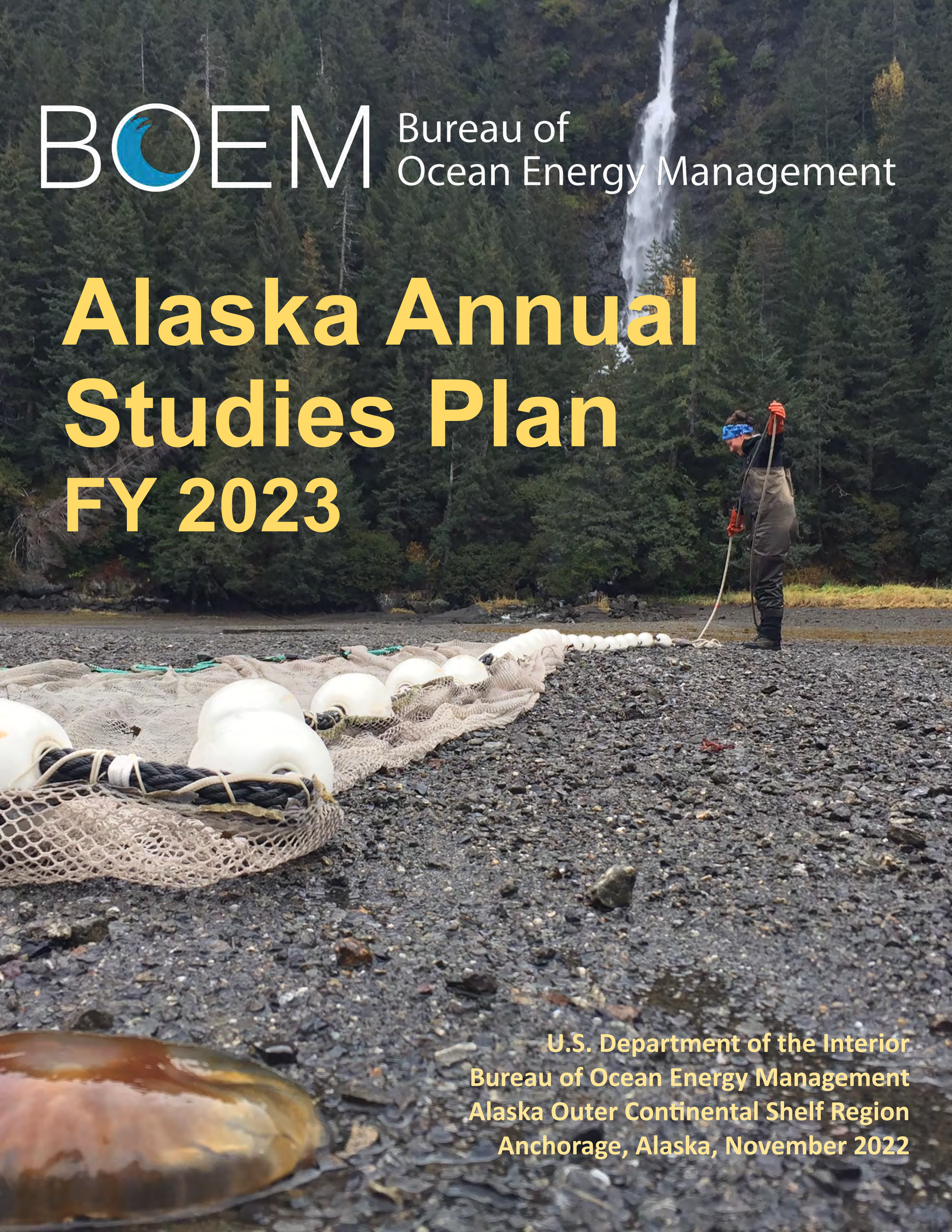

Bureau of Ocean Energy Management

Alaska Annual Studies Plan FY 2023

U.S. Department of the Interior
Bureau of Ocean Energy Management
Alaska Outer Continental Shelf Region
Anchorage, Alaska, November 2022

Prepared by
U.S. Department of the Interior
Bureau of Ocean Energy Management
Anchorage, Alaska Office
3801 Centerpoint Drive, Suite 500
Anchorage, Alaska 99503-5823

November 2022

The Environmental Studies Program has chosen to "go green." This document can be accessed in electronic format at http://www.boem.gov/akstudies/. For assistance accessing the document or for further information about the Studies Program and our planning process, please contact Alaska.Studies@boem.gov or Dr. Heather Crowley at heather.crowley@boem.gov.

The inclusion of study profiles in this document does not constitute a commitment by the U.S. Department of the Interior, Bureau of Ocean Energy Management to conduct or fund any or all of the studies. Method of procurement may be selected at the discretion of BOEM. The scope of the studies is subject to change prior to initiation of any work.

Cover Image: Fieldwork in Kachemak Bay, Alaska.

Photo credit: Project team for *The Influence of Water Flow, Seasonality, and Water Conditions on Fish Communities in Estuarine Nearshore Habitats in Kachemak Bay, Alaska* (Coastal Marine Institute student project). OCS Study BOEM 2019-067.

United States Department of the Interior
BUREAU OF OCEAN ENERGY MANAGEMENT
Alaska Regional Office
3801 Centerpoint Drive, Suite 500
Anchorage, Alaska 99503-5823

November 8, 2022

Dear Stakeholder:

Thank you for your interest in the Environmental Studies Program (ESP) of the Bureau of Ocean Energy Management (BOEM). As BOEM's priorities evolve, we continue to assess our information needs and identify new study ideas each year to meet these needs. We are providing this *Alaska Annual Studies Plan FY 2023* as a convenient reference describing our recent programmatic updates and our plans for fiscal year (FY) 2023 and beyond.

We have restructured and streamlined the *Alaska Annual Studies Plan* while continuing to focus on input we receive from our partners within and outside of the Federal Government. We are interested to receive your feedback and any suggestions you have for the BOEM *Alaska Annual Studies Plan FY 2024*. We assess information needs and develop new study profiles each year, following a well-established process based on stakeholder input and scientific peer review.

To assist us in processing suggestions for new studies, we ask that you follow the formatting guidance for a study profile shown on the next page. Please keep in mind that studies proposed for our consideration must address specific BOEM mission and decision needs. Suggestions may be submitted via email to Alaska.Studies@boem.gov, and must be received by us no later than December 9, 2022, to ensure consideration for FY 2024 (October 1, 2023–September 30, 2024). We will issue a final *Alaska Annual Studies Plan FY 2024* in the autumn of 2023.

We sincerely appreciate your participation in this process, and we look forward to receiving your suggestions. If you have any questions about the submission process, please contact me at heather.crowley@boem.gov.

Sincerely,

Heather A Crowley

Heather A. Crowley, Ph.D.
Alaska Studies Coordinator

Bureau of Ocean Energy Management
https://www.boem.gov/akstudies/
Alaska.Studies@boem.gov

Proposed Study for FY 2024

Formatting Guidance: We recommend study profiles be concise (~2-3 pages) but provide sufficient information to clearly indicate the goals and objectives of the project. Please keep in mind that studies proposed for consideration must address specific BOEM mission and decision needs as described in Section 2.0 of this document. The method of procurement for any funded study shall be selected at the discretion of BOEM.

Title: Enter a brief, descriptive title

Administered by: BOEM Alaska Regional Office

Period of Performance: FY 202X–202X

Study Framework: *(Provide one or two sentences for each of the following elements, as appropriate)*

Problem: Who or what is potentially affected? This includes baseline studies.

Intervention: What is your solution to the problem? How do you measure potential interactions and/or change?

Comparison: What is the intervention measured against? Consider in terms of hypothesis testing, control vs. treatment, and/or natural change.

Outcome(s): What is the expected outcome and understanding?

Context: What are the circumstances and/or geographic domain(s)?

BOEM Information Need(s): Provide brief and conclusive reason(s) why BOEM needs the information. Explain how this information will be used to manage Outer Continental Shelf (OCS) resources. The specific decision or document relying on the information should be stated.

Background: Provide a brief narrative of relevant issues. Explain what information is required and provide pertinent background. Include details about whether this study ties in with other efforts, and if so, how. Include a description of the current status of information. That is, what is the level of adequacy of existing information, does any exist, does it need to be more geographically specific?

Objectives: Clearly and succinctly state the overall purpose of the study by identifying one or more specific objectives.

Methods: Provide a brief description of how the objectives of the study will be accomplished, including what information, techniques or methods are available that could be used. Also note expected study products in this section (e.g., technical reports, database, model, bibliography)

Specific Research Question(s): Identify specific research questions this study will address.

Additional information: Provide additional relevant information, such as dates when products would be most useful and for what purpose.

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LIST OF STUDY PROFILES

STUDIES PLANNED FOR FY 2023

STUDIES TO BE CONSIDERED FOR FY 2024

ACRONYMS AND ABBREVIATIONS

ADF&G	Alaska Department of Fish and Game
ANIMIDA	Arctic Nearshore Impact Monitoring in Development Area
ASP	Alaska Annual Studies Plan (BOEM)
AOOS	Alaska Ocean Observing System
BOEM	Bureau of Ocean Energy Management
BSMP	Beaufort Sea Monitoring Program
CESU	Cooperative Ecosystem Studies Unit
CIRCAC	Cook Inlet Regional Citizens Advisory Council
CMI	Coastal Marine Institute
COMIDA	Chukchi Offshore Monitoring in Drilling Area
COSA	Committee on Offshore Science and Assessment of the National Academies of Sciences, Engineering, and Medicine
DPP	Development and Production Plan
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Environmental Studies Program (BOEM)
ESPIS	Environmental Studies Program Information System
FY	Fiscal Year
IARPC	Inter-agency Arctic Research Policy Committee
LCI	Lower Cook Inlet
MML	Marine Mammal Laboratory
MMPA	Marine Mammal Protection Act
N/A	not applicable
NAAQS	National Ambient Air Quality Standards
NCEI	National Centers for Environmental Information
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOPP	National Oceanographic Partnership Program
NPRB	North Pacific Research Board
NREL	National Renewable Energy Laboratory
NSB	North Slope Borough

OCS	Outer Continental Shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OCSLA	Outer Continental Shelf Lands Act
OSRA	Oil-Spill risk Analysis
PAH	Polycyclic Aromatic Hydrocarbon
PSD	Prevention of Significant Deterioration
QA/QC	Quality Assurance/Quality Control
SI	Smithsonian Institution
STEM	Science, Technology, Engineering, and Mathematics
TBD	To be determined
UAF	University of Alaska Fairbanks
USDOI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UT	University of Texas

SECTION 1.0 INTRODUCTION

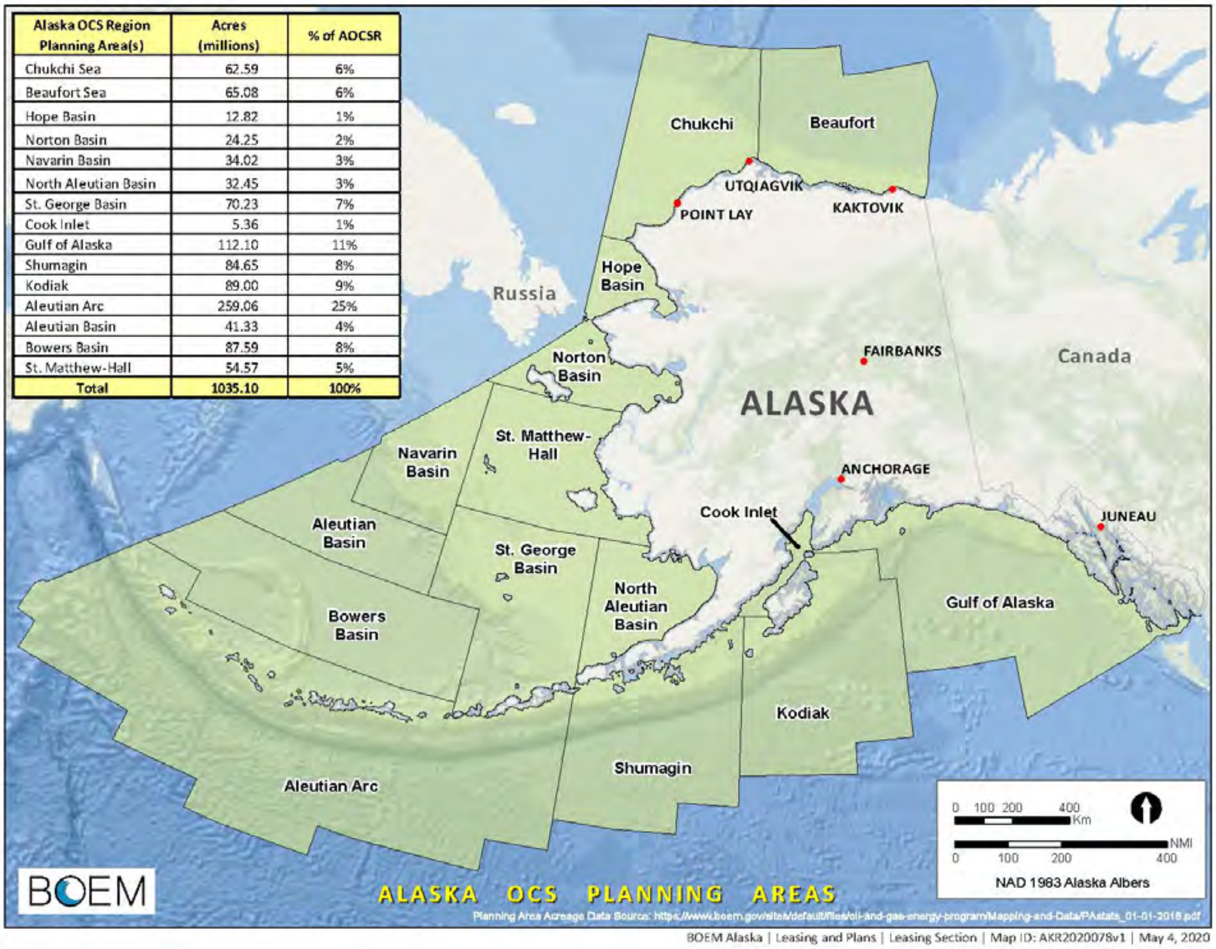
The U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) uses high-quality scientific information to manage the responsible exploration and development of offshore energy and marine mineral resources on the U.S. Outer Continental Shelf (OCS). The Alaska OCS consists of approximately 1 billion acres of federal jurisdiction lands submerged under the ocean seaward of state boundaries, generally beginning three nautical miles off the coastline and extending for 200 miles.

