

Environmental Studies Program: Ongoing Study

Field	Study Information
Title	Impacts of Sedimentation and Drivers of Variability in the Boulder Patch Community, Beaufort Sea (AK-19-01)
Administered by	Alaska Regional Office
BOEM Contact(s)	Dr. Christina Bonsell (christina.bonsell@boem.gov)
Procurement Type(s)	Cooperative Agreement
Conducting Organization(s)	University of Texas at Austin, University of Alaska Fairbanks
Total BOEM Cost	\$750,000
Performance Period	FY 2019–2024
Final Report Due	September 2024
Date Revised	February 15, 2023
Problem	The Boulder Patch provides complex and unique habitat and supports high biodiversity in an area of considerable oil and gas interest, which includes the proposed construction of Liberty Island (less than half a mile away). Impacts of industry activity may smother/bury/kill productive biological area, but mitigation measures may be possible.
Intervention	This study will conduct a monitoring program to examine long-term drivers of community variability that could be altered during Liberty development activities. In addition, it will test possible mitigation measures using common industry materials to “reseed” or replace habitat lost due to Liberty Island development activities.
Comparison	The community structure will be documented to allow for future comparison against post-development data to assess impacts of oil and gas activity. Further, experimentally-placed boulders will be compared to buried boulders to test efficacy of artificial reefs to mitigate development impacts.
Outcome	Results will include defined spatial gradients and temporal trends in environmental conditions, benthic community structure, and kelp production in the Boulder Patch community; evaluation of the effect of sediments on Boulder Patch community; and assessment of artificial reefs as possible habitat mitigation.
Context	Beaufort Sea Planning Area

BOEM Information Need(s): Impacts to the Boulder Patch from proposed gravel island construction were identified by local communities as a concern during scoping for Liberty Island. Information about how Boulder Patch organisms may be affected by development activities and other disturbances will inform potential future NEPA and EFH analyses for island construction in the Beaufort Sea. Potential mitigation measures will be explored and may be incorporated in future analyses.

Background: The Boulder Patch, which is located close to the proposed Liberty Development Project (less than a half a mile away), is an area of hard bottom substrate uncommon to the region. Its high biodiversity supports tightly linked food webs, and connects to higher trophic levels such as fishes, seals, and polar bears. It is highly vulnerable to both natural and anthropogenic disturbances. Spatial isolation of boulder fields and slow development of benthic communities can limit ecosystem recovery from disturbances. Previous BOEM-sponsored studies have shown that recovery in this area from disturbances can take a decade or more to resolve (Konar 2007 and 2013). Resiliency to anthropogenic disturbances is unknown, yet critically important to understand in maintaining ecological integrity. Sediment collecting on the hard-bottom rocky habitat could slow community recovery even more through burial and smothering rather than whole organism removal, since the hard-substrate would no longer be available to colonizers. This proposed study builds on previous work and provides an opportunity to assess possible ecological effects of environmental disturbances before and during the construction of a gravel island. This study provides invaluable information about impacts of gravel island construction on complex, specialized habitat and will assess potential mitigation measures.

Objectives:

- Define spatial gradients and temporal trends in environmental conditions, benthic community structure, and kelp production in the Boulder Patch community
- Evaluate the potential effect of sediments and nearby island construction on the Boulder Patch community
- Test artificial rock reefs as possible habitat mitigation.

Methods: Monitoring of Boulder Patch habitat will occur before and possibly during Liberty Island construction. Biological and physical data collected will include: kelp production, salinity, depth, temperature, pH, irradiance, turbidity, fish and invertebrate presence, and stable isotopic trophic structure. Colonization substrates using typical island materials (Atigun Pass rocks) will be assessed and compared to existing Boulder Patch habitat. Recolonization will be assessed from settling plate experiments and reciprocal transplant manipulations of cobbles.

Specific Research Question(s):

1. What physical and chemical factors affect spatial distribution and abundance of kelp in the Boulder Patch?
2. What are the production and community composition responses of kelp in the Boulder Patch to year-round variations in light availability and oceanographic conditions?
3. How do invertebrate and fish use of under ice habitat in the Boulder Patch vary over time?
4. What is the effect of sedimentation on resilience and the abundance and distribution of Boulder Patch biota under winter and summer conditions?
5. What are potential mitigation and monitoring methods, such as replacement or substitute substrates, to minimize loss of Boulder Patch habitat?

Current Status: Ongoing, fieldwork underway.

Publications Completed: None

Affiliated WWW Sites: <http://www.boem.gov/akstudies/>

References:

- Konar, B., 2007. Recolonization of a high latitude hard-bottom nearshore community. *Polar Biology* 30.5: 663-667.
- Konar, B., 2013. Lack of recovery from disturbance in high-arctic boulder communities. *Polar Biology* 36.8: 1205-1214.