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Experimental evidence of site specific preferential processing of either ice algae or phytoplankton by benthic macroinfauna in Lancaster Sound and North Water Polynyas, Canada

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Rapid warming is dramatically reducing the extent and thickness of summer sea ice of the Arctic Ocean, changing both the quantity and type of marine primary production as the longer open water period favours phytoplankton growth and reduces ice algal production. The benthic ecosystem is dependent on this sinking organic matter for source of energy, and ice algae is thought to be a superior quality food source due to higher essential fatty acid content. The resilience of the benthos to changing quality and quantity of food was investigated through sediment incubation experiments in the summer 2013 in two highly productive Arctic polynyas in the North Water and Lancaster Sound, Canada. The pathways of organic matter processing and contribution of different organisms to these processes was assessed through 13C and 15N isotope assimilation into macroinfaunal tissues. In North Water Polynya, the total and biomass specific uptake of ice algal derived C and N was higher than the uptake of phytoplankton, whereas an opposite trend was observed in Lancaster Sound. Polychaetes, especially individuals of families Sabellidae and Spionidae, unselectively ingested both algal types and were significant in the overall organic matter processing at both sites. Feeding preference was observed in crustaceans, which preferentially fed on ice algae at Lancaster Sound, but preferred phytoplankton in North Water Polynya. Bivalves also had a significant role in the organic matter processing overall, but only showed preferential feeding on phytoplankton at Lancaster Sound polynya. Overall the filter feeders and surface deposit feeders occupying lowest trophic levels were responsible for majority of the processing of both algal types. The results provide direct evidence of preferential resource utilisation by benthic macrofauna and highlight spatial differences in the processes. This helps to predict future patterns of nutrient cycling in Arctic sediments, with implications to benthic-pelagic coupling and overall marine productivity.