

## Environmental Studies Program: Ongoing Study

Field	Study Information
Title	A Sustainable, Integrated AMBON in the U.S. Arctic (NT-20-10)
Administered by	Alaska Regional Office
BOEM Contact(s)	Dr. Christina Bonsell ( <a href="mailto:christina.bonsell@boem.gov">christina.bonsell@boem.gov</a> )
Procurement Type(s)	Interagency Agreement
Conducting Organization(s)	NOAA
Total BOEM Cost	\$508,000 plus Joint NOPP Funding (~\$1,036,000)
Performance Period	FY 2020–2024
Final Report Due	February 2024
Date Revised	September 28, 2023
Problem	The Arctic has ongoing and prospective energy activities, coupled with natural environmental variability that may disrupt ecosystem function and services. A cost-effective system is needed to determine the type and magnitude of these impacts and the resiliency of the ecosystem to change.
Intervention	Long-term studies that monitor marine ecosystems are necessary to distinguish between changes caused by natural processes and those caused by human activities. Researchers will leverage existing datasets and build upon previous work to select and assess indicator species from microbes to whales at scales appropriate for impact analysis.
Comparison	Potential effects will be identified by integrating and synthesizing past and ongoing research programs in the Chukchi and Beaufort Seas to assess natural variability and provide a backdrop to assess impacts from development. The range and patterns of natural variability, and relationships to environmental drivers can only be discerned from long term data collection.
Outcome	Study products will assist the Bureau of Ocean Energy Management (BOEM) in performing NEPA impact analyses and address stakeholders' concerns about potential ecosystem consequences from offshore energy development and natural resiliency during great environmental change.
Context	Chukchi and Beaufort Seas

**BOEM Information Need(s):** BOEM needs a more rigorous yet efficient monitoring system to improve information about the health of biodiversity in the Chukchi Sea as a means to enhance environmental impact assessments and develop better metrics for cumulative impact analysis. A systematic and comprehensive methodology is needed to collect biodiversity measures for the marine environment.

**Background:** Biological diversity is defined as the variety of life, encompassing variation at all levels of complexity – genetic, species, ecosystems, and biomes – and including functional diversity and diversity across ecosystems. A growing body of research demonstrates that: (1) the maintenance of marine biodiversity (including coastal biodiversity) is critical to sustained ecosystem and human health and to

resilience in a globally changing environment; and (2) the condition of marine biodiversity offers a proxy for the status of ocean and coastal ecosystem health and the ability to provide ecosystem services. Thus, managing our marine resources in a way that conserves existing marine biodiversity would help address other ocean management objectives. For example, it would provide information to enhance management against threats such as invasive species and infectious agents, enable predictive modeling, better inform decision-making, and allow for adaptive monitoring and Ecosystem-Based Management.

This study expands upon the pilot national Marine Biodiversity Observing Network (MBON), including the Arctic MBON (AMBON) project in the Chukchi Sea, extending it into the Beaufort Sea. AMBON also links to the Distributed Biological Observatory (DBO), which coordinates long-term monitoring of biologically productive regions across a broad latitudinal array in the Arctic. AMBON began as 5-year research partnership (2015-2020) between university and Federal investigators that integrated with the Alaska Ocean Observing System (AOOS) as the central data node to provide a publicly accessible and user-friendly database. AMBON continues through this study which is funded through the National Ocean Partnership Program, with contributions from the National Oceanographic and Atmospheric Administration (NOAA), BOEM, the United States Office of Naval Research (ONR), and the National Aeronautics and Space Administration (NASA). AMBON is primarily focused on the continental shelf in the Chukchi Sea, with linkages to other Arctic waters. Through these partnerships, AMBON will make biodiversity data available to a broad audience of users and stakeholders, from local to pan-Arctic to global.

Assessments of possible adverse risk from OCS energy development often focus on differentiating human-induced effects from natural variability. Given the complexity of marine ecosystems and the possible effects of global climate change, this often requires making observations over large ocean areas, seasonally, and over multiple years and even decades to acquire reasonable statistical confidence.

