/Results:

- North Slope crude oil penetrated farther into overlying sea ice than observed in previous experiments. The presence of oil resulted in notable negative impacts on the biological community, completely inhibiting ice algal growth.

- These findings suggest that an oil spill in ice-covered waters could have substantial and lasting negative impacts on the microorganisms at the base of this critical Arctic food chain.

Final Report: Collins RE. 2017. Crude oil infiltration and movement in first-year sea ice: impacts on ice-associated biota and physical constraints. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-087. 78 p.

Chukchi Acoustic, Oceanography and Zooplankton Study: Hanna Shoal

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/26890

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

National Studies List: AK-13-02 (2014–2017)

Study Products (available in ESPIS): Final report

Marine mammal observer using 25x "big-eye" binoculars.

Purpose:

The focus of this study is to determine the circulation of water around the Hanna Shoal area, the source of this water (Chukchi Shelf or Arctic Basin) and its eventual destination, and the abundance of large planktonic prey at the shoal. The dynamic nature of this circulation and prey delivery was studied relative to whale distribution and habitat utilization in the northeastern Chukchi Sea and extreme western Beaufort Sea. This study had three component projects: marine mammal distribution (passive acoustics and visual methods), biophysical patterns and trends (moored and shipboard observations on oceanography and zooplankton), and a noise modeling/near real-time monitoring system.

Findings/Results:

- The impact of Hanna Shoal on the rest of the Chukchi Sea shelf is disproportionate to its physical size. Through a complicated series of physical, chemical, and biological mechanisms, the shoal affects the entire regional food web with impacts reaching all the way to humans.
- This complex region supports a complicated ecosystem of numerous factors—persistence of sea ice, weak currents supporting a retention area, landscape ecology, and regional and local meteorological and oceanographic forcing—all combining to determine whether or not there will be favorable conditions for the species that live there.
- The study developed a continuous 5-year dataset with extensive spatial coverage, allowing researchers to monitor not only the inter-annual variability in the Arctic, but also document changes to oceanographic and prey parameters, evidenced already in the dataset.
- A suite of passive acoustic analyses tools allowed the researchers to characterize seasonal variation in the acoustic environment and the acoustic contributions from different types of sound sources throughout the study areas.

Final Report: Mocklin JA, Friday NA, editors. 2018. Chukchi Offshore Monitoring In Drilling Area (COMIDA): factors affecting the distribution and relative abundance of endangered whales and other marine mammals in the Chukchi Sea. Final report of the Chukchi Sea acoustics, oceanography, and zooplankton study: Hanna Shoal Extension (CHAOZ-X). Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-008. 457 p.

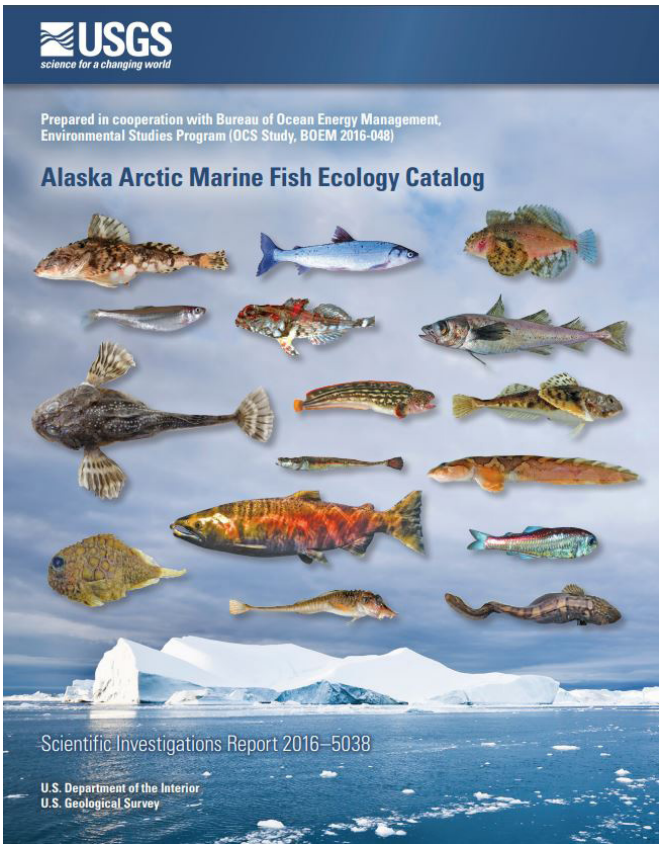
Arctic Fish Ecology Catalogue

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/100125

Conducted by: U.S. Geological Survey, Western Fisheries Research Center

National Studies List: AK-07-05 (2009–2017)

Study Products (available in ESPIS): *Alaska Arctic Marine Fish Ecology Catalog*



Alaska Arctic Marine Fish Ecology Catalog.

