Contribution of sea ice algae to various benthic feeding types on the Chukchi Sea shelf
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**Introduction**

Arctic waters have two main sources of primary production: sea ice algae (pPOM) and phytoplankton (pPOM). The ongoing reduction of seasonal sea ice coverage in the Chukchi Sea due to climate warming could shift the contribution of primary production increasingly or entirely towards pPOM. The loss of pPOM, a high energy food source, that occurs early in the year and supports a large benthic community, could have detrimental impacts on benthic organisms. This impact could be different depending on the feeding type of the organisms.

Stable carbon isotopes can be a useful biomarker to trace these two sources of production through marine food webs. Sea ice algae typically are enriched in δ13C compared to phytoplankton (Spreire et al. 2006). This isotopic enrichment can also be found in individual biochemical components of the ice algal production, such as fatty acids (Wang et al. 2014). The fatty acid biomarkers of interest here are the 16:1(n-7), 16:4(n-1) and 20:5(n-3). Here we use fatty-acid specific stable isotopes to trace pPOM in various benthic feeding types on the Chukchi Sea.

**Question**

How does ice algal consumption differ for different benthic feeding types?

**Methods**

- Benthic invertebrates were collected in the Chukchi Sea in 2012 with van Veen grabs and Plumb Staff Beam Trawls.
- Snow crabs and various clam species were divided into four feeding types (Fig. 1)
- Fatty acids (FA) 16:1(n-7), 16:4(n-1) and 20:5(n-3) were extracted from invertebrate samples in an accelerated solvent extraction (ASE) system
- These FA were converted into fatty acid methyl esters (FAME) and analyzed using gas chromatography and continuous-flow isotope ratio mass spectrometry at the Alaska Stable Isotope Facility
- Stations were arranged by the date at which ice concentration averaged over 7 days was ≤30%, according to Alaska Ocean Observing System (AOOS) sea ice data

**Results**

- Large variations in FA δ13C were found among individuals within all feeding types.
- At locations with shorter ice coverage/ early ice retreat, most feeding types had relatively similar δ13C values of all three FA, which typically were intermediate between known δ13C values for FA from pPOM and pPOM (Fig. 2, grey panels).
- We observed a significant increase in δ13C of 16:1(n-7) in omnivores (p=0.019), which overlapped with δ13C ranges known for this FA deriving from pPOM. The other two FA in omnivores did not have any clear trends to separate between pPOM and pPOM sources.
- All other feeding types, FA δ13C values remained within the known ranges for the pPOM source.
- These results indicate that pPOM (Fig. 3) may not be a significant food source for many benthic consumers, except for higher trophic level omnivores. However, literature values of δ13C in FA should be regarded with caution because of high annual variability.

**Conclusions**

1. It is curious that not all FA showed the same trends within a given feeding type and subsequent analyses are needed to determine which FA are the most reliable ice algal biomarkers.
2. The positive link between omnivores and some ice algal FA as opposed to other feeders may come from feeding on intermediary consumers that feed on ice algae, which would not be observed in these other feeding types.
3. Where specific trophic links exist between pPOM and some feeding types, most notably omnivores, it may depend on the ability of prey taxa to opportunistically use other food sources (i.e., pPOM) in changing sea ice conditions to determine if these changes will have an effect on these higher trophic level omnivores.

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**Literature Cited**