Mandated by Section 20 of the Outer Continental Shelf Lands Act, BOEM's Environmental Studies Program (ESP) develops, funds, and manages scientific research to support environmental analysis under the National Environmental Policy Act (NEPA) and informs policy decisions on the development of energy and mineral resources on the OCS. The ESP has provided over $1.2 billion for research since its inception in 1973; more than $450 million of that amount has funded studies across Alaska's 15 planning areas (Figure 1), resulting in more than 2,500 technical reports and innumerable peer-reviewed publications (see Appendices for table listings of the most recent reports and publications).

Initially, the ESP focused on obtaining baseline information on the vast biological resources and physical characteristics of the Alaskan environment. As more information was amassed, the ESP has evolved to emphasize topical studies in smaller areas to answer specific questions and fill identified information needs related to potential impacts associated with OCS activities. Currently, the ESP in Alaska is managing more than 50 ongoing study projects in disciplines such as physical oceanography, fate and effects of pollutants, protected species, marine ecology, and the social sciences, including Indigenous knowledge. BOEM analysts use final reports, data, and peer-review publications from ESP-funded studies to prepare NEPA documents and other reports and analyses to meet the requirements of other Federal laws, including but not limited to the Marine Mammal Protection Act (MMPA),Endangered Species Act (ESA), Magnuson-Stevens Fishery Conservation and Management Act, Clean Air Act, and the National Historic Preservation Act.

Many of the ESP's completed study reports can be found through the Catalog of U.S. Government Publications at https://catalog.gpo.gov/F. BOEM Alaska Regional Office study reports can also be found at https://www.boem.gov/AKpubs. Project data are typically delivered to Federal data repositories such as the National Centers for Environmental Information (NCEI) and posted to the Alaska Ocean Observing System (AOOS) and customized project websites.

Section 2.0 of this plan discusses BOEM's current priority information needs for Alaska. This is followed by an overview of the Alaska Regional Office's study planning process and current study efforts.



Alaska OCS Region Planning Area(s)	Acres (millions)	% of AOCSR
Chukchi Sea	62.59	6%
Beaufort Sea	65.08	6%
Hope Basin	12.82	1%
Norton Basin	24.25	2%
Navarin Basin	34.02	3%
North Aleutian Basin	32.45	3%
St. George Basin	70.23	7%
Cook Inlet	5.36	1%
Gulf of Alaska	112.10	11%
Shumagin	84.65	8%
Kodiak	89.00	9%
Aleutian Arc	259.06	25%
Aleutian Basin	41.33	4%
Bowers Basin	87.59	8%
St. Matthew-Hall	54.57	5%
Total	1035.10	100%

Figure 1. BOEM Alaska OCS Planning Areas

SECTION 2.0 IDENTIFICATION OF INFORMATION NEEDS

BOEM’s mission is to manage development of OCS energy and mineral resources in an environmentally and economically responsible way. The Bureau looks to ESP to provide the best available science to help fulfill its mission. In Alaska, BOEM needs updated information about potential impacts to the physical, biological, and human environments from offshore energy and marine mineral development activities and how those impacts can be avoided or minimized. When responding to these needs, the ESP in Alaska seeks to incorporate Indigenous and local knowledge and strives to address cross-cutting themes such as climate change; environmental justice concerns; tribal issues and how BOEM’s activities may affect the subsistence way of life, traditional ways, and Indigenous cultural resources; and building capacity for science, technology, engineering, and mathematics (STEM) in communities through citizen science.

To address these information needs and accomplish its goals, BOEM's ESP supports research studies in the following areas:

1. **Effects of OCS Activities:** Information on environmental impacts from activities authorized by BOEM, how to prevent or lessen adverse impacts, and how to provide information needed for legal compliance.
2. **Affected Resources**: Information on the status and resilience of biological resources, habitat areas, and human communities from potential impacts.
3. **Monitoring:** Information on the environmental impacts of BOEM-authorized activities over the entire duration that those impacts will occur.
4. **Cumulative Impacts:** Information to address the cumulative environmental impacts from a BOEM-authorized activity.
5. **Compliance:** Information to demonstrate that BOEM's decisions comply with applicable environmental laws.

2.1 Priority Information Needs

In consideration of the goals outlined by the current administration, as well as information needed to support analyses under NEPA and other regulations for potential future activities on the Alaska OCS, we identify four research topics that represent our highest priority information needs for FY 2024.

2.1.1 Acoustic Effects on Marine Biota

It can be challenging to evaluate how anthropogenic noise affects ecosystem function. BOEM needs further information to assess how noise from BOEM-authorized activities may influence the health, behavior, distribution, and relative abundance of marine biota, their habitats, and the subsequent subsistence use of these resources by rural communities.

2.1.2 Climate Change

Climate change adds complexity when assessing and understanding ecosystem changes, because it becomes much harder to parse out effects of anthropogenic activities when baselines are shifting. For example, when analyzing the impacts of a particular action, it is important to distinguish effects associated with the action from those attributable to changing environmental conditions and natural variation. BOEM needs enhanced methodologies, such as better survey methods and improved ecosystem models, to understand effects of climate change at the local ecosystem level.

2.1.3 Renewable Energy

Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, calls for the Secretary of the Interior to identify steps that can be taken to increase renewable energy production on public lands and in offshore waters. Alaska holds considerable potential for renewable energy development, which can be harnessed to supply a cost-effective source of energy to Alaska's remote communities. As part of a current BOEM-funded study, *Feasibility Study for Renewable Energy Technologies in Alaska Offshore Waters* (AK-21-x07), the Department of Energy's National Renewable Energy Laboratory (NREL) estimated the technical power potential of wind, tidal, and wave energy resources across the Alaska OCS (Figure 2). More information is needed to help understand how renewable energy technologies may impact the marine ecosystem and cultural resources, as well as subsistence, commercial, and recreational fisheries.

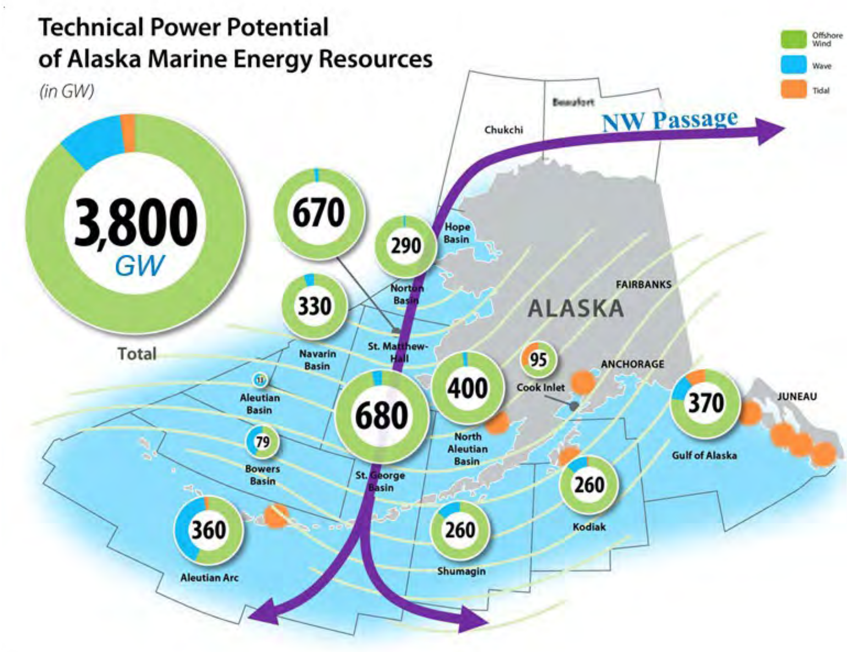


Figure 2. Map summarizing the technical power potential for marine energy resources (offshore wind, wave, tidal) in Alaska OCS Planning Areas. (courtesy of the National Renewal Energy Laboratory)

2.1.4 Offshore Critical Mineral Resources

Executive Order 14017, *America's Supply Chains*, directs agencies across the Federal Government to take actions to foster resilient supply chains by reducing dependence on foreign sources of critical materials, which are identified as essential to the economic and national security of the United States. BOEM is the steward of minerals on the OCS, including critical minerals. Alaska has potential offshore critical minerals to supply our strategic needs, but they are currently an underexplored and untapped resource. BOEM needs information about potential environmental effects from mining of offshore minerals, including disruption of benthic communities due to seabed disturbances.

2.2 Geographic Areas of Interest

The wide range of environmental conditions from the Gulf of Alaska and Cook Inlet to the Bering Sea and the Arctic is important to consider when formulating new studies. Though extremely diverse, these areas share many of the same information needs, such as the need for assessment of variability and long-term trends in oceanographic conditions and biological communities. For example, a better understanding of trophic and community structure in nearshore habitats is needed to support evaluation of resiliency of fish and invertebrate populations, as well as subsistence, recreational, and commercial use of these resources, under changing environmental conditions in each area. While BOEM is currently placing primary emphasis on studying the Cook Inlet Planning Area, the Arctic region remains relevant both because there are active leases in the Beaufort Sea and the Arctic provides exceptional opportunities to carefully examine climate change and other topics that are relevant across the many OCS areas. The ESP in Alaska is seeking to broaden its geographic focus due to the potential for increased interest in offshore renewable energy and marine mineral resources, particularly along Alaska's southern coast, from the Gulf of Alaska to the Aleutian Arc.

2.2.1 Cook Inlet

There are currently 14 active oil and gas leases in Cook Inlet (Figure 3) and additional leases may result from Lease Sale 258, which is scheduled for December 2022. Information is needed to support NEPA impact assessments for exploration plans that may be submitted for any of these leases. The 2023–2028 National OCS Oil and Gas Leasing Proposed Program (posted at https://www.boem.gov/national-program) also identifies Cook Inlet Lease Sale 267, tentatively scheduled for 2026. In addition, BOEM has received inquiries and expressions of potential interest regarding development of wind and tidal renewable energy resources in Cook Inlet OCS areas.

Though a substantial volume of data documenting current environmental conditions exists for Cook Inlet, additional synthesis of this widely dispersed information is needed. Additional needs related to Cook Inlet include, but are not limited to: the distribution and geographic range of the endangered Cook Inlet beluga whale stock; effects of climate change on distribution, community composition, and habitat use of marine mammals, fish and invertebrates; detail on species distribution and ecosystem function during the winter months; and the need for enhanced interpretation of the surface and subsurface circulation and density fields, including improved modeling of rip currents to better assess impacts from future tidal renewable energy development, as well as from potential oil spills.