Purpose:

The marine fishes in waters of the United States north of the Bering Strait have received new and increased scientific attention over the past decade, as have the frontier qualities of the region and concerns about the effects of Arctic climate change. Many marine species have important traditional and cultural value to Alaska Native residents. Effective decisions about research and monitoring investments must be based on reliable information and plausible future scenarios.

Findings/Results:

- This study carried out a comprehensive evaluation of the marine fish from the Chukchi and Beaufort Seas in a single reference and synthesized the information in a single volume publication.
- The synthesis addressed the following areas: environmental and biological constraints; oceanographic overview; adaptation and acclimation; life history strategies; fish assemblages; foraging and feeding behavior; bioenergetics; use of time and space; growth and reproduction; migration; predation, parasitism, competition, and mutualism; dynamics of population abundance and production; conservation; subsistence; climate change; and information needs.
- The resultant *Arctic Marine Fish Ecology Catalog* is organized in eight chapters, a glossary, and three appendixes.

Final Report: Love MS, Elder N, Mecklenburg CW, Thorsteinson LK, Mecklenburg TA. 2016. Alaska Arctic marine fish ecology catalog. Reston (VA): U.S. Department of the Interior, U.S. Geological Survey and Bureau of Ocean Energy Management. U.S. Geological Survey Scientific Investigations Report 2016-5038; OCS Study BOEM 2016-048. doi: 10.3133/sir20165038. 784 p.

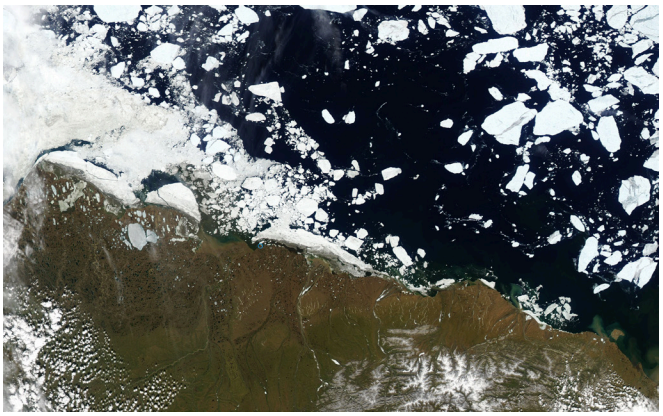
Development of a Very High-Resolution Regional Circulation Model of Beaufort Sea Nearshore Areas

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/100076

Conducted by: Rutgers University

National Studies List: AK-15-02 (2015–2018)

Study Products (available in ESPIS): Final report and technical manual



Satellite image of the Beaufort Shelf on June 23, 2016.

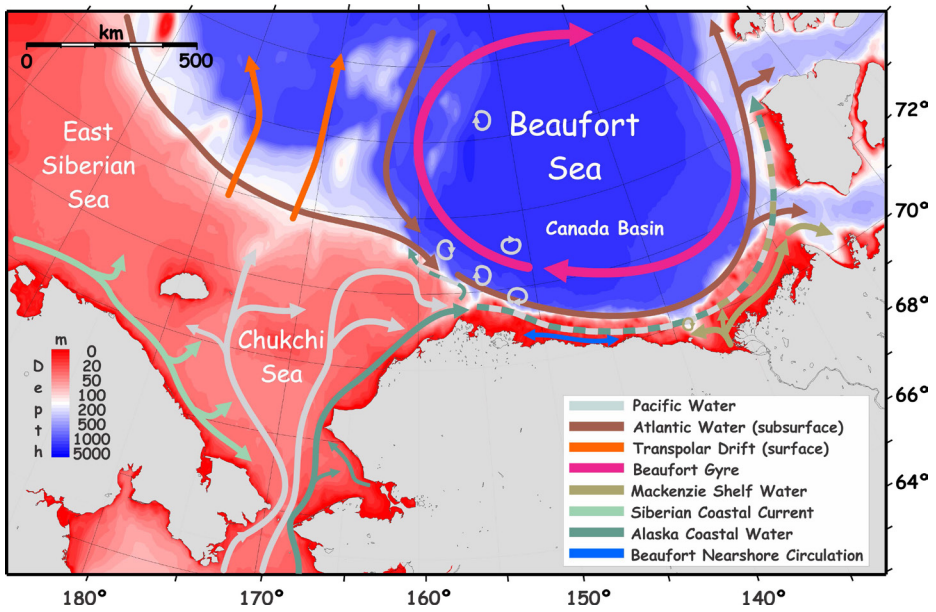
Purpose:

