Strong community turnover in epibenthos composition along and across the shelf and slope of the central and eastern Beaufort Sea

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Introduction

Arctic epibenthic communities play an essential role in energy transfer through food webs to higher trophic levels and in nutrient recycling through mineralization processes. It is, therefore, important to understand the distribution and structure of epibenthic communities over large geographical scales and in relation to environmental conditions. As part of the Pacific Arctic region, the Beaufort Sea is influenced by nutrient-rich waters entering from the Chukchi Sea in the west and freshwater inflow from the Mackenzie River in the east. The narrow shelf drops to a steep slope at about the 200 m depth contour. These environmental settings are known environmental conditions that can have strong influence on epibenthic communities, but information on the distribution of epibenthic communities on the Beaufort Sea slope is scarce.

Questions

- **How do epibenthic communities vary in relative composition (abundance and biomass) with bottom depth?**
- **How do epibenthic communities vary along an west-east gradient from the central to the eastern Beaufort sea shelf and slope?**
- **Which sedimentary environmental drivers influence community composition on the shelf (data only available for 20-200 m)?**

Methods

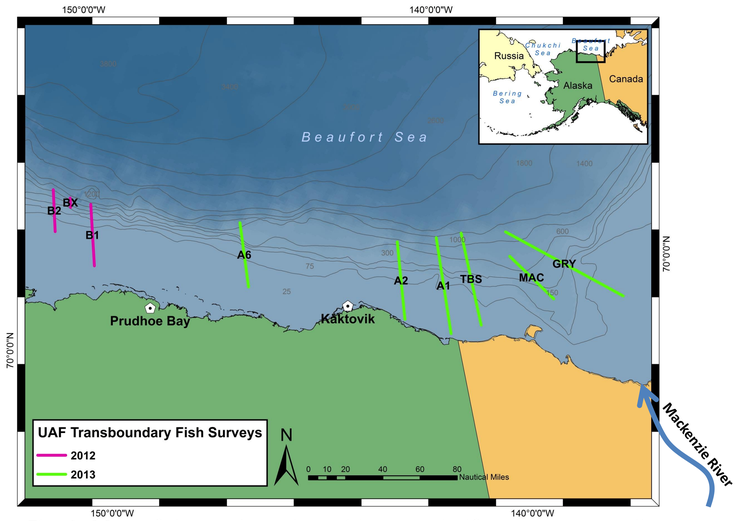
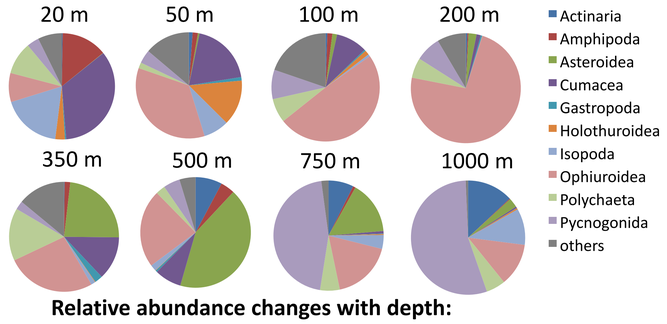


Fig. 1: Map of the study region with cross-shelf and slope sampling transects. Pink transects were sampled in 2012 and green transects in 2013.

- Sampling in the Beaufort Sea from 137.8-151.1 °W and 69.6-71.5 °N in October 2012 (B1, B2, BX) and August 2013 (all other transects) as part of the BOEM-funded US-Canada Transboundary program.
- Epibenthos was sampled at a total of 57 stations along 9 shelf-to-slope transects (20, 50, 100, 200, 350, 500, 750, 1000 m, some depths missing on some transects).
- Fauna was collected using a plumb-staff beam trawl and identified to lowest taxonomic level possible.
- Relative abundance and biomass of major taxon groups determined.
- Multidimensional scaling analysis of epibenthic community in relation to sediment-related variables [other variables will become available later]
- Presence/absence data compared between TB12/13 and Carey et al. 1972 sampling