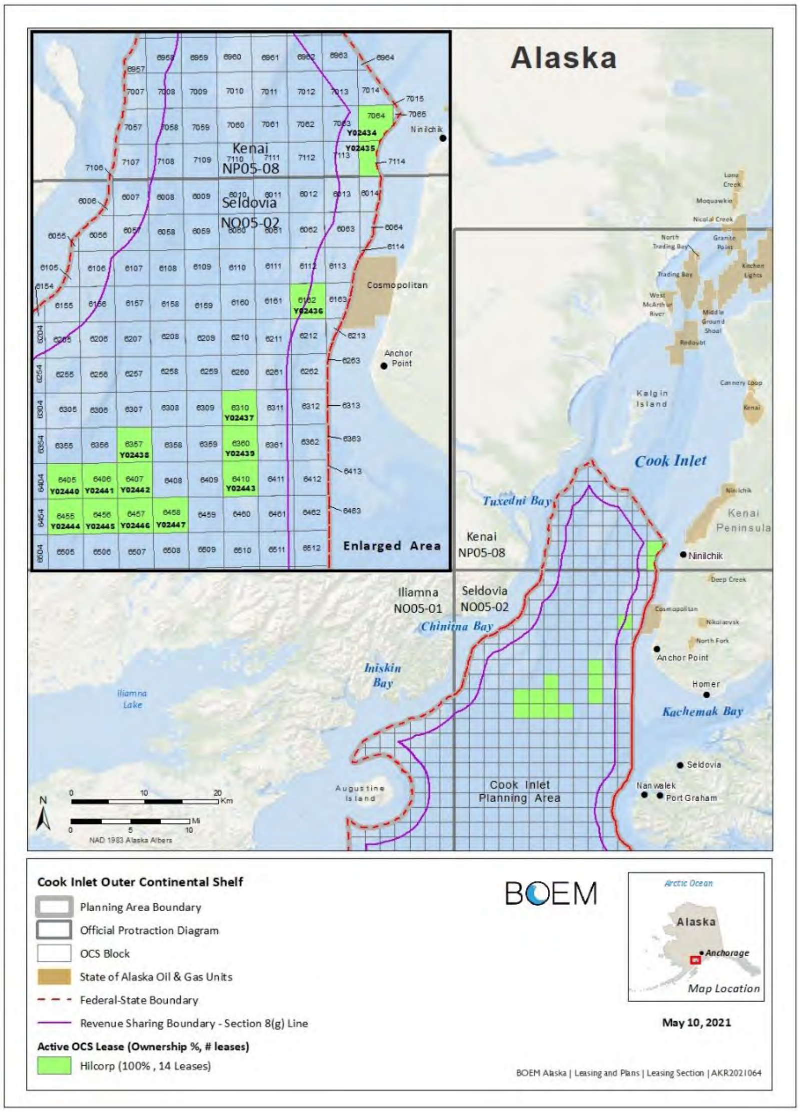


Figure 3. Cook Inlet OCS Leases

2.2.2 Beaufort Sea

There are currently six active oil and gas leases in the Beaufort Sea (Figure 4). These include Northstar, a joint Federal/State of Alaska production unit located in state waters, and the planned Liberty Drilling and Production Island. Residents of coastal communities along the Beaufort Sea have expressed concerns about long-term effects of OCS activities, particularly changes to ocean currents and sedimentation rates and potential effects on social systems, including subsistence whaling activities in the vicinity of Northstar and Liberty. Other issues affecting this area include the effects of climate change and potential impacts of increased vessel presence and associated sounds on the marine environment and subsistence activities. Furthermore, OCS activities in the Beaufort Sea can potentially affect the entire U.S. Arctic, including the Chukchi and Bering Seas, due to the common vessel transit routes through these areas, in addition to the oceanographic and ecological connections of these subregions. Finally, BOEM shares many of the same goals and priorities with the Interagency Arctic Research Policy Committee (IARPC), as outlined in its *Arctic Research Plan 2022–2026* (https://www.iarpccollaborations.org).

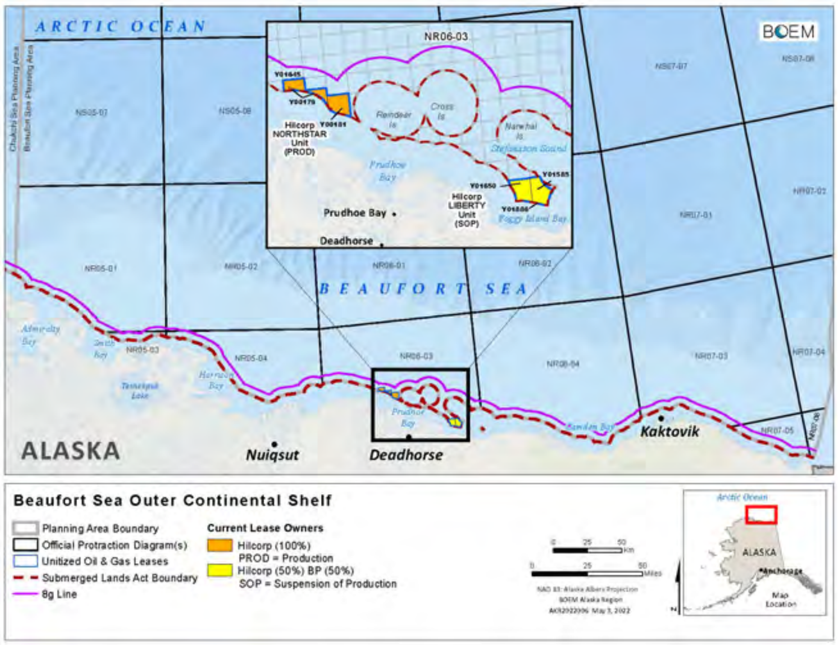


Figure 4. Beaufort Sea OCS Leases

2.2.3 Gulf of Alaska, Kodiak, Shumagin, Aleutian Arc

The planning areas along the southern coast of Alaska are well situated for development of offshore wind, wave, and tidal energy due to the proximity of marketable resources to the many remote coastal communities in this area (see Figure 2).

Also, as shown in Figure 5, the Aleutian Arc is an area with potential hydrothermal mineral formations, which can include high concentrations of critical elements such as cobalt, zinc, manganese, silver, and gold, as well as an abundance of iron, nickel, and molybdenum. In addition, the Gulf of Alaska and Kodiak Planning Areas contain a number of seamounts that are consistent with the geologic and oceanographic criteria required to potentially host ferromanganese crusts (Gartman et al., 2022).

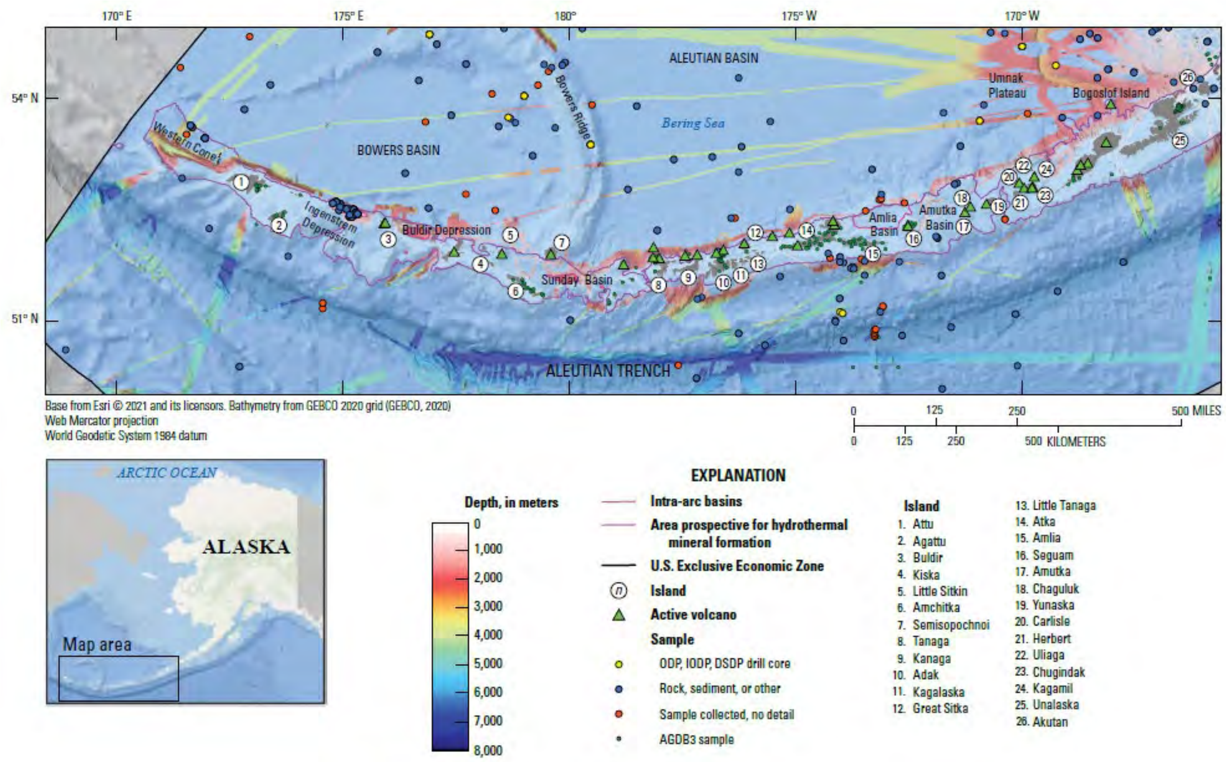


Figure 5. Map of the Aleutian Arc, Alaska, showing active volcanoes along the arc and back arc. Unimak Pass, the beginning of the offshore section of the Aleutian Arc, is at the easternmost end of the map. Seafloor is shown in gray outside of the U.S. Exclusive Economic Zone (EEZ). The arc and arc islands are prospective for hydrothermal mineral formation (Gartman et al. 2022).

2.3 Topical Areas for Future Research Consideration

Here, we present a general discussion of important topical themes and concerns that may become high priorities for BOEM in the future. We continually monitor these issues to ensure preparedness when priority information needs arise. The narrative will focus on BOEM mission needs in Alaska and across the OCS within the context of increased focus on marine renewable energy and mineral resources; varying industry interest in oil and gas exploration, development, and production; and altered baselines and potential trends in a changing environment.

2.3.1 Interdependent Physical, Biological and Social Processes

The Alaska Regional Office has a long history of supporting multidisciplinary research, beginning with the “Outer Continental Shelf Environmental Assessment Program” (OCSEAP) surveys conducted between the 1970s and early 1990s and the “Beaufort Sea Monitoring Program” (BSMP) in the 1980s. These were followed by the “Arctic Nearshore Impact Monitoring in the Development Area” (ANIMIDA) program and its follow-on projects in the Beaufort Sea, the multiple components of the “Chukchi Sea Oceanographic Monitoring in the Drilling Area”

(COMIDA) program and current projects such as the Arctic Integrated Ecosystem Surveys and the Arctic Biodiversity Monitoring Program.

There is an ongoing need for an integrated approach to examining interrelationships between physical, biological, and social processes to improve our understanding of the effects of climate change on the environment and facilitate better assessments of the potential impacts of activities on the OCS. For example, loss of ice cover and increasing ocean temperatures are causing changes to both physical oceanography and ecosystem productivity at local and regional levels, with substantial ramifications for marine mammals, birds, and fish species. Oceanic current patterns, especially in nearshore regions, are strongly influenced by climatological factors such as winds, river runoff, and sea ice coverage. In addition, the duration and extent of seasonal sea ice, seawater temperature, and water mass structure are critical controls on biological production in the water column, organic carbon cycling, and pelagic-benthic coupling. Climate change is also associated with altered water chemistry, particularly a reduction in pH, which will likely produce substantial habitat stresses for calcifying marine organisms (Mathis and Cross 2014). Climate change also introduces many socioeconomic concerns, including increased shoreline erosion and permafrost melt that threatens coastal villages and infrastructure; changes in distribution and availability of hunted subsistence species; and potential changes in commercial and subsistence fisheries as commercial species such as groundfish and salmon move north.

2.3.2 Physical Oceanography

BOEM needs a better understanding of the physics controlling regional circulation and oceanographic features, as well as ice conditions, across many Alaska Planning Areas to inform and improve regional analyses of potential biological impacts due to climate change and from OCS activities. For example, more detailed information would be needed about currents in the area of a potential wave or tidal energy converter emplacement to support assessment of impacts to fish and other organisms, especially those that have planktonic life stages.

An ongoing challenge in Alaska is the need for better, finer-scale ocean circulation models and higher resolution data to facilitate analysis of impacts from potential offshore activities and possible oil spills. Accurate information on surface wind fields, ocean currents, and sea ice is important for assessing the fate of spilled oil and the potential impacts on biota in the area. It is particularly important to know locations and seasonal and interannual changes in water masses, ocean currents, and sea ice. The need for updated oceanographic information is heightened by the pace of climate change seen in Alaska.

