

In the Shadow of the Atlantic: Niche Plasticity and Coexistence Strategies of Boreal-Arctic Sibling Zooplankton in the Pelagic Realm

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Abstract

The intensified inflow of warm Atlantic Water into the arctic ocean is reshaping pelagic ecosystems, making them increasingly similar to those of the North Atlantic. As a result, resident Arctic zooplankton species now commonly coexist with closely related boreal counterparts over broad regions, particularly in the European Arctic. This study explores ecological interactions between such sibling species—representing diverse taxonomic and functional groups (large calanoid copepods, amphipods, euphausiids, chaetognaths)—with a focus on their habitat use, trophic strategies, and trait plasticity.

Field data were collected during summer cruises from 2022 to 2024 aboard RV Oceania and RV Helmer Hanssen, covering six fjords across Svalbard and adjacent shelf waters. Vertical distributions and isotopic niches ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) were analyzed to assess spatial and trophic overlap. Species identification was based on morphological criteria and confirmed with molecular tools. Selected specimens for isotopic analysis were imaged at high resolution, and body measurements were extracted using machine learning-assisted image processing.

Although sibling species often shared similar horizontal distributions, they tended to differ in their vertical occurrence within the water column, suggesting partial spatial segregation. Stable isotope data showed that trophic niches between sibling species often overlapped, but both the position and width of these niches varied depending on the functional role of the

species pair, the region, and the extent to which the species co-occurred at depth. These patterns highlight the variability in habitat use and trophic structure among boreal and Arctic zooplankton, offering insight into the complexity of Arctic pelagic systems in the context of ongoing Atlantification.

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