Microplastic monitoring in the Yukon River

What is microplastic?

Microplastic is plastic that has been degraded into microscopic particles. Microplastic can be introduced to our wastewater by washing polyester clothing, or during rain or snowmelt events from sources like degrading tires or other plastic litter degrading over time.

Microplastic monitoring

The Government of Yukon conducts annual microplastic sampling in the Yukon River in the Whitehorse area. This sampling helps us to better understand if microplastic is present on the surface of the Yukon River and helps us to make informed decisions on how to protect the river from this contaminant.

To understand how to monitor this potential contaminant we formed a partnership with researchers who specialize in microplastic at the Northern Alberta Institute of Technology (NAIT). They can analyze microplastic samples that we collect from the Yukon River using a sampling method known as “ASTM D8332”. The method is designed to sample from the surface of moving freshwater, allowing us to understand how microplastic may be present at the surface of the Yukon River and how particles may be transported downstream.

We collect samples and send them to NAIT for analysis using their advanced microscope technology. NAIT is able to separate, count and identify 8 different main types of microplastics.

Methods

The ASTM D8332 sampling system is low-impact and allows for the filtration of very large volumes of water – thousands of litres – over a long period of time. Stirring sediment and eroding banks are deliberately avoided, and only about 500 ml of water is taken from site, which is needed to rinse the filtered material from the sieve into a jar. The intake is a single 3/4-inch pipe that is equipped with an intake screen to prevent fish ingress or damage.

The sample collection system is fully portable, easy to use and virtually plastic-free. It is inexpensive, simple to build and can be used by anyone. The materials used and the sampling design deliberately avoid plastic to reduce potential contamination. Sampling takes only a few hours and mostly involves monitoring the pump for malfunction.

Figure 1. The sampling equipment set up in the Yukon River. The pump is suspended from two wooden tripods, positioning the intake on the upstream side and the outlet over the filter sieve, downstream of the intake to avoid recirculating water.

Sampling locations

The Marsh Lake Dam (Lewes River Control Structure): Representing the Yukon River before passing through Whitehorse.

Below the Livingstone Trail Environmental Control Facility discharge: Where treated wastewater is discharged into the Yukon River from the lagoons between August and October each year, located at the end of Long Lake Road. This is suspected to represent one of the larger microplastic sources in Whitehorse.

Upstream of the confluence with the Takhini River: The last sampling location on the Yukon River before another major river enters.

Figure 2. Back rinsing sieve to collect the sediment into sample jars.

Figure 3. Sediment sent for analysis representing several thousand litres.

Near Burma Road: This is the downstream-most location before the Yukon River enters Lake Laberge.

Study limitations

The sampling method only collects water from approximately 5 to 10 centimetres below the surface. While this does provide useful information about the potential for transportation, it does not inform us about the presence of microplastic lower in the water column or in the sediment on the substrate. Different areas in the water column would require targeted research and a different methodology to study.

Contamination is difficult to avoid, however field staff and researchers at NAIT take extreme precautions to avoid the potential of accidentally adding microplastic to the samples. Where contamination is unavoidable, we track contamination that may be introduced during the measuring process.

Results

Water at the surface of the Yukon River appears to have exceptionally low microplastic concentrations across all the sampling locations, in comparison to what researchers have found in other urban areas. In fact, after filtering thousands of litres of water, the microplastic concentrations found in samples were so low that they are barely distinguishable from background contamination. After this intensive filtration, the number of plastic fibres and particles in our samples were nearly identical to the number found in control samples. However, our sampling, as well as other research, suggests that microplastic does not remain at the surface of the water column for very long and more information is needed to determine where microplastic ends up.

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Full report can be found at Yukon.ca.

Community partners

We would like to thank our friends and colleagues at the Council of Yukon First Nations, Ta'an Kwäch'än Council and the Kwanlin Dün First Nation for their continued interest, input and support. We look forward to continuing these partnerships.

We would also like to thank the team at NAIT for hosting the Water Science and Stewardship branch and training us on the ASTM-D8332 method. Many thanks for their ongoing analytical services and expert advice, and special thanks to Katrina Gonzales; Laboratory Technologist and Nadia Stelck; Microplastics Technologist.