2.3.3 Fate and Effects of Pollutants

The environmental effects of offshore energy development on biota, including effects from potential contaminant spills, is a concern for coastal communities in Alaska. Residents are especially concerned about potential contamination of their food supply, which includes commercial and recreational fisheries as well as all manner of subsistence harvested species, such as whales, seals, migratory birds, and fish. Additional information is needed about the chemical composition and weathering characteristics of Alaska crude oils, including from natural seeps, to better understand potential effects from oil spills.

2.3.4 Air Quality

In December 2011, Congress transferred jurisdiction and authority for the regulation of oil and gas-related air emissions on the OCS adjacent to the North Slope Borough from the Environmental Protection Agency (EPA) to BOEM. While implementing its authority for the regulation of oil and gas-related air emissions, BOEM will need air quality monitoring information to assess the cumulative air quality impact of OCS Arctic oil and gas activity and to support compliance with the OCSLA and environmental justice initiatives. In particular, future increases in OCS activities in the region would introduce the need for more information to evaluate how resulting levels of substances such as black carbon and methane might impact climate change, as well as human health.

2.3.5 Marine Mammals and Protected Species

Information is needed across Alaska about potential impacts to marine mammals from offshore energy-related activities. Species protected under the ESA and MMPA are of particular concern. Possible hazards include noise from various industrial and support activities, oil spills and other discharges, and increased human interaction with offshore species.

The current spatial and temporal use patterns on the OCS and effects from loss of sea ice are of ongoing concern for sensitive species including cetaceans, sea otters, and pinnipeds. More comprehensive abundance estimates for marine mammals are also needed to enhance the assessment of potential impacts under NEPA and assist the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Fish and Wildlife Service (USFWS) in ensuring compliance with Federal management and regulatory mandates for marine mammals under the MMPA. Furthermore, potential impacts to marine mammals and other species from development of renewable energy resources will take on increased importance in the coming years.

The effect of noise on the well-being and behavior of marine mammals is a particularly acute information need. It is also important to assess the factors that may be affecting the habitat use, health, population status and migration routes of different species and the potential cumulative impacts from multiple factors (e.g., noise from industry activities combined with environmental change). BOEM also will continue to develop specific information on the hearing capabilities of baleen whales and other marine mammals to better understand their behavior in response to industrial noise.

2.3.6 Migratory Birds

Information is needed about potential impacts of offshore energy exploration, development, and production to species protected under the Migratory Bird Treaty Act. Possible impacts include disturbance and displacement from preferred habitats, effects of noise on communication, increased stress levels and changes to nesting and reproduction, collision due to artificial light, oil spills and other pollutant discharges, increased abundance of predators and scavengers.

2.3.7 Fish and Lower Trophic Communities and Essential Fish Habitat

Assemblages and populations of fish and benthic organisms in Alaska marine ecosystems have undergone observable regime-shifts in diversity and abundance in recent decades (Dunton et al. 2016). BOEM needs information to assess and manage the potential environmental effects of OCS activities on marine fish, forage fish, invertebrates, and their habitat, including more detailed data about the biology and ecology of many marine fish and invertebrate species inhabiting areas of potential energy development activity, including the effects of potential contaminant releases on species presence, distribution, and abundance. Furthermore, Alaska Native peoples are concerned that OCS activities will affect subsistence fish populations and reduce availability for subsistence harvest. Consequently, research on fisheries and recruitment to nearshore feeding populations are an important consideration.

It is important to assess the distribution and abundance of fishes in Alaska waters and to distinguish between changes due to anthropogenic and natural effects; one potential approach for this is ecosystem-based modeling. In addition, BOEM engages in consultation with NOAA's National Marine Fisheries Service (NMFS) under the Magnuson-Stevens Fishery Conservation and Management Act regarding any action that may adversely affect designated Essential Fish Habitat (EFH) for adult and late juvenile life-stages of shellfish, groundfish, forage fish and Pacific salmon. More information is needed to evaluate EFH and to clarify environmental assessment and mitigation needs under various development practices (e.g., seismic surveys, pile driving, and habitat alterations, among others).

2.3.8 Alaska Native Culture, Subsistence, and Socioeconomics

BOEM needs information to identify and document potential impacts to the human environment from federal actions. These needs include the spatial, temporal, cultural, and economic aspects of subsistence activities and harvest patterns for Alaska Native Peoples living in coastal communities. Other topics include socioeconomic profiles, impacts to sociocultural systems, sharing and application of Indigenous knowledge, and human values of the OCS such as recreation and tourism and commercial, sport, or personal use fisheries. In addition, Alaska Native communities frequently express concern about cumulative impacts of OCS activities, as well as climate change, on their subsistence way of life. Some of the concerns include diminished access to hunting and fishing areas around offshore activities and infrastructure, reduced harvests, increased hunter efforts, increased hunter cost and general food security.

There is an ongoing need to monitor key indicators of socioeconomic and cultural changes in Alaska Native communities. For example, the Iñupiat rely on a wide variety of marine resources as significant sources of food and the harvesting, sharing and consuming of subsistence resources form an important part of the traditional Iñupiaq culture and spiritual life. Another key interest is the use of local and traditional knowledge in analysis of climate change and potential environmental effects. We continue to seek and include firsthand knowledge of local subsistence hunters to enhance the scientific knowledge base.

2.2.9 Archaeological Resources

The archaeological significance of offshore areas has been increasingly recognized in recent years and marine archaeological studies have been showing the presence of prehistoric sites on the shelves beneath the modern ocean. Basic information and analysis of archaeology potential on the Alaska Outer Continental Shelf is needed for assessments to support the National Historic Preservation Act and NEPA review.

SECTION 3.0 PROGRAM OVERVIEW OF THE ESP IN ALASKA

This section discusses the overarching framework BOEM uses to guide development of the ESP research portfolio and the processes followed by the Alaska Regional Office for planning and conducting studies. Finally, we present information about our ongoing and planned new studies, as well as projects identified for further consideration for FY 2024.

3.1 Ocean Stewardship Through Science

Environmental stewardship is at the core of BOEM's mission. Diverse Federal laws task BOEM with protecting the marine, coastal, and human environments, and, through the ESP, BOEM utilizes the best available science to support sound policy decisions and manage OCS resources.

3.1.1 Strategic Science Questions

As discussed in the ESP's Strategic Framework (USDOI, BOEM, ESP 2020), BOEM seeks to achieve its mandate through research that addresses the following Strategic Science Questions:

- How can BOEM best assess cumulative effects within the framework of environmental assessments?
- What are the acute and chronic effects of sound from BOEM-regulated activities on marine species and their environment?
- What are the acute and chronic effects of exposure to hydrocarbons or other chemicals on coastal and marine species and ecosystems?
- What is the effect of habitat or landscape alteration from BOEM-regulated activities on ecological and cultural resources?
- What are the air emissions impacts of BOEM-regulated activities to the human, coastal, and marine environment and compliance with the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments?

- How will future ocean conditions and dynamics amplify or mask effects of BOEM-regulated OCS activities?
- How does BOEM ensure the adequate study and integrated use of social sciences in assessing the impacts of OCS activities on the human environment?
- How can BOEM better use existing or emerging technology to achieve more effective or efficient scientific results?
- What are the best resources, measures, and systems for long-term monitoring?

Studies in Alaska must also address reduced ice cover and increased ocean temperatures and how these changes will interact with OCS activities over the next 25–50 years:

- What role will ocean currents and sea ice play in distribution of anthropogenic pollutants near exploration and development prospects?
- How are ocean currents and biota affected by reduced sea ice conditions?
- How do cold temperatures and presence of sea ice alter the fate of spilled oil?

In addition to the physical and biological environment, the ESP in Alaska needs to consider many socioeconomic issues directly and indirectly affected by the observed changes. For example, the people of Alaska's remote communities rely heavily on subsistence resources and are especially concerned about changes in distribution and availability of hunted subsistence species, as well as industrial activities that may affect hunting success or the habitats of important subsistence species. In addition to subsistence, the people of Cook Inlet are also concerned about potential effects of OCS activities on commercial fishing, sport fishing, and tourism.

3.1.2 Criteria for Study Development and Approval

The ESP's structured decision-making approach to prioritizing study ideas for funding consideration consists of an evaluation by BOEM subject-matter experts to identify a short-list of high priority study profiles for further consideration. This evaluation is based on the following seven criteria (detailed in the ESP's *Studies Development Plan 2023–2024* (USDOI, BOEM, ESP 2022)).

1. Need for the information in BOEM decision-making
2. Contribution to existing knowledge
3. Research concept, design, and methodology
4. Cost-effectiveness
5. Leveraging of funds
6. Partnerships and collaboration
7. Multi-regional and strategic utility

3.2 The Studies Planning Process

Research planning in BOEM's Alaska Regional Office follows an annual cycle (Figure 6) that begins with the autumn distribution of the *Alaska Annual Studies Plan* (ASP) to more than 200 partner and stakeholder groups across Federal, State, Alaska Native, Tribal, academic, and industry sectors. The ASP describes ongoing research, reveals proposed new studies for the coming fiscal year, and requests input from scientists, stakeholders, partners and the general public about information needs and suggestions for new studies.

More than 70 individual study suggestions are received from external stakeholders and BOEM staff each year, including ideas identified from programmatic reviews and public comments. These are evaluated and prioritized in consideration of the strategic science questions and criteria identified above.

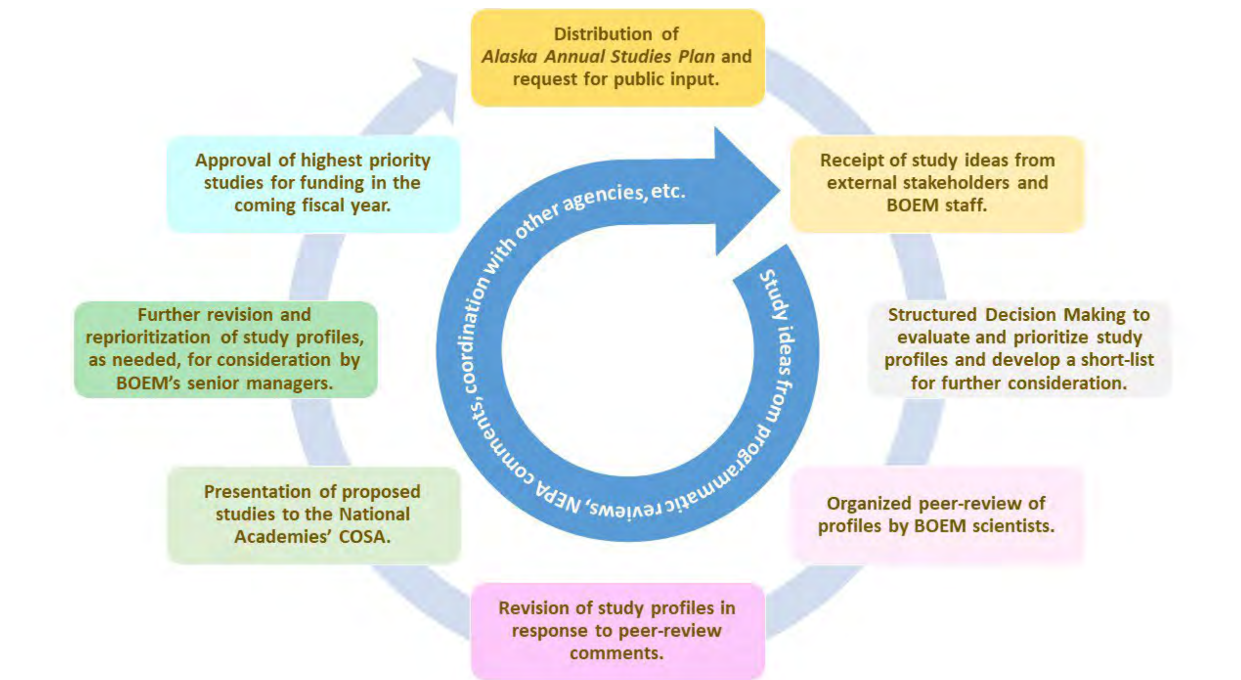


Figure 6. The Alaska Regional Office's Annual Studies Planning Cycle

Following this evaluation, the study profiles move through several additional steps before the circle is closed:

1. The proposed profiles undergo an organized process of peer-review by scientists throughout BOEM to evaluate the priority and quality of each proposed study, including providing feedback on technical aspects of proposed study methods.

2. The proposed studies are presented to the Committee on Offshore Science and Assessment (COSA) of the National Academies of Sciences, Engineering, and Medicine for additional input.
3. The profiles are again revised, reprioritized, and finalized during summer for consideration by senior managers at the regional and national levels to determine funding allocation in the new fiscal year.
4. The highest priority studies are approved for funding.
5. The ASP is published and circulated to the public in autumn, when the cycle begins again.

