

Environmental Studies Program: Ongoing Studies

Study Area(s): Beaufort Sea

Administered By: Alaska OCS Region

Title: Characterizing Bacterial Communities in Beaufort Sea Sediments in a Changing Arctic (AK-13-03-19)

BOEM Information Need(s) to be Addressed: This study will characterize sediment bacteria in and around oil and gas lease areas on the Beaufort Sea OCS. Applied next-generation DNA sequencing (NGS) will be used to determine bacterial biogeochemical functions to forecast ecosystem functions in benthic communities in response to a changing Arctic. This information will support NEPA analyses and documentation for potential future lease sales, EPs, and DPPs.

Total BOEM Cost: \$25,000
plus Joint Funding (\$25,000)

Period of Performance: FY 2016-2018

Conducting Organization: CMI, UAF

Principal Investigator(s): Alexis Walker

BOEM Contact: [Rick Raymond](#)

Description:

Background: Benthic bacteria play an integral role in nutrient cycling and organic matter (OM) degradation in marine sediments. In the Arctic, changing climate conditions have reduced sea ice cover resulting in shifts in marine primary productivity patterns, which affects the quality of OM deposited to the seafloor. Bacterial diversity and community composition can reflect local biogeochemical processes, exposure to contaminants, and nutrients/OM availability to the benthic food web. Bacteria can also indicate the presence of contaminants such as heavy metals and hydrocarbon in crude oil in the environment. Some bacterial genera are known obligate oil-degraders and can “bloom” following oil exposure and rapidly breakdown chemical components of oil *in situ*. Establishing the presence and distribution of known oil-degrading taxa and associated community diversity can provide valuable insights into how microbial communities respond to oil exposure in a given location.

Providing links between bacterial community composition and community function is a growing area of research aimed at identifying ecologically significant bacterial groups. Arctic benthic bacterial communities have only been explored in a few studies, primarily conducted in Greenland and Norwegian deep-sea sediments. Preliminary analysis of benthic bacterial communities from a limited subset of sites in the western Beaufort Sea supports predictions that these communities will reflect the heterogeneity of this system. These data are expected to provide high but varying levels of diversity, indicating that the majority of benthic bacterial diversity in Beaufort Sea sediments has yet to be discovered.

Objectives:

- Assess the diversity and community structure of sediment bacteria at 70 locations distributed across the Beaufort Sea continental shelf and slope, including locations in the vicinity of the oil and gas lease sale areas.
- Examine correlations between environmental parameters and corresponding bacterial diversity and community composition.

Methods: 16S ribosomal (rRNA) marker gene surveys will be conducted on sediments according to published protocols to assess the diversity and community structure of bacterial populations in the Beaufort Sea benthos. Samples will be sequenced from total genomic DNA extracted from sediment samples. Primers from the Earth Microbiome standard protocol will be used to amplify the V4 region of the 16S rRNA gene. Operational Taxonomic Units (OTUs) will be used to characterize bacterial assemblages at each study site and provide estimates of species richness and relative abundance. Sequence data will be analyzed using the QIIME toolkit with associated taxonomic identification matched against the Green Genes 16S reference database. Patterns in community structure among locations will be examined by evaluating the species matrix based on OTU data in standard morphological species matrices using multivariate statistics. Relationships between community structure and environmental parameters will be evaluated using Bray-Curtis Distances with Canonical Correspondence Analysis (CCA) and non-metric multidimensional scaling (nMDS).

Current Status: Completed

Final Report Due: May 2018

Publications Completed:

Walker, A. 2018. Characterizing Bacterial Communities in Beaufort Sea Sediments in a Changing Arctic. In: CMI Graduate Student Projects: Volume 1. University of Alaska Coastal Marine Institute, Fairbanks, Alaska. OCS Study BOEM 2018-021.

Affiliated WWW Sites: <http://www.boem.gov/akstudies/>
<http://www.cfos.uaf.edu/cmi/>
<https://marinecadastre.gov/epis/#/search/study/100135>

Revised Date: August 8, 2018