Objectives: This project continues to build upon the principal objectives and lessons learned from the first 5-year AMBON effort but builds to achieve a sustainable approach to biodiversity monitoring across ecosystem components in the Arctic Ocean.

- Continue taxonomic and spatial coverage of a ‘microbes to whales’ approach of biodiversity observations on the Chukchi shelf.
- Integrate ecosystem level biodiversity information across existing field programs.
- Build a sustainable biodiversity monitoring network across all ecosystem components.

Methods: Researchers will coordinate goals across AMBON components and with collaborating projects through workshops, review of historical information, database planning, and data agreements. The field campaign collects ecosystem level biodiversity information across two existing programs: 1) the *Chukchi Ecosystem Observatory (CEO)*, which provides year-round environmental and biological observations including a moored water sampler that will collect year-round eDNA samples, a sediment trap to sample phytoplankton, and passive acoustics to observe vocalizing marine mammal presence; and 2) the Distributed Biological Observatory (DBO) – *Northern Chukchi Integrated Study (NCIS)*, including adding two emerging essential ocean variables: (EOVs) microbes (through eDNA collections) and epibenthic invertebrates, together with fish and seabird collections. Researchers will conduct data reviews and collaborations across these and other research projects to link biodiversity observations across time and space to populate national MBON Portal and other targeted databases and establish a sustainable biodiversity monitoring network.

Specific Research Question(s): What are the regional patterns of biodiversity on the Alaska Arctic shelves, how do they influence ecosystem complexity and function, and how do they inform energy resource management?

Current Status: Ongoing, sample and data analysis in progress. Results shared in reports, conference presentations, and peer-reviewed journals.

#### Publications Completed:

Chapman ZM, Mueter FJ, Norcross BL, Oxman DS. 2023. Arctic cod (*Boreogadus saida*) hatching season and growth rates in the Bering, Chukchi and Beaufort seas. Deep-Sea Research II. <https://doi.org/10.1016/j.dsr2.2022.105226>.

Chavez FP, Miller RJ, Muller-Karger FE, Iken K, Canonico G, Egan K, Price J, Turner W. 2021. MBON—Marine Biodiversity Observation Network: An observing system for life in the sea. Oceanography 34(2):12–15. <https://doi.org/10.5670/oceanog.2021.211>.

Cooper LW, Grebmeier JM. 2022. A chlorophyll biomass time-series for the Distributed Biological Observatory in the context of seasonal sea ice declines in the Pacific Arctic region. Geosciences, 12(8):307.

Danielson SL, Grebmeier JM, Iken K, Berchok C, Britt L, Dunton KH, Eisner L, Farley E, Fujiwara A, Hauser, et al. 2022. Monitoring Alaskan Arctic shelf ecosystems through collaborative observation networks. Oceanography 35(3–4):198–209. <https://doi.org/10.5670/oceanog.2022.119>.

Gall AE, Prichard AK, Kuletz KJ, Danielson SL. 2022. Influence of water masses on the summer structure of the seabird community in the northeastern Chukchi Sea. PLoS ONE 17(4): e0266182. <https://doi.org/10.1371/journal.pone.0266182>.

Labunski EA, Kuletz KJ, Lanctot R, Saalfeld S, Morgan TC, McGuire RL, Gall AE. 2022. Marine bird distribution and abundance in the Northern Bering and Chukchi Seas: Final Report. Anchorage (AK): U.S. Department of the Interior, Bureau of Ocean Energy Management. 175 p. Report No.: OCS Study BOEM 2022-067.

Mueter FJ, Iken K, Cooper LW, Grebmeier JM, Kuletz KJ, Hopcroft RR, Danielson SL, Collins RE, Cushing D. 2021. Changes in diversity and species composition across multiple assemblages in the northeast Chukchi Sea during two contrasting years are consistent with borealization. Oceanography 34(2):38–51. <https://doi.org/10.5670/oceanog.2021.213>.

#### Affiliated WWW Sites:

<http://www.boem.gov/akstudies/>

<http://ambon-us.org/>

<https://marinebon.org/pages/ambon/>