To provide valuable input into oil spill models, this study used a state-of-the-science sea ice and ocean circulation model to simulate at least a decade of the currents, sea ice, and winds in the Beaufort Seas nearshore areas.

Findings/Results:

- This study reviewed the basic oceanography of the Beaufort shelf to illustrate the relevant details of the circulation and ice models used for the numerical simulations and their implementation for this particular region.
- This study also performed numerical model output and observation data comparisons.
- This project has advanced our modeling capabilities in the Beaufort Sea and across the entire Arctic.

Final Report: Curchitser EN, Hedstrom K, Danielson S, Kasper J. 2017. Development of a very high-resolution regional circulation model of Beaufort Sea nearshore areas. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-018. 81 p.



Circulation in the Beaufort and Chukchi Seas.

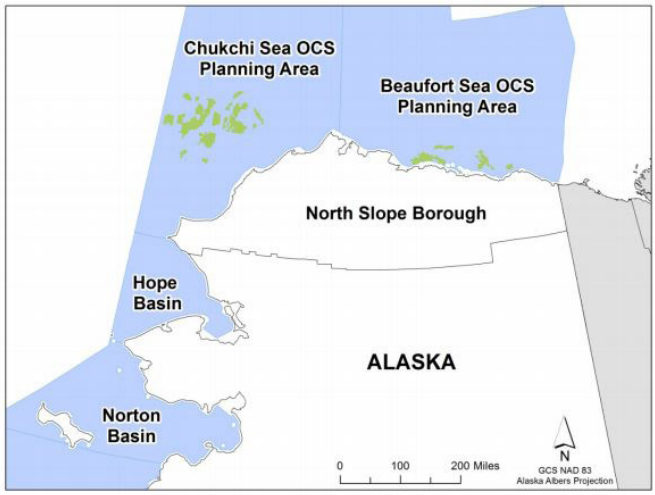
Arctic Air Quality Impact Assessment Modeling

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/26887

Conducted by: Eastern Research Group, Inc., Ramboll Environ US Corporation

National Studies List: AK-13-01 (2013–2018)

Study Products (available in ESPIS): Final reports (6) and database



Alaska OCS planning areas and study location.

Purpose:

This study facilitated BOEM's assessment of potential air quality impacts from oil and gas exploration, development, and production on the Alaska OCS and related onshore activities. This report summarizes the findings of the air quality modeling used to assess these potential air quality impacts, as well as the development of the supporting meteorological datasets and emission inventory. This study estimated increases in concentrations of emissions from existing and proposed anthropogenic activities by using computerized atmospheric dispersion modeling and photochemical grid modeling.

Findings/Results:

- The air quality modeling indicated low estimated air quality impacts from the criteria air pollutants at the shoreline, primarily due to low emissions from sources or large distances from the receptors.
- A comprehensive baseline inventory was developed for the study area, including criteria air pollutants, hazardous air pollutants, greenhouse gases, hydrogen sulfide, and ammonia.
- The baseline inventory included stationary sources located in North Slope communities and oil fields; on-road motor vehicles; non-road equipment; marine vessels and other offshore sources; the Trans-Alaska Pipeline System; airports; and road dust.
- The researchers developed a future scenario inventory representing full build-out based on potential future activities as defined by BOEM.

