

Microbiome and diet turnover as an indicator of rapid environmental change in the Arctic Ocean

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Climate change is rapidly altering the Arctic marine ecosystem and threatening cold-adapted species. Changes in community composition and increased competition and predation are expected to disrupt the trophic interactions among organisms in the Arctic marine ecosystem, including the microbial community. Despite the essential role of the microbial diversity in host health, trophic ecology and close interaction with the environment, studies on the gut microbial communities of Arctic fish remain scarce.

Polar cod (*Boreogadus saida*), an abundant endemic circumpolar fish, functions as key species in the Arctic marine food web and might be an indicator for the environmental status of the Arctic pelagic biosphere. In particular, its diet composition might be a proxy to monitor seasonal trophic links and borealization of prey species. Furthermore, the use of certain bacterial groups to evaluate fish health and environmental status has been suggested. We extracted dietary and gut microbial information from polar cod sampled in the Barents Sea during summer and the understudied Beaufort and Chuckchi Sea in autumn using DNA metabarcoding. We described diverse polar cod prey compositions at the species-level, revealing previously undescribed prey items. Polar cod caught in the Barents Sea mainly fed on amphipods, krill and fish, whereas copepods and ostracods were common prey items in the Alaskan Arctic. Several prey items, typically found in temperate and sub-Arctic waters, point to an increasing presence of temperate and boreal species in the Arctic. We unraveled high bacterial diversity in the polar cod gut microbiome, providing an ecological baseline. The observation of bacterial groups previously not observed in the Arctic, provides new insights in the distribution of polar microbes.

Keywords: Arctic ecosystem; DNA metabarcoding; Prey composition; Dietary analysis; Microbiome