3.3 Scientific Studies are Developed and Conducted in Partnership

A guiding principle of the BOEM and the ESP is partnerships should be sought, whenever possible, to leverage funds with other interested Federal, State, and private stakeholders to maximize the utility of results and extend limited budgets. When conducting research projects in Alaska, the ESP routinely coordinates with numerous Federal, State, and local agencies; Tribal entities; non-governmental organizations; academic institutions; and active research and monitoring programs in Alaska supported by industry.

The University of Alaska Coastal Marine Institute (CMI), a cooperative arrangement created in 1993, allows the ESP to access the scientific expertise of regional and local experts to collect and disseminate environmental information about coastal topics associated with the development of energy resources in the Alaska OCS. In nearly three decades, the Alaska CMI has funded 125 studies—including 13 student-led projects—and leveraged approximately $23 million of BOEM funds into almost $47 million of relevant marine-based research, with non-Federal matching funds from more than 50 different organizations. More information about the CMI can be found at https://uaf.edu/cfos/research/cmi.

The ESP also conducts cooperative research with universities through the Cooperative Ecosystem Studies Units (CESUs). The CESUs are working partnerships among leading academic institutions, Federal, State, and non-governmental organizations. A national network of seventeen CESUs provides research, education, and technical assistance for stewardship of cultural and natural resources. BOEM currently participates in seven CESUs that encompass all areas of the OCS.

Additional linkages have been established at an international level with other arctic nations' research and regulatory entities. The ESP in Alaska coordinates with Arctic Council activities, including the Arctic Monitoring and Assessment Programme, Conservation of Arctic Flora and Fauna, Protection of the Arctic Marine Environment, and other working groups. The ESP provides information to these working groups through review of reports and plans, such as the Arctic Council Arctic Marine Strategic Plan 2015–2025, and informs working group members of available information sponsored by BOEM. Further, the ESP identifies and facilitates specific studies that can coordinate and integrate with working group activities.

BOEM also strives to incorporate Indigenous and local knowledge of Alaska Native peoples, Alaskan residents, and the permanent participants of the Arctic Council in its decision-making processes (Kendall et al. 2017; Brooks et al. 2019). The ESP considers and integrates Indigenous and local knowledge at all stages, beginning with the study development process through the preparation of study products and interpretation of results. In field-oriented studies sponsored by the ESP, researchers typically coordinate directly with local communities to discuss their plans, seek advice, and ensure that interested individuals learn about the project and its results. The process of integrating Indigenous and local knowledge and community-based monitoring varies from project to project, but the outcome of better information for decision-making is a common goal.

3.4 CURRENT EFFORTS OF THE ESP IN ALASKA

3.4.1 Ongoing Studies

Study profiles for each of the studies identified in Table 1 can be found at the Ongoing Studies Table link on the page https://www.boem.gov/AKstudies

This information, which is updated three times each year, includes:

- An updated status of each study.
- Report due dates.
- Related publications.
- Affiliated websites.

Table 1. BOEM Alaska Regional Office Ongoing Studies

NSL #	Study Title	Planning Area(s)	Start FY	Partners
	Biology			
AK-16-07	Arctic Integrated Ecosystem Survey, Phase II	Beaufort, Chukchi	2017	NOAA; UAF; USFWS
AK-17-03	Marine Bird Distribution and Abundance in Offshore Waters	Beaufort, Chukchi, Cook Inlet	2017	USFWS
AK-18-01	Environmental Resource Areas: Developing Products to Support Oil-Spill Risk Analysis (OSRA) and National Environmental Policy Act (NEPA)	All Alaska Planning Areas	2018	USGS
AK-19-01	Impacts of Sedimentation and Drivers of Variability in the Boulder Patch Community, Beaufort Sea	Beaufort	2019	UT-Austin
AK-19-02-02	Kelp Restoration in the Boulder Patch	Beaufort	2019	CMI

AK-19-02-03	Utilization of the Under-ice Habitat by Arctic Cod in the Western Arctic Ocean: A Multidisciplinary Collaborative Study	Beaufort, Chukchi	2019	CMI
AK-19-02-10	Are expanding Pink Salmon populations in the Arctic produced from regional watersheds?	Beaufort, Chukchi	2020	CMI
AK-19-92-13	Harnessing the Power of eDNA as a Real-time Assessment tool of Nearshore Arctic Marine Communities	Beaufort	2021	CMI
AK-19-02-14	Delineating Species and Stock Boundaries in the Arctic-Bering Cisco Species Pair	Beaufort	2021	CMI
AK-19-02-15	Understanding Spatial Dynamics and Movement of Pacific Halibut (*Hippoglossus stenolepis*) in the Northern Bering Sea	Chukchi, Bering	2021	CMI
AK-20-07	Early Detection Plan for Marine Non-native Species on the Arctic Outer Continental Shelf	Beaufort, Chukchi	2020	SI
AK-20-10	Monitoring the Recovery of Seabirds and Forage Fish Following a Major Ecosystem Disruption in Lower Cook Inlet	Cook Inlet	2020	USGS
AK-20-11	The Impact of Marine Fish Communities on Red-throated Loon Productivity in the Beaufort Sea	Beaufort	2020	USGS
AK-21-03	Resource Areas to Support Oil Spill Risk Analysis (OSRA) and National Environmental Policy Act (NEPA) Needs in the Cook Inlet Region	Cook Inlet	2021	ADF&G
AK-21-06	GPS Tagging of Seabirds to Obtain Areas of Foraging Aggregations and Forage Fish Schools in Lower Cook Inlet	Cook Inlet	2021	USGS
AK-22-01	Lower Cook Inlet Fish and Invertebrate Community Composition, Distribution, and Density Cook Inlet	Cook Inlet	2022	USGS
NT-20-10	A sustainable, integrated AMBON in the US Arctic	Beaufort, Chukchi	2020	NOPP
	Fates and Effects			
AK-19-02-11	Investigating the Impacts of Oil Exposure and Changing Snow Cover on Sea Ice Microbial Communities	Beaufort	2020	CMI
AK-19-02-12	Hydrocarbon Oxidation Products in Cook Inlet: Formation and Bioaccumulation in Mussels	Cook Inlet	2020	CMI
AK-19-02-16	Biological effects of Cook Inlet crude oil degradation products and suspect screening of oxidized polycyclic aromatic hydrocarbons (PAHs)	Cook Inlet	2021	CMI
AK-20-05	Improvements to the Oil Spill Risk Analysis (OSRA) Input Quality Assurance/Quality Control (QA/QC) and Validation	All Alaska Planning Areas	2020	
AK-21-02	Synthesis of Contaminants Data for Cook Inlet: Evaluation of Existing Data as “Baseline Conditions” and Recommendations for Further Monitoring	Cook Inlet	2021	CIRCAC
	Information Management			

AK-16-02	Collaboration with North Pacific Research Board (NPRB) Arctic Marine Research Program	Beaufort, Chukchi	2016	NPRB
AK-19-02	Alaska Coastal Marine Institute	All Alaska Planning Areas	2019	CMI
AK-19-02-09	Arctic Marine Biodiversity and Ecosystem Structure Data Analysis and Synthesis	Beaufort Chukchi	2020	CMI
AK-20-02	Support for Alaska Marine Science Symposium	All Alaska Planning Areas	2020	NPRB
AK-21-x07	Feasibility Study for Renewable Energy Technologies in Alaska Offshore Waters	All Alaska Planning Areas	2021	NREL
AK-22-06	Retrospective Synthesis of Historical Alaska OCS Oil and Gas Activities	All Alaska Planning Areas	2022	
	Marine Mammals and Protected Species			
AK-19-02-05	Evaluating Novel Assessment Approaches for Coastal Ice Seal Haulout Areas and Behavior in the Alaskan Beaufort Sea	Beaufort	2019	CMI
AK-20-01	Cook Inlet Beluga Acoustic Monitoring in Lower Cook Inlet (LCI) Rivers	Cook Inlet	2020	NOAA
AK-20-04	Quantifying Sea Otter Abundance, Distribution, and Foraging Intake in Cook Inlet Alaska	Cook Inlet	2020	USGS
AK-21-01	Winter Ringed Seal Density within Beaufort Sea Oil and Gas Project Areas	Beaufort	2021	ADF&G
AK-21-04	Bowhead Whale Migration Patterns along the Alaskan Beaufort Shelf in During a Period of Rapid Environmental Change	Beaufort	2021	CESU-UAF
	Physical Oceanography			
AK-17-01	Wave and Hydrodynamic Modeling in the Nearshore Beaufort Sea	Beaufort	2017	CESU-UAF; USGS
AK-19-02-08	Exploring radium isotopes as tracers of groundwater inputs, flushing rates, and produced water in Cook Inlet	Cook Inlet	2020	CMI
AK-19-02-17	Satellite Ocean Color Remote Sensing of Water Mass Dynamics in Cook Inlet	Cook Inlet	2022	CMI
AK-19-03	Landfast Ice Climatology in the Beaufort and Chukchi Seas	Beaufort, Chukchi	2019	CESU-UAF
AK-20-03	Update of River Overflood on Sea Ice and Strudel Scour Database	Beaufort	2020	
AK-22-04	Cook Inlet Physical Oceanography: Synthesis and Modeling	Cook Inlet	2022	UAF
	Social Science and Economics			
AK-15-05	Traditional Knowledge Implementation: Accessing Arctic Community Panels of Subject Matter Experts	Beaufort, Chukchi	2016	NSB
AK-19-02-18	From Beaufort to Bering Seas: Analyzing Relationships of Communication and Risk-sharing	Beaufort, Chukchi	2022	CMI
AK-19-05	Monitoring of the Cross Island Subsistence Whale Hunt for Effects from Liberty DPP	Beaufort	2019	

AK-20-06	Subsistence Harvest and Iñupiaq Knowledge of Beluga Whales for Kaktovik, Alaska	Beaufort	2021	ADF&G
AK-21-05	Coastal and Submerged Historic Properties and Precontact Sites on the Alaska Outer Continental	All Alaska Planning Areas	2021	

Partner Codes	
ADF&G = Alaska Department of Fish and Game	CESU = Cooperative Ecosystem Studies Unit
CIRCAC = Cook Inlet Regional Citizens Advisory Council	CMI = University of Alaska Coastal Marine Institute
MML = Marine Mammal Laboratory (NOAA)	NOAA = National Oceanic and Atmospheric Administration
NOPP = National Oceanographic Partnership Program	NPRB = North Pacific Research Board
NREL = National Renewable Energy Laboratory	NSB = North Slope Borough
SI = Smithsonian Institution	UAF = University of Alaska Fairbanks
USFWS = U. S. Fish and Wildlife Service	USGS = U. S. Geological Survey
UT = University of Texas	

3.4.2 Planned New Studies

The studies identified in Table 2 are tentatively planned to be initiated in FY 2023.

Table 2. BOEM Alaska Regional Office Studies Planned for FY 2023*

Discipline	Study Title	Planning Area(s)
PO	Tidal Flow Characteristics and Associated Biological Use of Cook Inlet	Cook Inlet
SS	Cook Inlet Area-wide Recreation and Tourism Inventory	Cook Inlet
FE	Pipeline Gas Release Frequency, Scenarios, and Impacts	All Alaska Planning Areas
	Discipline Codes	
	FE = Fates & Effects PO = Physical Oceanography SE = Socio-Economics	

* Initiation and conduct of any of these planned studies is subject to availability of funds.

Field	Study Information
Title	Tidal Flow Characteristics and Associated Biological Use of Cook Inlet
Administered by	Alaska Regional Office
BOEM Contact(s)	TBD
Procurement Type(s)	TBD
Conducting Organization(s)	TBD
Total BOEM Cost	TBD
Performance Period	FY 2023–2025
Final Report Due	TBD
Date Revised	November 4, 2022
Problem	BOEM needs an improved understanding of the potential renewable tidal energy areas within the Cook Inlet Outer Continental Shelf (OCS) to inform planning decisions for potential tidal renewable and conventional energy development, facilitate engineering design, and provide baseline information about biophysical interactions to support environmental analyses.
Intervention	This study will synthesize and make existing information accessible, identify information needs, and sample up to four identified tidal renewable energy sites in the Cook Inlet OCS and State of Alaska waters.
Comparison	The study would assess the potential for tidal renewable energy and resource use in the Cook Inlet OCS compared to existing historical and modeled information.
Outcome	This study would characterize tidal flow, tidal energy, biological use and productivity, and design parameters at up to four areas in Cook Inlet to identify potential renewable energy sites, potential impacts, and design parameters.
Context	Cook Inlet Planning Area and adjacent State of Alaska waters in upper Cook Inlet

BOEM Information Need(s): Information is needed to understand renewable tidal energy potential within the Cook Inlet OCS to inform decisions for planning, support environmental analyses for potential tidal renewable as well as conventional energy development, and facilitate appropriate engineering design. Information from the study could inform a future Request for Interest, aid in site selection, and provide information about biological vulnerabilities to tidal energy technologies to help guide mitigation during the National Environmental Policy Act (NEPA) process.

