Ocean circulation, ice melt and increasing tourism could all be contributing to Arctic microplastics

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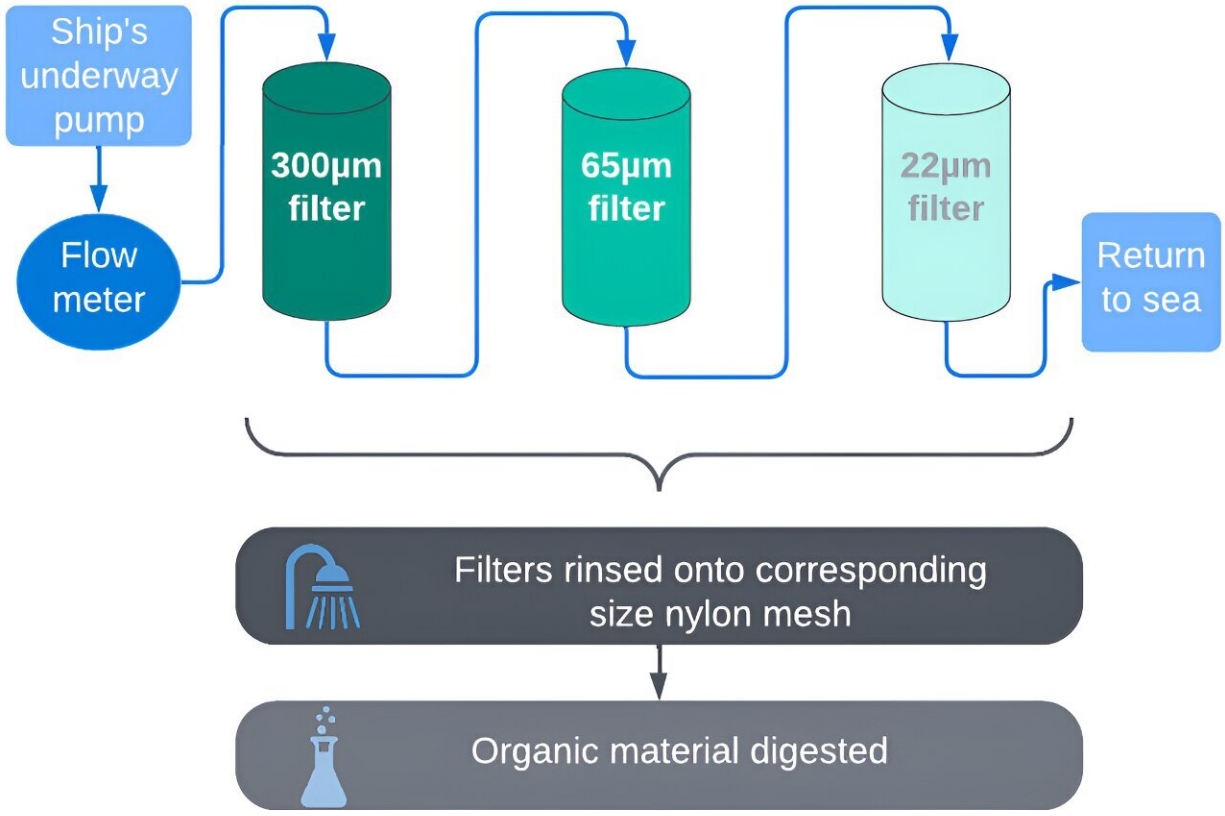

Infograph summarizing methods used to collect and process samples for each transect conducted during the research cruise. Credit: *Frontiers in Marine Science* (2023). DOI: 10.3389/fmars.2023.1241829

Scientists measured microplastic concentrations in the highly productive Barents Sea and suggest that ocean circulation, ice melt, tourism, inadequate waste management, shipping and fishing are all likely contributors.

Numerous studies have shown that global microplastic quantities in the marine environment are increasing, even in remote locations such as the Arctic.

The Barents Sea, which adjoins the Arctic Ocean, is one of the most productive oceanic areas in the world and home to an enormous diversity of organisms.

It is also a key route for Atlantic water flow into the Arctic Ocean and has been earmarked as a potential microplastic hotspot.

A new study, by scientists from Plymouth Marine Laboratory and the University of Exeter, explored large volume samples of sub-surface water collected from transects through the Barents Sea to quantify, characterize and determine distribution of microplastics in this region, with a focus on potential impacts to zooplankton.

Given that the Barents Sea is an area of high primary productivity and the size of microplastics overlapping with optimal prey size of zooplankton, it is considered likely that zooplankton within this region will be consuming microplastics, facilitating the entry of these anthropogenic particles into polar food webs.

Previous studies have shown that the ingestion of microplastic by zooplankton can negatively affect fertility and growth as well as alter the sinking velocity of their feces; an important process that assists the transport of carbon and nutrients to deeper waters and the seabed.

Overall, the mean microplastic quantity in the eastern Barents Sea was 0.011 microplastics per cubic meter (range: 0.007—0.015 m^{-3}).

Microplastics were found in higher abundances nearer land mass at the southern end of the transect and northwards towards the ice edge, recording 0.015 microplastics m^{-3} during both transect legs.

Microplastics were predominantly fibrous (92.1%) and typically blue (79%) or red (17%) in color.

A range of polymers were identified including polyester (3.8%), copolymer blends (2.7%), elastomers (7.1%) and acrylics (10.6%), with the vast majority observed from anthropogenically modified cellulose, such as rayon.

The study concludes that while it is not possible to determine the source of the plastic through this study, the highest concentrations were found close to sources of anthropogenic pollution and ice melt, which are known repositories of marine microplastic.

The possibility of local input is also likely; as tourism in Svalbard continues to increase, the lack of adequate waste infrastructure will result in increased leakage into the surrounding waters.

Increased tourism, paired with other local sources including wastewater input, shipping activities and fishing, could explain the higher levels of microplastic abundance towards the coastline compared to further offshore.

Heather Emberson-Marl, lead author on the paper and MSc student with the University of Exeter and Plymouth Marine Laboratory, said, "It is apparent that microplastic data from the Arctic is limited and this study will act as a reference point for further research."

"Additionally, sampling methods between studies of microplastics within the Arctic vary and the differing units of measurement used in previous research make it difficult to draw comparisons."

"We recommend that future studies should strive for a standardized sampling protocol to allow for direct comparisons and more robust conclusions on the ecological and toxicological effects on the Arctic's marine biology."

Dr. Rachel Coppock, Marine Ecologist at Plymouth Marine Laboratory and co-author on the study, commented, "The Arctic region is remote and most of us might imagine that it is a pristine natural wonder."

"But once microplastics enter the marine environment they are transported on currents, often from populated areas many thousands of miles away, ending up far from the source and in the case of the high Arctic, may become trapped in sea ice and released during the spring melt."

"Warming seas are causing greater sea ice melt, potentially releasing further microplastics and adding another layer of complexity to marine life adapting to a changing world."

The research is published in the journal *Frontiers in Marine Science*.

More information: H. Emberson-Marl et al, Microplastics in the Arctic: a transect through the Barents Sea, *Frontiers in Marine Science* (2023). DOI: 10.3389/fmars.2023.1241829

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