

Environmental Studies Program: Ongoing Studies

Study Area(s): Beaufort Sea, Chukchi Sea

Administered By: Alaska OCS Region

Title: Functional Diversity of Epibenthic Communities on the Chukchi and Beaufort Sea Shelves (AK-13-03-27)

BOEM Information Need(s) to be Addressed: This study will evaluate the functions lower trophic epibenthic organisms have within overall ecosystem processes to better understand the way these Arctic ecosystem operate. Potential disturbance from oil and gas activities to these processes could be identified through changes in the biological trait composition of benthic communities. BOEM NEPA analysts evaluate the potential effects of oil and gas lease sales and the cumulative effects of human activities in areas that may be impacted by OCS oil and gas exploration, development, and production activities. A better understanding of how the lower trophic communities contribute to the local ecosystem will support analysts evaluating potential impacts of development that may cascade through the lower and upper trophic ecosystem. This will directly contribute to implementing BOEM's mission of risk assessment and development of management strategies. Baseline data collected will also facilitate future environmental effects monitoring at Liberty and other potential oil and gas developments on the OCS.

Total BOEM Cost: \$23,548
plus Joint Funding (\$23,548)

Period of Performance: FY 2017-2018

Conducting Organization: CMI, UAF

Principal Investigator(s): Lauren Sutton

BOEM Contact: [Lorena Edenfield](#)

Description:

Background: Functional diversity encompasses the role of species within a community through redundancy and similarities of shared traits. For example, high functional redundancy, where many species of a community share similar biological traits, leads to high ecosystem stability and increased resilience because a specific community function would still be maintained even if one species were to disappear due to a disturbance. In contrast, a taxonomy-based community analysis would show the change in species composition, but would not indicate how this change relates to overall ecosystem functioning.

Biological trait analysis (BTA) assesses functional diversity by assigning biological traits to species based on their life history, morphology and behavior, thus identifying their function and role in a specific environment. Functional diversity includes traits related to morphology (body form, fragility, colonial/solitary), behavior (mobility, adult movement, feeding habit, trophic level, bioturbation, depth range), and life history (size,

weight, adult age, reproductive strategy, larval development size). Each trait is further separated into modalities. For example, the feeding habit trait is separated into six modalities: surface deposit feeder, subsurface deposit feeder, suspension feeder, scavenger, predator, and parasite.

Benthic communities are especially suitable for this purpose because they integrate processes over time spans of months to years and are thus excellent indicators of longer-term impacts.

Objectives:

- Establish an epibenthic biological trait analysis (BTA) benchmark of ecosystem functioning for the Beaufort Sea and Chukchi Sea shelf systems
- Compare the functional diversity of the Beaufort Sea and Chukchi Sea shelf communities using biological trait analysis.

Methods: Researchers will select epibenthic invertebrates collected in 10 to 60 meter water depths during previous and ongoing BOEM field studies. A combination of measurable biological traits (e.g., weight, body size, body form) and traits derived from extensive literature research (e.g., life history information, feeding type) will be used to create a database of biological traits from vouchers as well as specimen photographs. Each species' affinity to one or more of the 6 'modalities' (scavenger, predator, etc.) will be evaluated using a multivariate linear ordination method called fuzzy coding analysis. Researchers will calculate modalities over all taxa at each station and compare biological traits between stations along both the Beaufort Sea and Chukchi Sea shelves.

Current Status: Completed

Final Report Due: September 30, 2018

Publications Completed:

Sutton, L. 2018. Functional Diversity of Epibenthic Communities on the Chukchi and Beaufort Sea Shelves, *in* CMI Graduate Student Projects: Volume 2, B. Konar (Ed.). Final Reports, OCS Study BOEM 2018-058, University of Alaska Coastal Marine Institute and USDO, BOEM Alaska OCS Region.

Affiliated WWW Sites: <http://www.boem.gov/akstudies/>
<http://www.cfos.uaf.edu/cmi/>
<https://www.boem.gov/BOEM-2018-058/>

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