Background: There is growing interest from utilities in potential tidal renewable energy development in Cook Inlet. Tidal renewable energy systems are designed to extract the kinetic or potential energy flow and convert it into electricity. Cook Inlet has the highest tidal renewable energy potential in the United States and has a theoretical resource of 160 terawatt hours per year (TWh/yr) (Kilcher et al. 2021). Semidiurnal tidal currents in Cook Inlet create strong frontal convergence zones known as rips (Haley 2000). Current velocities within the rips exceed 8 knots (Nelson and Whitney 1996). These tidally induced rips could produce tidal energy, but they also serve as migratory pathways for salmon returning to their spawning streams, forage sites for sea birds, and areas for diverse fish catch by fishers (Moulton 1996; Okkonen 2005). Very little information has been published to-date regarding the characterization of tidal current energy in Cook Inlet. However, U.S. Department of Energy laboratories have recently been investigating the renewable energy potential of Cook Inlet, Alaska, though further work is needed (Branch et al. 2021; NREL 2021). In addition, BOEM initiated the *Feasibility Study for Renewable Energy Technologies in Alaska Offshore Waters* (AK-21-x07) in 2021. The goal of that effort is to identify areas of high potential for developing renewable energy across Alaska, which will help to inform selection of study sites for this project focused on Cook Inlet.

Objectives:

- Collate and synthesize available data on the physical qualities and quantities of the tidal energy and flow in Cook Inlet, Alaska, as well as the biological use and productivity of tidal renewable energy areas of interest, including the nearby current rips.
- Collect detailed physical oceanography data necessary to characterize the tidal flow, energy, and design criteria parameters throughout the water column at designated sites in Cook Inlet, Alaska.
- Evaluate design parameters for large-scale hydrokinetic energy potential specific to Cook Inlet, Alaska.
- Inform modeling refinements of Cook Inlet tidal energy to validate large-scale renewable energy potential.

Methods: Researchers will identify and gather existing, relevant, and readily available physical oceanographic and biological datasets and information for up to four potential tidal renewable energy site locations. The datasets will be organized into a common framework for review, synthesis, and identification of specific information needs to guide development of field plans and inform modeling needs, following the approach outlined by Kilcher et al. (2016). Researchers will conduct a field campaign to collect measurements needed to characterize tidal flow, tidal energy, design parameters, and biological resource use and productivity of up to four tidal renewable energy sites.

Specific Research Question(s):

1. What are the tidal flow, energy dynamics, and biological observations throughout the water column?
2. What is the biological use or productivity of the selected sites and of current rips in the proximity?
3. What are the design parameters for large-scale renewable energy components and structure?
4. How can current models be enhanced to characterize renewable tidal energy?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References:

Branch R, Wang, T, Whiting J, Yang Z, Garcia-Medina G. 2021 Sea ice collision risk assessment for tidal turbine siting in Cook Inlet, Alaska. Richland (WA): Pacific Northwest National Laboratory. 38 p. PNNL-32329. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-32329.pdf.

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Kilcher L, Thresher R, Tinnesand H. 2016. Marine hydrokinetic energy site identification and ranking methodology part II: tidal energy. Golden (CO): National Renewable Energy Laboratory. 30 p. NREL/TP-5000-66079. https://www.nrel.gov/docs/fy17osti/66079.pdf.

National Renewable Energy Laboratory (NREL). 2021. Cook Inlet tidal energy resource characterization effort. Golden (CO): National Renewable Energy Laboratory. 2 p. NREL/FS-5700-79933. https://www.nrel.gov/docs/fy21osti/79933.pdf.

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Nelson WG, Whitney JW. 1996. A description of summer and winter environmental conditions within Cook Inlet, Alaska. In: SPE Western Regional Meeting; 1996 May; Anchorage, Alaska. p. SPE-35688-MS.

Okkonen SR. 2005. Observations of hydrology and currents in central Cook Inlet, Alaska during diurnal and semidiurnal tidal cycles. Fairbanks (AK): University of Alaska Coastal Marine Institute and U.S. Department of the Interior, Minerals Management Service. 38 p. Report No.: OCS Study MMS 2004-058. https://espis.boem.gov/final%20reports/3217.pdf.

Wang T, Yang Z. 2020. A tidal hydrodynamic model for Cook Inlet, Alaska, to support tidal energy resource characterization. Journal of Marine Science and Engineering. 8(4):254. https://doi.org/10.3390/jmse8040254.

Field	Study Information
Title	Cook Inlet Area-wide Recreation and Tourism Inventory
Administered by	Alaska Regional Office
BOEM Contact(s)	TBD
Procurement Type(s)	TBD
Conducting Organization(s)	TBD
Total BOEM Cost	TBD
Performance Period	FY 2023–2026
Final Report Due	TBD
Date Revised	November 4, 2022
Problem	BOEM-authorized activities could affect ocean-dependent and ocean-enhanced recreation and tourism resources of Cook Inlet. Information on the characteristics, location, and timing of recreation and tourism for the Cook Inlet area are dated, which could result in inaccurate baselines and imprecise effects analyses.
Intervention	This study would develop information on the recreation and tourism resources of the Cook Inlet area.
Comparison	Study outcomes would be compared to results of similar studies conducted in other planning regions.
Outcome	Information would be used to describe the affected environment and potential effects, develop and implement mitigation of effects, and inform consultations.
Context	Cook Inlet Planning Area and adjacent coastal areas

BOEM Information Need(s): Understanding how recreation and tourism may be affected by Cook Inlet Outer Continental Shelf (OCS) energy development is important for assessing potential impacts. BOEM needs a baseline study regarding the relative importance of ocean-dependent and ocean-enhanced recreation and tourism for residents and visitors of the area and how these amenities could be affected by future OCS lease sales, exploration, and development. Results would be useful for describing the affected environment, analyzing potential impacts, developing and implementing mitigation measures, and informing consultations and public involvement.

Background: The Cook Inlet Planning Area and adjacent coastal areas encompass portions of three Alaska boroughs, Kenai Peninsula Borough (KPB), the Lake and Peninsula Borough, and the Kodiak Borough. Tourism and recreation are key sectors of the region's economy. Previously viewed as a mature industry with large positive impacts but modest or negative overall growth, it is now seen as a fast-growing sector as visitor's and resident's interests and local opportunities continue to grow and evolve (Kenai Peninsula Borough 2019). Much of the emerging recreation and tourism is taking place on public lands such as the Chugach National Forest, Kenai Fiords National Park, Katmai National Park and Preserve, the Kenai National Wildlife Refuge, and the Lake Clark National Park and Preserve.

The upper Cook Inlet area hosts a mature offshore energy sector in state waters. After a two-decade hiatus (no OCS lease sales were held from 1996 to 2017), recent industry interest and investment has focused on the state and OCS waters of the lower Cook Inlet. This renewed activity raised concerns for the potential effects of OCS development on the region's recreation and tourism sector, especially those ocean-dependent and ocean-enhanced activities. A few studies have been conducted on the effects of OCS development on recreation and tourism in Alaska, but these have been limited to specific sectors (e.g., Kenai Peninsula sportfishing) (Criddle, et al. 1998) or have focused on the effects of catastrophic events, such as the *Exxon Valdez* oil spill (Fall 2001). The baseline information in these studies needs to be updated to capture changes that have occurred to the sector in the last 20 years.

Research in the Atlantic (Parsons and Firestone 2018; Smythe et al. 2018.), Gulf of Mexico (Eastern Research Group, Inc. 2014), and Pacific Regions (Hoelting and Burkardt 2017) has led to new insights on how routine OCS conventional, renewable energy projects, and technological disasters in all OCS regions could affect recreation and tourism (Industrial Economics, Inc. 2014). Baseline information has routinely been developed on this sector in these areas. This information, including geographic information in the Marine Cadastre, has been important in marine spatial planning to prevent and reduce conflicts. Developing similar information for Alaska-specific conditions would contribute to comprehensive OCS-wide data on this sector.

Objectives:

- Establish a baseline of ocean-dependent and ocean-enhanced recreation and tourism activities, amenities, and associated expenditures (e.g., those that are dependent on or sensitive to coastal and marine resources).
- Identify the preferences that visitors and residents consider to be of value when making recreational choices and how these preferences might differ based on geographic location within the study area or between residents and non-residents.
- Document trends to better understand how the recreation and tourism industry has responded to Cook Inlet offshore energy infrastructure projects.
- Provide a framework for monitoring the spatial and temporal aspects of recreation and tourism.

Methods: BOEM anticipates a three-year study. In year one, researchers would assemble baseline data on the dimensions of ocean-dependent and ocean-enhanced recreation and tourism (i.e., activity, location, timing, level of participation, past expenditures) and the portion of recreation and tourism that would be sensitive to OCS activities. For year one, the synthesis of existing information and secondary data would be compiled using literature reviews, archival research, and examination of publicly available data. In years two and three, primary data would be collected using a combination of focus groups, surveys, interviews, and community workshops, which would require travel to hub cities and smaller communities; these methods would be used to measure current preferences, values, and expenditures of residents and visitors. Researchers would seek an Office of Management and Budget approval number for primary data collection efforts to comply with the Paperwork Reduction Act. Other methods could be adapted from studies in other regions (e.g., Garcia et al. 2012; Smythe et al. 2018).

Specific Research Question(s):

1. How could routine OCS activities and industrial accidents affect recreation and tourism in the Cook Inlet area?
2. What are the specific recreation and tourism resources, activities, and expenditures in the Cook Inlet area and when and where do these occur?
3. What measures could be used to monitor and mitigate effects to recreation and tourism?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

Criddle KR, Greenberg JA, Geier H, Hamel C, Herrmann M, Lee ST, Lewis CE. 1998. An economic assessment of the marine sport fisheries in lower Cook Inlet. In: University of Alaska Coastal Marine Institute Annual Report No.: 4. Report No.: OCS Study MMS 98–0062. p. 5–12.

Eastern Research Group, Inc. 2014. Assessing the impacts of the Deepwater Horizon oil spill on tourism in the Gulf of Mexico region. New Orleans (LA): U.S. Department of the Interior, Bureau of Ocean Energy Management. 192 p. Report No.: OCS Study BOEM 2014-661.

Fall JA, Miraglia R, Simeone W, Utermohle CJ, Wolfe RJ. 2001. Long-term consequences of the Exxon Valdez oil spill for coastal communities of southcentral Alaska. 350 p. Report No.: OCS Study MMS 2001-032.

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Hoelting K, Burkardt N. 2017. Human dimensions of climate change in coastal Oregon. 203 p. Report No.: OCS Study BOEM 2017-052.

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Parsons G, Firestone J. 2018. Atlantic offshore wind energy development: values and implications for recreation and tourism. 58 p. Report No.: OCS Study BOEM 2018-013.

Smythe T, Smith H, Moore A, Bidwell D, McCann J. 2018. Methodology for analyzing the effects of Block Island Wind Farm on Rhode Island recreation and tourism activities. 300 p. Report No.: OCS Study BOEM 2018-068.

Field	Study Information
Title	Pipeline Gas Release Frequency, Scenarios, and Impacts
Administered by	Alaska Regional Office
BOEM Contact(s)	TBD
Procurement Type(s)	TBD
Conducting Organization(s)	TBD
Total BOEM Cost	TBD
Performance Period	FY 2023–2025
Final Report Due	TBD
Date Revised	November 4, 2022
Problem	Information about pipeline gas release frequency and release scenarios is dispersed throughout peer reviewed and gray literature, and modeled scenarios specific to the Alaska Outer Continental Shelf (OCS) are unavailable. Impacts of natural gas releases to the environment are difficult to document or locate.
Intervention	This study will collate and synthesize existing technical information on U.S. onshore and offshore OCS pipeline gas releases and their impacts to the environment. This study would also model pipeline gas release scenarios relevant to the Alaska OCS using readily available software and models.
Comparison	The results will support gas release scenarios used in National Environmental Policy Act (NEPA) assessments by modeling gas release, ignition, and explosion frequencies, spatial footprint of hazards using Alaska OCS relevant data, and documented impacts to resources.
Outcome	The project will produce a synthesis report on historic onshore and offshore gas pipeline releases including documentation of impacts to the environment. This synthesis will include quantitative gas release information, such as release frequencies or explosion footprints derived from modeling, for use in gas release scenarios in Alaska OCS NEPA documents.
Context	All Alaska OCS areas

BOEM Information Need(s): Modeled gas pipeline release scenarios specific to the Alaska OCS are unavailable and impacts of natural gas are not well documented and consequently are difficult to locate in the literature. BOEM uses information about the general impacts of natural gas and natural gas release scenarios to estimate impacts in NEPA documents. Better information on natural gas impacts to the environment and quantitative scenario factors from gas pipeline release models will facilitate informed and refined NEPA analyses. Frequency estimates are not readily available in the literature. This study will use specific modeled pipeline gas releases relevant to the Alaska OCS to provide information on the frequency of U.S. onshore or offshore OCS pipeline gas releases caused by small or large-scale punctures, ruptures, ignition and/or explosions. Finally, this study will synthesize documented impacts to resources from natural gas releases for use in impact analyses.

