

The Power of Multi-Matrix Monitoring in the Pan-Arctic Region:

Plastics in Water and Sediment

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Litter and microplastic assessments are being carried out worldwide. Arctic ecosystems are no exception, and plastic pollution is high on the Arctic Council's agenda. Water and sediment have been identified as two of the **priority compartments** for monitoring plastics under the Arctic Monitoring and Assessment Plan (AMAP). We use the AMAP framework to illustrate how scientists, governments, and Arctic Peoples can work together to address plastic pollution.

Understanding the full picture of microplastic pollution in a region requires knowledge of both aquatic and sedimentary systems, and the links between them.

Existing data in the Arctic

	Water		Sediment	
	Freshwater	Marine	Freshwater	Marine
SOURCES	Limited data	Limited data	Limited data	Limited data
INSHORE	Limited data	Limited data	Limited data	Limited data
OFFSHORE	-	Data available	-	Data available

Published data on plastic pollution in the Arctic is sporadic and collected using a wide spectrum of methods which limits the extent to which data can be compared.

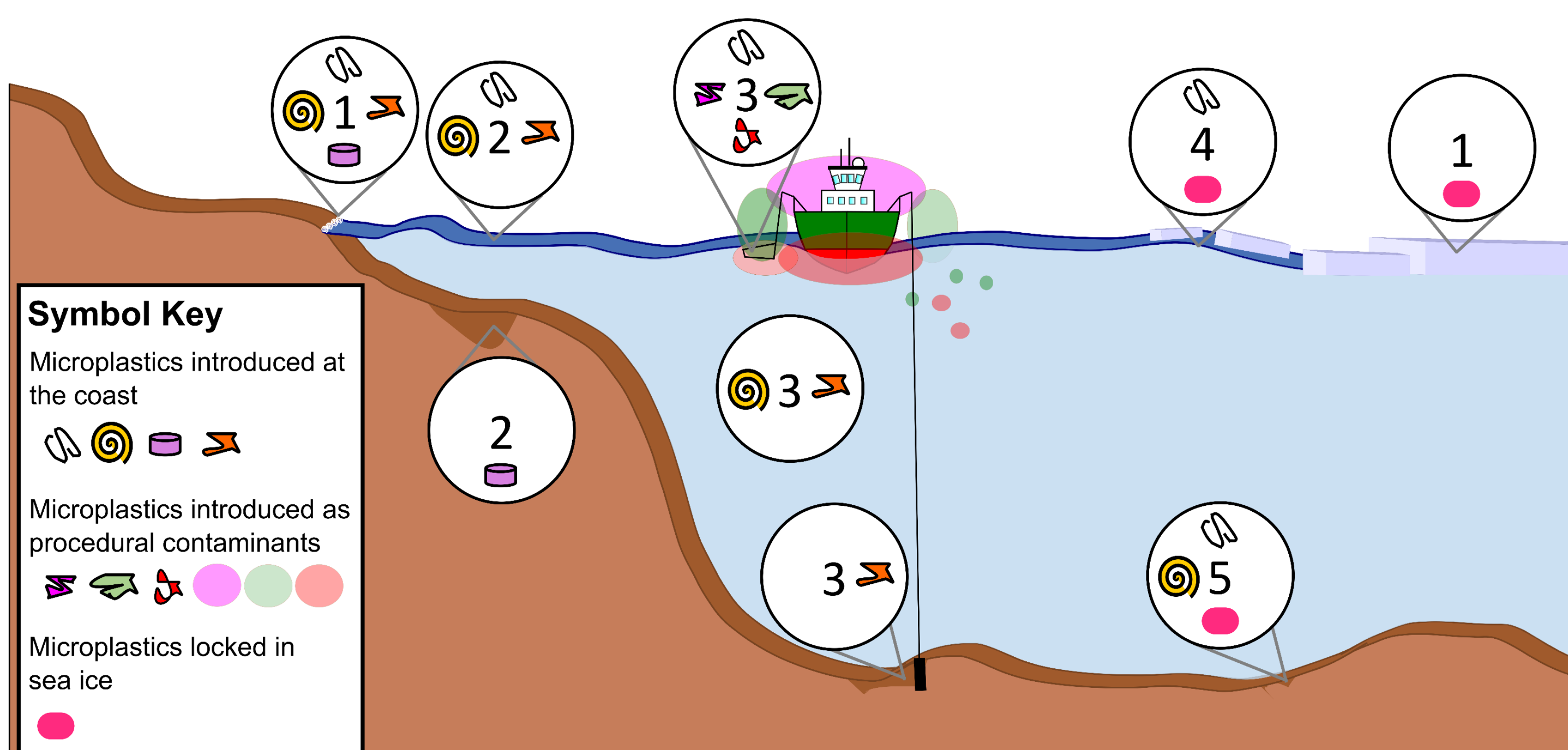
Key messages

A harmonised and coordinated effort is needed to gather data on plastic pollution for the Pan-Arctic.

Multi-matrix sampling in a given region has tremendous advantages for building a full picture of environmental microplastic contamination.

This will aid in identifying priority regions for focused mitigation efforts.