Final Report: Fields Simms P, Do B, Brashers B, Stoeckenius T, Morris R. 2018. Arctic air quality impact assessment modeling study: final project report. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-020. 58 p.

ShoreZone Along the Alaska Peninsula

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/100079

Conducted by: Coastal and Ocean Resources, Moran Environmental Recovery LLC

National Studies List: AK-15-03 (2015–2018)

Study Products (available in ESPIS): Final report, related publications, image library, and databases

Purpose:

The Alaska Peninsula, south of Anchorage, is a remote and diverse part of the Alaska coastline covering a wide range of physical characteristic and biotic communities. BOEM commissioned an inventory of nearshore habitats using ShoreZone, a powerful coastal habitat classification, mapping, and inventory system. ShoreZone relies on the collection and interpretation of aerial video and high resolution still photos by geologists and biologists to provide a standardized inventory of these habitats. This study focused on a nearshore inventory needed to fill a gap in the Alaska ShoreZone dataset along the Alaska Peninsula in the North Pacific Ocean. The ShoreZone imagery, mapping, and ground station data will be invaluable for management of this area due to the lack of other information encompassing the entire area. It will also be highly useful in the event of an oil spill or other marine emergency in terms of planning and response.

Findings/Results:

- The study collected a total of 16,304 photos and 19.4 hours of aerial video.
- Surveys conducted at 28 ground stations provided additional detail on physical and biological attributes, which assisted with ShoreZone mapping.

David's Island.

Final Report: Cook S, Daley S, Saupe S, Lindeberg M, Morris M, Morrow K, Myers R, Park A. 2018. ShoreZone imaging and mapping along the Alaska Peninsula. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-037. 301 p.

Distribution of Fish, Crab and Lower Trophic Communities in the Chukchi Sea Lease Area

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/26842

Conducted by: University of Alaska Fairbanks, Alaska Fisheries Science Center, and U.S. Fish and Wildlife Service

National Studies List: AK-11-08 (2012–2016)

Study Products (available in ESPIS): Final report and related publications

Final report cover design by James Kelly, Decaffeinated Designs, http://www.decaffeinateddesigns.com/.

Purpose:

This study formed a large part of the broader Arctic Ecosystem Integrated Survey, the first comprehensive fisheries ecosystem assessment of the Northern Bering Sea and Chukchi Sea. Surveys conducted in the summers of 2012 and 2013 from several platforms sampled demersal and pelagic fish communities. Oceanographic and biological samples collected during these surveys provided a trove of new information on the distribution, abundance, biology, and population dynamics of pelagic and demersal fish and invertebrate populations, in addition to new insights into the physical forcing and plankton dynamics of the system.

Findings/Results:

- Large differences were found in oceanographic conditions between 2012 and 2013, associated with differences in local winds and in the flow of water through the Bering Strait and in the Chukchi Sea.
- Plankton, fish, and invertebrate species of Pacific origin dominated demersal and pelagic communities throughout the region, but distinct Arctic populations of some species were associated with Arctic water masses on the northeast Chukchi Sea shelf.
- A major legacy of the project will be the databases and maps available through the Alaska Ocean Observing System's Arctic Portal (http://portal.aoos.org/arctic), as well as through national archives.

Final Report: Mueter FJ, Weems J, Farley EV, Kuletz K, Lauth RR, Sigler MF. 2017. Arctic ecosystem integrated survey final report on distribution of fish, crab, and lower trophic communities in the northeastern Bering Sea and Chukchi Sea. Anchorage (AK): U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Alaska OCS Region. OCS Study BOEM 2017-077. 1558 p.

California Current Cetacean and Ecosystem Assessment Survey and Use of Data to Produce and Validate Cetacean and Seabird Density Maps

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/100116

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

National Studies List: PC-16-05 (2016)

Study Products (available in ESPIS): Final report

Blainville's beaked whale.
Photo Credit: Barbara Taylor (NOAA/SWFSC).

Purpose:

This study conducted a dedicated acoustic survey for cetaceans throughout the California Current off the U.S. West Coast in 2016. The survey, called Passive Acoustic Survey of Cetacean Abundance Levels (PASCAL), was conducted in search of beaked whales, sperm whales, and dwarf and pygmy sperm whales. Due to their cryptic behavior, these species are difficult to survey visually. The goal was to improve data for estimating population size for these species throughout the study area. The survey also focused on (1) identifying acoustic calls to the species through concurrent visual/acoustic detections and (2) starting to understand the association of beaked whales to topographic seafloor features.