Background: Natural gas pipelines are associated with potential hazards and risks that can lead to a natural gas pipeline failure. Major causal factors for pipeline failure, such as third-party digging, may differ substantially for the Alaska North Slope, where population density is unusually low. Estimates used for quantitative scenario elements, such as the hazard area, are difficult to generate without modeling. Serious impacts can occur from the release, dispersion, fire, and/or explosion of natural gas. Fire and ignition of a gas release can increase the impact area, as compared to dispersion. Depending upon the circumstances and conditions, the type of open fire may vary. For example, ignited releases can produce jet fires, vapor cloud fires, or fireballs (Shan et al. 2020). Models can be used with confidence to estimate the hazard distance or hazard area from a natural gas pipeline release.

The impacts of natural gas releases to the environment are not widely reported and are often located in incident reports produced by the regulatory agency. However, some information on the impacts of natural gas to resources is dispersed throughout the body of scientific and gray literature.

Objectives:

- Synthesize technical information on the frequency, spatial and temporal footprint, modeling, and consequences of historical natural gas pipeline releases.
- Estimate the frequency of occurrence of U.S. onshore and offshore OCS natural gas pipeline releases or ruptures using relevant historical information from the Department of Transportation, Pipeline and Hazardous Materials Safety Administration and the Bureau of Safety and Environmental Enforcement.
- Estimate the frequency of occurrence of onshore and offshore pipeline gas releases resulting in ignition, fire, and explosion for the Alaska North Slope and Cook Inlet region. Discuss causal factors that are similar to or different from the onshore and offshore continental U.S.
- Utilize specific pipeline release scenarios and a software system to model the behavior, dispersion, ignition, fire, and explosion of natural gas in order to quantify the spatial and temporal footprint of the hazard.

Methods: Researchers will collect existing U.S. onshore and offshore OCS pipeline natural gas release and impact information found in journal publications and gray literature reports produced by government, private sector, non-governmental, and academic entities, as well as information produced from regulatory agencies. Effort will focus on historical U.S. onshore and offshore OCS pipeline gas releases, ignition, or explosion frequency, and spatial and temporal footprints. Researchers will identify the best readily available model(s) to test specific parameters of U.S. onshore or offshore OCS pipeline natural gas release or rupture and subsequent fire and or explosion (e.g., MMS 2009; Stephens et al. 2002). Using three to six pipeline scenarios provided by BOEM, Alaska Regional Office the researchers will model specific input parameters. Products will include a technical summary reference for the frequency of onshore or offshore pipeline gas releases caused by small or large-scale punctures, ruptures, ignition and/or explosions, documented scenarios and quantitative parameters such as hazard area. Finally, this study will synthesize documented impacts to environmental, social, or economic resources from natural gas releases for use in impact analyses.

Specific Research Question(s):

1. What is the frequency of a natural gas pipeline release, and/or subsequent fire, and/or explosion?
2. Are there differences in frequencies between U.S. onshore and offshore OCS natural gas pipeline releases?
3. What modeled or calculated gas release parameters provide quantitative information to assess impacts from a natural gas release or rupture, ignition, and/or explosion from an onshore or offshore pipeline?
4. What are the documented impacts of natural gas releases or subsequent fire or explosion to resources?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References:

MMS [Prepared by S.L. Ross, Environmental Research Ltd., SINTEF and Wellflow Dynamics]. 2009. Assessing risk and modeling a sudden gas release due to gas pipeline ruptures. Herndon (VA): U.S. Department of the Interior, Marine Minerals Service. 93 p. https://www.bsee.gov/research-record/tap-607-assessing-risk-and-modeling-sudden-gas-release-due-gas-pipeline-ruptures.

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3.4.3 Potential Future Studies

The studies listed in Table 3 were identified as potential candidate projects for FY 2024. Further consideration and prioritization of these studies will be evaluated in the context of current information needs.

Table 3. BOEM Alaska Regional Office Studies to be Considered for FY 2024

Discipline	Study Title	Planning Area(s)
BIO	Linking Summer and Winter Foraging Areas to Diet and Annual Survival of Seabirds from Colonies in the Lower Cook Inlet Area	Cook Inlet
PO	Sea Ice Climatology within Cook Inlet, Alaska	Cook Inlet
	Discipline Codes	
	BIO = Biology PO = Physical Oceanography	

Field	Study Information
Title	Linking Summer and Winter Foraging Areas to Diet and Annual Survival of Seabirds from Colonies in the Lower Cook Inlet Area
Administered by	Alaska Regional Office
BOEM Contact(s)	TBD
Procurement Type(s)	TBD
Conducting Organization(s)	TBD
Total BOEM Cost	TBD
Performance Period	FY 2024–2028
Final Report Due	TBD
Date Revised	November 4, 2022
Problem	Seabird breeding populations in lower Cook Inlet (LCI) have declined dramatically since baseline studies in the 1990s, and reproductive success has been severely curtailed since the 2014-2016 North Pacific marine heat wave. Mechanisms of this decline and outlook for recovery are uncertain.
Intervention	Recent studies (2016-2021) have included population counts and estimates of breeding success, but basic ecological (diet composition, overwintering areas) and demographic (annual survival) parameters are required to better understand recent population changes or predict recovery potential, and future population status have not been measured.
Comparison	These fundamental parameters were measured in the 1990s when baseline data on seabird population ecology in LCI were gathered after the *Exxon Valdez* oil spill. Findings on current populations will be compared from those earlier studies.
Outcome	The rate of recovery of seabirds from the heatwave is unknown but could be modeled after a better understanding of foraging limitations and adult survival rates. This increased understanding would provide information on the status and trends of seabird populations to address future concerns about disturbance in LCI from oil and gas operations.
Context	Lower Cook Inlet

BOEM Information Need(s): Understanding natural and anthropogenic risks to seabirds in potential oil and gas lease areas has been a BOEM priority for decades, both to mitigate impacts of offshore oil development, drilling, and shipping, and to assess the impact of potential oil spills. Recent ecological events in the LCI region have altered the fundamental demography of seabird populations. The information collected in this study will update baseline data to support environmental analyses for future lease sales and exploration, development, and production activities in Cook Inlet and provide information to support an analysis of the potential cumulative effects of climate change and oil and gas activities.

Background: The USGS has been studying seabirds and forage fish in LCI intermittently since 1995, both before (1995-2001) and after (2016-2021) the prolonged marine heat wave of 2014-2016. In 2015-2016, as much as one-quarter of the common murre population in the Gulf of Alaska (GOA) and Bering Sea died from starvation, and they failed to produce offspring at multiple colonies throughout the North Pacific. Likewise, in LCI, poor food supplies led to population declines and breeding failures in both common murres and black-legged kittiwakes; effects have persisted into 2021. Impacts of the heatwave will continue to be felt for several more years—even if food supplies and productivity return to normal—because of the huge loss of recruitment from recent breeding failures. To date, there is no obvious explanation for all these aberrant observations, but its occurrence makes clear the need to track the recovery (or failure) of these populations and to research possible mechanisms of change. We hypothesize that poor foraging conditions, acute population declines, and multi-year recruitment failures have modified the age composition and future growth potential of current populations.

Objectives: This study will identify the mechanisms that may account for breeding failures, increased adult mortality, and failure to secure food, with the following specific objectives:

- Track post-breeding migration and identify overwinter foraging areas of adult murres and kittiwakes.
- Quantify diets of adult murres and kittiwakes.
- Assess adult survival in murres and kittiwakes.

Methods: To discover overwintering habitats, the post-breeding migration of kittiwakes and murres will be tracked with geolocator (GLT) tags before they leave their colonies. Researchers will recapture the birds when they return to the colony the following spring, and data stored on the tags will be downloaded. To quantify diets of adults and chicks, fecal DNA sampling will be conducted using next-generation sequencing (NGC) during the breeding season. This will eliminate lethal sampling that has been used historically and will provide more comprehensive prey information compared to bill-load and regurgitation sampling alone. To measure annual survival of kittiwakes and murres, traditional mark-recapture methods will be used. Adult breeding birds will be captured, marked, and re-sighted using a unique combination of colored plastic leg bands to determine “recapture” rates and estimate survival rates. At least 4-5 years of tagging and re-sighting effort are needed to obtain enough data to estimate annual survival with recapture models.

Specific Research Question(s):

1. What is the likelihood that seabirds can recover from the die-off and breeding failures?
2. Where are the important foraging areas for murres and kittiwakes during summer and winter?
3. How have diet composition, quality of prey, and adult survival changed since baseline studies were conducted in the 1990s?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites N/A

Environmental Studies Program: Alaska Annual Studies Plan FY 2023

Field	**Study Information**
Title	Sea Ice Climatology within Cook Inlet, Alaska
Administered by	Alaska Regional Office
BOEM Contact(s)	Caryn Smith (caryn.smith@boem.gov)
Procurement Type(s)	TBD
Conducting Organization(s)	TBD
Total BOEM Cost	TBD
Performance Period	FY 2024–2027
Final Report Due	TBD
Date Revised	November 4, 2022
Problem	Synthesized sea ice data for Cook Inlet is quite dated, and conditions have changed rapidly in recent years. Updated information about sea ice geographic coverage and duration is needed to validate coupled ice-ocean models used in BOEM's Oil Spill Risk Analysis (OSRA), improve tidal energy resource characterization for renewable energy applications, and to inform environmental reviews and decision-making on OCS activities.
Intervention	This study will analyze interpreted sea ice data (*e.g.*, National Weather Service [NWS] and the National Ice Center [NIC]) for Cook Inlet to produce improved estimates of sea ice geographic coverage over time. Remotely sensed imagery, observations, and contributions of physical forcing mechanisms will be evaluated to gain new insights into changes in sea ice.
Comparison	The results will document geographic coverage and changes in sea ice cover for almost a quarter of a century.
Outcome	The analysis will document the role of physical forcing mechanisms on sea ice areal coverage and duration, offer information for validation of coupled ice-ocean circulation and tidal resource characterization models, and improve understanding of the existing environment to support National Environmental Policy Act (NEPA) analyses.
Context	Cook Inlet Planning Area

BOEM Information Need(s): Improved modern understanding of changes in sea ice type, geographic extent, and persistence is needed to provide context for interpretation of changing ecosystem patterns and inform environmental reviews and decision-making regarding oil and gas exploration and development plans. In addition, BOEM needs updated information about sea ice, including the type and geographic extent of sea ice coverage over time, to validate coupled ice-ocean circulation models used to support OSRA and to evaluate tidal resource characterization for renewable energy.

Background: During winter, sea ice that forms in upper Cook Inlet and areas of lower Cook Inlet (Nelson and Whitney 1995, 1996) can substantially impact human activities (Parker and Jacobs 2018), the ecosystem (Laidre et al. 2017), and tidal resource characterization (Wang and Yang 2020). Ice types include pack ice, shorefast or beach ice, stamukhi (layered ice-cakes), and estuarine river ice. Ongoing environmental change in the subarctic has potentially altered the type, geographic coverage, and seasonality of the sea ice in and along the Cook Inlet coast. The sea ice geographic coverage along the Cook Inlet coast was last quantified bimonthly by Mulherin et al. (2001), but these data are more than two decades old. Understanding of the geographic coverage, shorefast ice persistence, and seasonality of sea ice is important for understanding the fate of spilled oil and for accurate tidal energy resource characterization. Sea ice persistence affects the fate of oil as sea ice acts as a barrier to oil penetrating the shoreline. Updated information is needed to facilitate modeling, planning, and decision making for either oil and gas or renewable energy and enable understanding of where sea ice occurs for oil and gas or renewable activities.

Objectives:

- Assess and document the sea ice type, geographic coverage, and persistence in Cook Inlet at a higher temporal resolution than historical studies and evaluate if it has changed over time.
- Evaluate how changes in sea ice relate to local and regional changes in physical parameters (e.g., temperature, pressure, freshwater influx or major storms), as well as to global climate shifts.

Methods: Researchers will compile a time-series of interpreted sea ice data (e.g., NWS Alaska Sea Ice Program and the NIC) for Cook Inlet from 2000 through 2022. Results will be analyzed to produce a climatology that includes, minimum, mean, median, and maximum sea ice geographic extent and to evaluate the changes in sea ice over time. Researchers will synthesize available historical observations and information on sea ice type in Cook Inlet. Researchers will document and conduct observations of the sea ice type, growth, and melt along a portion of the shoreline adjacent to the southcentral Alaska road system during one seasonal cycle. Researchers will compile a time series of physical parameters to evaluate any correlations between ice extent, ice type, and physical parameters.

Specific Research Question(s):

1. How has sea ice type, geographic extent, concentration, or persistence in Cook Inlet changed over time?
2. How has the sea ice in Cook Inlet been altered in recent decades and what can be inferred about ecosystem changes and oil and gas exploration and development or renewable energy activities in relation to these changes?
3. What is the best sea ice metric for use in OSRA model validation or accurate tidal energy resource characterization?

Current Status: N/A

Publications Completed: N/A

Affiliated WWW Sites: N/A

References:

Mulherin ND, Tucker WB III, Smith OP, Lee WJ. 2001. Marine ice atlas for Cook Inlet, Alaska. Hanover (NH): U.S. Army Engineer Research and Development Center Cold Regions Research and Engineering Laboratory. 155 p. Report No.: ERDC/CRREL Technical Report 01-10.

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Nelson WG, Whitney JW. 1996. A Description of Summer and Winter Environmental Conditions within Cook Inlet, Alaska. In Proceedings Western Regional Meeting, Anchorage, AK, May 22-24, 1996. Society of Petroleum Engineers. 14 p.

U.S. National Ice Center. 2022. Arctic ice products webpage: https://usicecenter.gov/Products/ArcticHome (Accessed February 3, 2022).

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Kendall JJ, Brooks JJ, Campbell C, Wedemeyer KL, Coon CC, Warren SE, Auad G, Thurston DK, Cluck RE, Mann FE, Randall SA, Storzer MA, Johnston DW, Meyer-Pietruszka D, Haller ML. 2017. Use of Traditional Knowledge by the United States Bureau of Ocean Energy Management to Support Resource Management. Czech Polar Reports. 7(2): 151-163.

Mathis J and Cross J. 2014. Biogeochemical assessment of the OCS Arctic Waters: Current Status and Vulnerability to Climate Change. University of Alaska Coastal Marine Institute, Fairbanks, Alaska. OCS Study BOEM2014-668. 319 pp.

USDOI, BOEM, ESP. 2020. Environmental Studies Program Strategic Framework. Sterling, Virginia.

USDOI, BOEM, ESP. 2022. BOEM Studies Development Plan 2023-2024. Sterling, Virginia.

APPENDIX 1: RECENT OCS STUDY REPORTS: 2018—2022

These and all Alaska study reports can be found at https://www.boem.gov/AKpubs.

OCS Study #	Title
BOEM 2022-057	Hydrocarbon Seeps in the Lower Cook Inlet, Gulf of Alaska, Chukchi Sea and Beaufort Sea OCS Planning Areas
BOEM 2022-027	Bureau of Ocean Energy Management Environmental Studies Program Alaska Outer Continental Shelf Bibliography 1990–2021
BOEM 2022-013	Oil-Spill Occurrence Estimators: Storm and Vessel Traffic Adjustment Factor Analyses
BOEM 2022-009	Comprehensive Synthesis of Effects of Oil and Gas Activities on Marine Mammals on the Alaska Outer Continental Shelf, Volume 1 | Volume 2 | Appendices | Annotated Bibliography
BOEM 2021-067	Ocean Migration and Behavior of Steelhead Kelts in Alaskan OCS Oil and Gas Lease Areas, Examined with Satellite Telemetry
BOEM 2021-056	Model-based Fish Distributions and Habitat Descriptions for Arctic Cod (*Boreogadus saida*), Saffron Cod (*Eleginus gracilis*) and Snow Crab (*Chionoecetes opilio*) in the Alaskan Arctic
BOEM 2021-055	Yakutat Wave Energy Converter Impact Assessment
BOEM 2021-050	Community Based Monitoring in Arctic and Cook Inlet Coastal Zones: Extension of the Local Environmental Observer (LEO) Network
BOEM 2021-048	Oil Spill Effects Literature Study of Spills of 500–20,000 Barrels of Crude Oil, Condensate, or Diesel
BOEM 2021-031	Monitoring the Recovery of Seabirds and Forage Fish Following a Major Ecosystem Disruption in Lower Cook Inlet
BOEM 2021-019	Measuring Wave Forces Along Alaska's Coastal Sea Ice
BOEM 2021-018	High Frequency characterization of the physicochemical parameters of cook Inlet, Alaska
BOEM 2021-017	Initiating an Arctic Marine Biodiversity Observing Network (AMBON)
BOEM 2020-063	Graduate Student Projects -Volume 4: Life Without Ice: Climate Change and the Subsistence Communities of St. Lawrence Island
BOEM 2020-051	Oil Spill Occurrence Rates for Cook Inlet, Alaska Oil and Gas Exploration, Development, and Production

BOEM 2020-050	Oil Spill Occurrence Rates from Alaska North Slope Oil and Gas Exploration, Development and Production
BOEM 2020-033	Microbial Biodegradation of Alaska North Slope Crude Oil and Corexit 9500 in the Arctic Marine Environment
BOEM 2020-029	Marine Arctic Ecosystem Study (MARES): Moorings on the Beaufort Sea Shelf (2016–2018) and Program Synthesis
BOEM 2020-027	Distribution and Relative Abundance of Marine Mammals in the Eastern Chukchi Sea, Eastern and Western Beaufort Sea, and Amundsen Gulf, 2019 Annual Report
BOEM 2020-001	Beaufort Sea: Hypothetical Very Large Oil Spill and Gas Release
BOEM 2019-021	Distribution and Relative Abundance of Marine Mammals in the Eastern Chukchi and Western Beaufort Seas, 2018 Annual Report
BOEM 2019-079	Ice Seal Movements and Foraging: Village-Based Satellite Tracking and Collection of Traditional Ecological Knowledge Regarding Ringed and Bearded Seals
BOEM 2019-078	Nearshore Food Web Structure on the OCS in Cook Inlet
BOEM 2019-076	Satellite Tracking of Bowhead Whales Habitat Use, Passive Acoustics and Environmental Monitoring
BOEM 2019-075	Assessment of nearshore communities and habitats: Lower Cook Inlet Nearshore Ecosystem 2015-2018
BOEM 2019-067	CMI Graduate Student Projects Volume 3: The Influence of Water Flow, Water Conditions, and Seasonality on Fish Communities in Estuarine Nearshore Habitats in Kachemak Bay, Alaska; Identifying Hatch Dates and Potential Hatch Location of Arctic Cod (*Boreogadus saida*) through Otolith Analysis
BOEM 2019-059	Estimation of abundance and demographic rates of Pacific walruses using a genetics-based mark-recapture approach
BOEM 2019-053	ANIMIDA III Boulder Patch and Other Kelp Communities in Development Area
BOEM 2019-032	Arctic Aerial Calibration Experiments (Arctic ACEs): Comparing Manned Aerial Surveys to Unmanned Aerial Surveys for Cetacean Monitoring in the Arctic
BOEM 2019-031	Coastal Community Vulnerability Index and Visualizations of Change in Cook Inlet, Alaska
BOEM 2019-030	Identifying sources of organic matter to benthic organisms in the Beaufort and Chukchi outer continental shelves

BOEM 2019-024	Chukchi Sea Acoustics, Oceanography, and Zooplankton Study: Hanna Shoal Extension (CHAOZ-X) and Arctic Whale Ecology Study (ARCWEST) Supplemental Report
BOEM 2019-009	Marine ARctic Ecosystem Study (MARES): Moorings on the Beaufort Sea shelf, 2016-2017
BOEM 2019-006	Oil Spill Preparedness, Prevention, and Response on the Alaska OCS
BOEM 2019-005	Coastal Marine Institute (CMI) Annual Report 25: Calendar Year 2018
BOEM 2018-064	University of Alaska Coastal Marine Institute, Program Administration 2013-2017
BOEM 2018-059	Migration Trends for King and Common Eiders and Yellow-billed Loons past Point Barrow in a Rapidly Changing Environment
BOEM 2018-058	CMI Graduate Student Projects: Volume 2: Functional Diversity of Epibenthic Communities on the Chukchi and Beaufort Sea Shelves; Using Trace Elements in Pacific Walrus Teeth to Track the Impacts of Petroleum Production in the Alaskan Arctic
BOEM 2018-048	Oil-Spill Occurrence Estimators: Fault Tree Analysis for One or More Potential Future Beaufort Sea OCS Lease Sales
BOEM 2018-037	ShoreZone Imaging and Mapping along the Alaska Peninsula
BOEM 2018-036	Fate and Persistence of Oil Spill Response Chemicals in Arctic Seawater
BOEM 2018-032	US Outer Continental Shelf Oil Spill Causal Factors Report (2018)
BOEM 2018-027	Northern Alaska Sea Ice Project Jukebox: Phase III
BOEM 2018-024	Marine Arctic Ecosystem Study—Biophysical and Chemical Observations From Glider and Benthic Surveys in 2016
BOEM 2018-023	Distribution and Relative Abundance of Marine Mammals in the Eastern Chukchi and Western Beaufort Seas, 2017 Annual Report
BOEM 2018-022	Arctic Whale Ecology Study (ARCWEST): Use of the Chukchi Sea by Endangered Baleen and Other Whales (Westward Extension of the BOWFEST)
BOEM 2018-021	CMI Graduate Student Projects: Characterizing Bacterial Communities in Beaufort Sea Sediments in a Changing Arctic; Chukchi-Beaufort Seas Storms and Their Influence on Surface Climate; Using Genotyping-by-Sequencing (GBS) Population Genetics Approaches to Determine the Population Structure of Tanner Crab (*Chionoecetes bairdi*) in Alaska
BOEM 2018-020	Arctic Air Quality Impact Assessment Modeling Study: Final Project Report

BOEM 2018-018	Development of a Very High-Resolution Regional Circulation Model of Beaufort Sea Nearshore Areas
BOEM 2018-017	Synthesis of Arctic Research (SOAR): Physics to Marine Mammals in the Pacific Arctic
BOEM 2018-016	Development of an Autonomous Carbon Glider to Monitor Sea-Air CO2 Fluxes in the Chukchi Sea
BOEM 2018-011	Annual Report 24 Calendar Year 2017
BOEM 2018-008	Chukchi Sea Acoustics, Oceanography, and Zooplankton Study: Hanna Shoal Extension (CHAOZ-X)
BOEM 2018-007	Technical Manual for a Coupled Sea-Ice/Ocean Circulation Model (Version 5)
BOEM 2018-006	US Outer Continental Shelf Oil Spill Statistics

APPENDIX 2: RECENT PUBLICATIONS FROM ALASKA STUDIES: 2018—2022

2022

Beatty WS, Lemons PR, Everett JP, Lewis CJ, Taylor RL, Lynn RJ, Sethi SA, Quakenbush L, Citta JJ, Kissling ML. 2022. Estimating Pacific walrus abundance and survival with multievent mark-recapture models. Marine Ecology Progress Series. 697:167-182.

BurnSilver S, Coleman JM, Magdanz J. 2022. Equality and equity in Arctic communities: how household-level social relations support community-level social resilience. Ecology and Society. 27(3):31

Clark CT, Horstmann L, de Vernal A, Jensen AM, Misarti N. 2022. Pacific walrus diet across 4000 years of changing sea ice conditions. Quaternary Research. 108:26-42.

Clarke JT, Ferguson MC, Okkonen SR, A. BA, Willoughby AL. 2022. Bowhead whale calf detections in the western Beaufort Sea during the open water season, 2012–2019. Arctic Science. 8(2):531-548.

Courtney M, Miller EA, Boustany AM, Van Houtan KS, Catterson MR, Paluk J, Nichols J, Seitz AC. 2022. Ocean migration and behavior of steelhead Oncorhynchus mykiss kelts from the Situk River, Alaska. Environmental Biology of Fishes. 105:1081-1097.

Danielson SL, J.M. Grebmeier, K. Iken, C. Berchok, L. Britt, K.H. Dunton, L. Eisner, E.V. Farley, A. Fujiwara, D.D.W. Hauser, et al. 2022. Monitoring Alaskan Arctic shelf ecosystems through collaborative observation networks. Oceanography. 35(3-4). First published online April 28, 2022

Dunmall K, McNicholl D, Zimmerman CE, Gilk-Baumer SE, Burril S, von Biela VR. 2022. First juvenile Chum salmon confirms successful reproduction for Pacific salmon in the North American Arctic. Canadian Journal of Fisheries and Aquatic Sciences. 79(5):703-707.

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