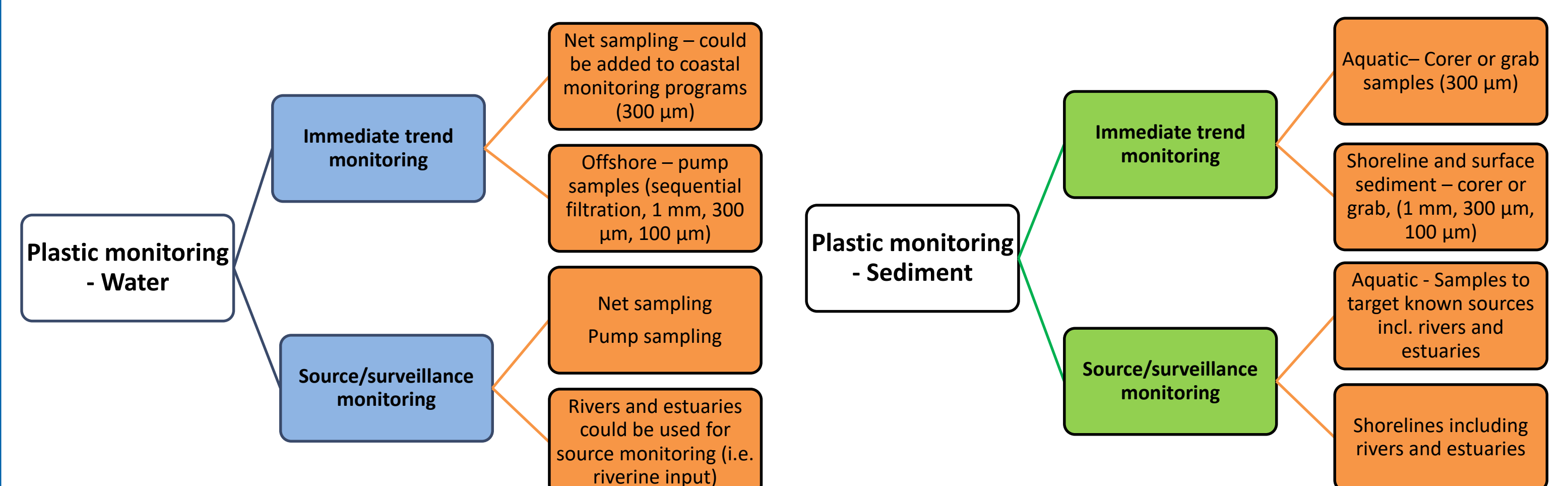
Future monitoring research should align with the priorities of local and regional Arctic communities.



Potential Benthic-Pelagic microplastics pathway. 1. Microplastics are released at the coast (left) and legacy microplastic pollution is trapped in sea ice (right). 2. Dense microplastics settle rapidly in the estuary and are quickly buried in a high sedimentation area, while others are carried in coastal currents. 3. Researchers operate within an area affected by their own microplastic shedding. At the surface floating microplastics from the shore are collected along with microplastics generated from the research cruise. Other microplastics are carried long distances by water masses as they sink. Still other microplastics are carried by bottom currents or debris flows and settle on the shelf, abyss, or in depressions. 4. Microplastics mix and sink at the ice margin, released from the ice or carried by northerly currents and ships. 5. Accumulation of variously sourced microplastics offshore.

Method recommendations

Assessment methodologies must be adapted to the ecosystems of interest to generate reliable data⁽¹⁾.



Monitoring with, by, and for Arctic Peoples

These recommendations are based on the priorities and insights of an international scientific community. However, this does not mean they include the research needs and priorities of communities and Indigenous peoples in the Arctic, and some of the methods, categories, standards, and research questions in plastic pollution research in the Arctic are skewed towards southern understandings and landscapes^(2,3). Recent work by Inuit Tapiriit Kanatami (ITK), an organization representing the 65,000 Inuit in the Canadian Arctic (Inuit Nunangat) have recognized that to date Arctic research priorities have ignored Indigenous community priorities. In order to rectify this, ITK recommend five priority areas for research in their homelands, taken from the National Inuit Strategy on Research (NISR), including: **advancing Inuit governance in research**, including being part of funding decisions; **enhancing the ethical conduct of research**, including strong community partnerships; **ensuring Inuit access, ownership, and control over data and information gathered in their homelands**, including monitoring data; and **building capacity in Inuit research through skill-sharing, equal partnership, and research infrastructure**⁽⁴⁾. While each Indigenous group and community in the Arctic will be different, many of these principles will hold across the Arctic.

Conclusion

Alone, environmental samples can provide information on presence, fate, and potential impacts to ecosystems.

Together, the quantification of microplastics in sediment and water from the same region produce a three-dimensional picture of plastics, not only a snapshot of floating or buoyant plastics in the surface water or water column, but also a picture of the plastics reaching the shoreline or benthic sediments, in lakes, rivers, and the ocean⁽⁵⁾.

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REFERENCES: AMAP (2021) AMAP Litter and Microplastics Monitoring Guidelines. Version 1.0; Martin et al., Arctic Science, 2022 (in press); Liborion et al., 2021. Sci. Total Environ. 782, 146809; Melvin et al., 2021. Frontiers Marine Sci. 8, 689108; Inuit Tapiriit Kanatami. 2018. "National Inuit Strategy on Research."