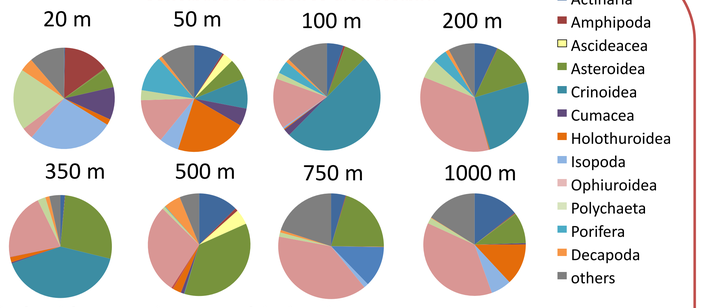
Results

Relative taxon abundance



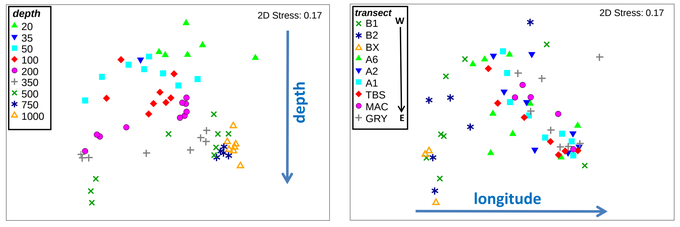
Relative abundance changes with depth:
20 m – dominated by isopods, amphipods and cumaceans
50-200 m – increasing relative abundance of ophiuroids
350-500 m – increasing abundance of asteroids
750-1000 m – numerically dominated by pycnogonids

Relative taxon biomass



Relative biomass changes with depth:
20 m – dominated by isopods, amphipods and polychaetes
50 m – diverse, high biomass of holothuroids
100-1000 m – dominated by various echinoderms:
ophiuroids, asteroids, crinoids

Community composition



Community similarity varies with depth and longitude:

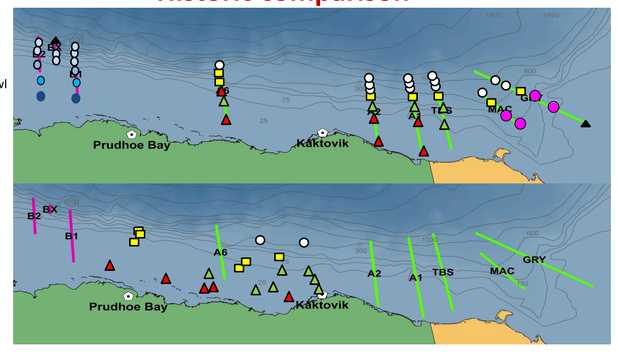
Depth effect more pronounced than longitudinal effect.

Longitudinal differences in community composition are most pronounced in the mid-slope depths (200-500 m, data not shown here).

Historic comparison

TB 2012/13
20 – 750 m
plumb-staff beam trawl
7 mm mesh,
4 mm codend liner

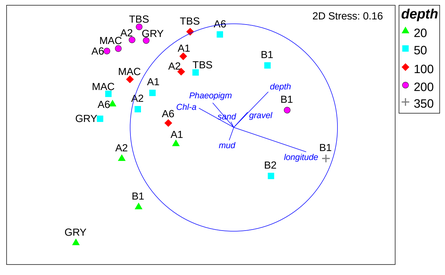
Carey 1972
WEBSEC 1972,
27 –721 m,
3.7 m semi-balloon shrimp trawl,
1.3 cm mesh liner



Similar depth-related patterns in 1972 and 2012/13 epifauna:

Distinct coastal, shelf, shelf break and slope communities

Environmental drivers



Food proxies (sediment chl-a and phaeopigments) separate communities more than sediment grain size characteristics.

Food proxies linear with longitude (higher pigments at more eastern locations)

Take-home messages

- Epibenthic communities in the central to eastern Beaufort Sea varied with depth and longitude. Depth patterns have roughly persisted since the 1970s.
- Mobile crustaceans dealt best with the environmentally dynamic shallow depths, while echinoderms dominated at all other depths. Pycnogonids, a typically rare group, were dense at 750 and 1000 m, while echinoderms dominated in biomass at depth.
- The relationship between food proxies and longitude in driving epibenthic community structure may indicate at important hydrographic controls in the region, especially along mid-slope depths.

Acknowledgements

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