Findings/Results:

- Researchers deployed a network of Drifting Acoustic Spar Buoy Recorders 30 times, and conducted towed array surveys in between deployments.
- The study obtained high-quality acoustic data for 28 of the 30 deployments.
- Over 380 days of recording effort revealed 1,011 detections of beaked whales. The total number of sightings during the seven surveys from 1991 to 2014 were 63 Cuvier's beaked whales, 27 Baird's beaked whales, and 38 Mesoplodon beaked whales.
- The high detection rate on the buoy recorders will provide much more precise estimates of beaked whale abundance than has been previously possible.

Final Report: Keating JL, Barlow J, Griffiths ET, Moore JE. 2018. Passive acoustics survey of cetacean abundance levels (PASCAL-2016) final report. Camarillo (CA): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-025. 22 p.

Tracking Movements of Threatened Migratory Rufa Red Knots in U.S. Atlantic Outer Continental Shelf Waters

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/100111

Conducted by: U.S. Fish and Wildlife Service, Northeast Region

National Studies List: AT-16-02 (2016–2018)

Study Products (available in ESPIS): Final report

Rufa red knot.
Photo by Yves Aubry, Canadian Wildlife Service.

Purpose:

Information on the movements and flight altitudes of high-priority bird species is essential for estimating exposure to offshore wind energy areas. In this study, we used digital very high frequency (VHF) transmitters and an array of automated radio telemetry stations to track the movements of the rufa red knot (*Calidris canutus rufa*), a federally protected shorebird as a threatened species under the Endangered Species Act, in Federal waters of the U.S. Atlantic Outer Continental Shelf (OCS). This and other information from this study is being used to inform ongoing environmental reviews and risk assessments of offshore wind energy development to red knots.

Findings/Results:

- A total of 388 red knots were fitted with digital VHF transmitters at major stopover areas in Canada and the U.S. Atlantic Coast during fall migration.
- Eight percent (8%) of the tagged birds were detected passing through one or more wind energy areas during fall migration.
- Flight trajectories over the Atlantic OCS were influenced by wind direction and likely reflected variation in migration routes of individuals from different wintering populations.
- Three-quarters of the flights across Wind Energy Areas were within the rotor swept zone (20 to 200 meters above the sea surface) of future wind turbines; however, the error around the estimated flight heights was very large (typically 100 to 200 meters).

Final Report: Loring PH, McLaren JD, Smith PA, Niles LJ, Koch SL, Goyert HF, Bai H. 2018. Tracking movements of threatened migratory rufa red knots in U.S. Atlantic Outer Continental Shelf Waters. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-046. 145 p.

Impact Assessment of Offshore Wind Turbines on High Frequency Coastal Oceanographic Radar

ESPIS Link: https://marinecadastre.gov/espis/#/search/study/100141

Conducted by: CODAR Ocean Sensors

National Studies List: AT-16-03 (2016–2018)

Study Products (available in ESPIS): Final report

Purpose:

The spinning blades of offshore wind turbines cause interference with high-frequency radars (HFR). The first five offshore wind turbines in the U.S. were installed in 2016 off Block Island, Rhode Island, near six coastal oceanographic SeaSonde HFR. This study focused on understanding the impact of these wind farms on the national coastal HFR network and developing techniques to mitigate the impact of turbine interference on all the radar data products.

Block Island Wind Farm.

Findings/Results:

- Wind turbine interference is caused by the amplitude modulation of the turbine's radar cross section.
- The location of the wind turbine interference in the Doppler spectrum is predictable and can be determined from the rotation rate of the wind turbine.
- Mitigation methods that remove signals from the Doppler spectrum based on the wind turbine rotation rate estimates are effective methods of mitigating wind turbine interference.

Final Report: Trockel D, Rodriguez-Alegre I, Barrick D, Whelan C. 2018. Impact assessment and mitigation of offshore wind turbines on high frequency coastal oceanographic radar. Sterling (VA): U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-053. 49 p.

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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