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Microplastics in beach sediment: Collecting baseline data for microplastic contamination around Iqaluit, Nunavut, and developing tools for effective community-based monitoring

Introduction

Marine plastic pollution is a significant global issue. Plastics do not biodegrade, yet many can breakup into smaller fragments and be easily transported in both water and air (Barnes et al., 2009). Microplastics, which are defined as plastic particles less than five millimeters in diameter (Arthur and Baker, 2011), can enter the environment through various different sources and are of particular interest as they can be ingested by many different organisms, causing an array of deleterious effects (Browne et al., 2007). The presence and persistence of microplastics in the environment is becoming increasingly recognized as an emerging environmental concern, however, data does not exist for many areas, and understanding the distribution and various drivers of microplastics within different environmental systems is still a topic that needs to be investigated further.

Currently, there is a general lack of standardized monitoring tools for plastics in the environment. While some standardized protocols exist for seabirds (Provencher et al., 2019), protocols for abiotic samples such as water and sediments are still in development. From a pan-Canadian perspective, it is critically important that any standardized monitoring tools used to track trends in plastic pollution in the environment are applicable across Canada, including in the north. For example, in areas where there is less pollution, larger quantities of samples may be needed to detect plastic pollution.

Community-based monitoring of plastic pollution is an important way to involve communities in pertinent research, as well as to facilitate regular and consistent sampling. That said, to ensure that this community-based monitoring is successful, sample collection methodologies need to be tested to establish that sampling is both feasible for communities and that the samples collected can be useful in the targeted studies. In 2018 several sediment sample types were taken in collaboration with the community of Qikiqtarjuaq. In order to more fully test and develop sediment collection protocols with northern communities the protocol needs additional testing and validating. This testing of methods involves assessing the ways in which samples are collected as well as the volume of sample required to provide an adequate representation of the concentration of microplastics in the area of interest.

Research Questions and Objectives

There are two main research questions we hope to answer with this study:

1. What is the current concentration of microplastic contamination in beach sediment around Iqaluit, Nunavut?
2. Are current methods for community-based monitoring of microplastics in sediment samples effective?

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Our objectives for this study are:

- To collect and analyse beach sediment samples for microplastic contamination in order to create a baseline dataset of the concentration of microplastic pollution in beach sediment around Iqaluit, Nunavut using the same methods that were used in Qikiqtarjuaq, Nunavut in 2018.
- To assess current beach sediment sampling methods and develop tools for effective community-based monitoring of microplastics in beach sediment.

Proposed Methods

Beach sediment samples will be collected in September 2019 during the Wildlife Contaminant Workshop in Iqaluit, NU in associated with the Environmental Technology Program at the Nunavut Arctic College. Three replicates of approximately 500 g of sediment will be collected at each location where beach surveys will be conducted for plastic debris. The beach surveys will be an activity held during the workshop led by Dr. Chelsea Rochman. Sample collection will replicate the methods used to collect previous beach sediment samples from Qikiqtarjuaq, NU, and Herschel Island, YT, and will involve filling glass jars with sediment using a metal spoon. The samples collected will not only provide information on the concentrations of microplastic contamination in beach sediments, but will also help identify the best ways to allow for community-based monitoring by evaluating the volume of sediment collected and whether appropriate results can be attained from such samples given current levels of plastic pollution. The samples will be collected with the Environmental Technology Students at the Nunavut Arctic College as part of a week-long workshop on plastic pollution. All of the students are Nunavut residents, and will participate in the sampling. No equipment or waste will be left on site, and access to the sampling locations will be by foot. We do not foresee any impacts on the environment, wildlife or people as a result of this study or the sample collection. We will not collect any sediment that is being used by wildlife, and if at any time there is a threat to disturbing wildlife, all sampling will stop. All data acquired for this study, including metadata, will be archived on the Polar Data Catalogue and open for use. This way we can ensure the data is available for uses beyond this study.

Research Outputs

This study is the basis of a chapter in my MSc thesis which I am completing at Carleton University in the Department of Geography and Environmental Studies under the supervision of Dr. Jesse Vermaire and Dr. Jennifer Provencher. The results from this study will be presented back to the class and to the students who participated in the sample collection at the 2020 Wildlife Contaminant Workshop in Iqaluit. The research results will also be shared at the ArcticNet meeting in December 2019, and research summaries will be shared with all participating communities, including Iqaluit.

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