ACCESS NUMBER: M11AC00002

STUDY TITLE: Epifaunal communities in the central Beaufort Sea

REPORT TITLE: Epibenthic Community Variability on the Alaskan Beaufort Sea Continental Shelf

CONTRACT NUMBER(S): M11AC00002 (Report BOEM 2013-01148)
SPONSORING OCS REGION: Alaska
APPLICABLE PLANNING AREA(S): Alaska OCS, Chukchi and Beaufort Seas
FISCAL YEAR(S) OF PROJECT FUNDING:
COMPLETION DATE OF REPORT:
COST(S): FY 2011:
CUMULATIVE PROJECT COST:
PROJECT MANAGER(S): Brenda Konar
AFFILIATION (of project manager): University of Alaska Fairbanks
ADDRESS: School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Fairbanks, AK 99775-7220
PRINCIPAL INVESTIGATOR(S)*: Brenda Konar
KEY WORDS: Alaskan Beaufort Sea, Epibenthos, Invertebrates, Community Composition

BACKGROUND: There is a growing need to increase our understanding of the species composition, abundance and biomass across the Alaskan Beaufort Sea shelf. This stems from a severe lack of existing knowledge of epibenthic communities in this area, the biological importance of the epibenthos to Arctic shelf systems, the rapid environmental changes that are occurring across the Arctic, and the increase in economic interest in this region. This project was designed to help fill existing gaps regarding the epibenthic community of the Alaskan Beaufort Sea shelf and offer a base for future studies in this region.

Primary Hypotheses Tested:
Hypothesis 1: The Alaskan Beaufort Sea shelf epibenthic communities are distributed across a depth gradient and are dominated by distinct taxonomic groups.
Hypothesis 2: A select group of environmental parameters and their variability influences the epibenthic community distribution.

DESCRIPTION: In August 2011, epibenthic species composition, abundance and biomass were collected at 71 stations on the Alaskan Beaufort Sea shelf using epibenthic trawls. Stations extended from 70.45° N and 145.09° W to 71.66°N and 155.25°W and ranged in water depth from 10 to 220 m. In addition to the biology, environmental data (depth, position, bottom water temperature, salinity, pH, chlorophyll and phaeopigments, sediment grain size, sediment chlorophyll *a* and sediment organic matter, total organic carbon, total organic nitrogen and carbon/nitrogen ratios) were collected at each station. Two gear types were used, a plum staff beam trawl (PSBT) and a modified version of the former (PSBT-A). A gear comparison was done at five opportunistically chosen stations to determine the variability in the performance of the two gear types. In addition to the gear comparison, we opportunistically resampled six stations no more than five days apart using the PSBT-A to determine the variability in samples collected at the same site. Biological data were analyzed to determine distribution and dominance of taxa across the study area. Environmental data were correlated with the biological data to determine possible drivers in epibenthic community structure.

SIGNIFICANT CONCLUSIONS: The dominance of taxa throughout the Beaufort Sea shelf varies longitudinally and throughout the depth gradients. Shallow stations were impoverished in abundance, biomass and diversity. These stations were dominated by highly mobile scavenger crustaceans. This reflects well the many environmental stressors that affect this area, such as ice scouring, high terrigenous sedimentation rates and predation by marine birds and mammals. Mid-depth stations had the highest diversity indices and were dominated by echinoderms, crustaceans, molluscs and cnidarians. These stations also had intermediate percentages of mud sand and gravel. This heterogeneous substrate could be responsible in part for this higher diversity. Deep stations had intermediate diversity values and were represented mostly by echinoderms. Reflecting the importance of the water advected through Barrow

Canyon, along the shelf slope, there was a decrease in abundance and biomass moving away from Barrow Canyon. However, an area of high abundance, comparable to the abundance of the western mid- and deep stations, exists at the far eastern mid-depth stations. This is could be due to different oceanographic processes occurring in this area. Also, it is possible that different physiological tolerances allow the small ophiuroid *Ophiocten sericeum* and scallop *Similipecten greenlandicus* to dominate the eastern stations and be mostly absent in the western area.

In general, the quality (type) of food and sediment grain size are important variables in determining the taxonomic distribution and richness, and the variability in abundance and biomass throughout the shelf. However, there are many processes and interactions that are particularly important for the epibenthos of the Beaufort Sea shelf, such as ice scouring, sedimentation rates and predation by marine birds and mammals. Many of these processes are directly affected by global warming, and will have implications for the epibenthos.

STUDY RESULTS: Significant spatial variability was observed in the community composition and dominant taxa with a total of 154 taxa identified. The shallow stations (<25 m) were dominated by mobile crustaceans and had the lowest diversity, the mid-depth stations (26-100 m) had the highest diversity indices and the deep stations (101-220 m) were mostly represented by echinoderms with intermediate diversity values. Biomass was highest at the western stations along the shelf break from longitude 155 to 150°W. While abundance mimicked the biomass stations, there was also an area of higher abundance on the far eastern mid-depth side of the study area from longitude 149 to 145°W. The most influential environmental drivers (bottom water temperature, salinity, pH, phaeopigments, sediment grain size, sediment organic matter, and carbon/nitrogen ratios) had a moderate to low correlation with abundance and biomass (≥ 0.5 at 0.1% significance level). However, the differences in taxonomic dominance, abundance and biomass among stations can be linked to gradients in the physical environment throughout the study area.

STUDY PRODUCT(S):

Ravelo AM and B Konar. 2012. Epifaunal communities in the central Beaufort Sea. Oral Presentation at the Alaska Marine Science Symposium, Anchorage Alaska, January 2012.

Ravelo AM and B Konar. 2013. Alaskan Arctic shelf epibenthic communities: A tale of two seas. Poster Presentation at the Alaska Marine Science Symposium, Anchorage Alaska, January 2013.

Ravelo AM and B Konar. In prep for Polar Biology. Epibenthic community varibility on the Alaskan Beaufort Sea continental shelf.