Structure of meio- and macrobenthic communities on the Beaufort Sea shelf and slope

Sarah M. Hardy1, Holly M. Bik2, Jyotsna Sharma3, Alexis M. Walker1
1University of Alaska, Fairbanks; 2University of Birmingham; 3University of Texas, San Antonio
Contact: shardy@alaska.edu

Rapid change is occurring in the Arctic concurrently with increased human activity, yet our knowledge of the structure and function of high-Arctic sediment communities is still rudimentary. The Beaufort Sea is particularly poorly sampled, and virtually unexplored at slope depths, providing little information with which to assess the impacts of petroleum exploration and extraction activities that are beginning in this area. We are investigating diversity and community structure of benthiic infauna on the Beaufort Sea across a range of depths (to 1000 m) using traditional taxonomic and environmental DNA sequencing approaches. We are also comparing results to additional sites in the next NE Chukchi Sea lease sale area. The Beaufort slope is topographically complex and characterized by an east-west gradient in benthiic habitat characteristics, with heavy input of terrestrial organic matter particularly in the region of the Mackenzie River delta. Warmer, saltier subsurface Atlantic water masses impact benthiic communities at mid-slope depths, likely resulting in influx of species of Atlantic origin. Food resources are variable across the region, with very high sediment chlrophyll concentrations at 350 m depth in some areas. Differences in nematode assemblages were detected across the Beaufort Sea shelf/slope, across depths within the Beaufort Sea, and between the Beaufort and adjacent NE Chukchi Sea. These differences were apparent in both morphological and environmental sequencing data. Preliminary analysis of macrofaunal communities showed variable community structure among transects, with high abundance and high dominance coincident with the Chi-max.

Meiofaunal Communities

Sediment community composition based on 18S amplicon-sequencing of environmental DNA highlights the importance of benthiic protists, dominated by dinoflagellates in the Chukchi and Stramenschekopf (including diatoms and the sessile Pedunculinales) in the Beaufort. These groups may represent an unquantified source of production entering the food web, particularly at shallower locations.

Macrofaunal Communities

Beaufort Sea Study Area

Several active leases for petroleum exploration are currently held in the Beaufort and adjacent Chukchi seas. Another lease sale is scheduled for the Beaufort Sea in 2017. At present, active production is only occurring on Alaska’s North Slope coastline, but active exploratory drilling is expected to begin in summer 2015 in the Chukchi.

Sampling locations in the Beaufort Sea (2012 – 2014). Macrofauna data are presented for transects B and TBS; meiofauna data are presented for a subset of the 2012 and 2013 Beaufort stations, and from additional sites in the NE Chukchi.

Comparing methods: nMDS plots of morphological and molecular OTU data for nematodes, colored by region; numbers next to each symbol indicate sampling depth. Molecular and morphological approaches both showed significant differences in nematode community structure among regions, and among depths (when samples were pooled across region).

Methods

• Meiofauna (>63 μm) were subsampled from the top 1 cm of 0.1 m² Van Veen grabs and 0.25 m² box cores in 2012 – 2014 (see map above for Beaufort locations; depths 40 – 1200m).
• Macrofauna (>500 μm) were collected from box cores and grabs in the Beaufort Sea only.
• Additional sediments were collected from the same box cores, or from replicate grab samples, for measurements of food quality/quantity and grain size.

• Meiofauna samples were preserved whole upon collection. Meiofauna were later extracted from sediments via decantation.

References: