Analyzing source and quantifying microplastic abundance in near-shore marine environments of Atlantic Canada

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ABSTRACT

The Atlantic Canada Microplastic Research Project, led by Bluenose Coastal Action Foundation (herein Coastal Action), is a partnership project aimed at addressing the environmental problem of marine plastic pollution, specifically microplastic (<5 mm in diameter). The project is an ecosystem-based research initiative that will quantify microplastic distribution and concentration across three locations in Atlantic Canada: the Bay of Fundy, the Bay of Islands (i.e., Gulf of St. Lawrence), and the LaHave River Estuary (i.e., Atlantic Coast).

As research shows, plastic particles allow chemicals to adhere to their surface as they travel throughout the marine environment, contributing to reduced water quality over time. Although research has been conducted on these impacts, further understanding of water quality impacts from microplastic pollution, and its subsequent impact on habitat and biodiversity, is needed across Atlantic Canada's ecosystems. The proposed project involves one year (2017-2018) of project development and training and two years (2018-2020) of microplastic sampling and analyses within the three study areas.

Sampling methodologies will replicate those used by researchers in the Great Lakes (Eriksen et al., 2013; Ballent et al., 2016; Corcoran et al., 2015) and the St. Lawrence River (Castañeda et al., 2014), to compare the results of those studies to data collected in Atlantic Canada.

Samples will be collected from surface water trawls and benthic sediment grabs to quantify microplastic particles and determine concentrations. The culmination of the proposed project will be an international workshop event to share and discuss results of microplastic data with researchers, scientists, non-governmental organizations and students.

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**INTRODUCTION**

Since large-scale production of plastics began in ~1950, the synthetic material has been synonymous with the Anthropocene (Munir and Bendell, 2018). This project will sample microplastic, <5 mm, which can be described in two categories. Primary microplastics are manufactured as small beads or ‘nurdles’ for use in cosmetic and industrial products. Secondary microplastics transform larger plastic into microscopic fragments by breaking them down through sun exposure and wave action. These ubiquitous particles have seeped into terrestrial, freshwater, and marine environments to the point that plastic, in some form, has been discovered in most water bodies around the world (UNEP, 2016).

The Atlantic Canada Microplastic Research Project (herein the project) will sample 3 coastal locations in Eastern Canada with the primary goal of quantifying microplastic in the region. The 3-year project seeks to fill the gap in Atlantic Canadian marine debris research and add to existing Canadian research by using sampling methods from the St. Lawrence River (Castañeda et al., 2014) and Great Lakes (Eriksen et al., 2015; Corcoran et al., 2015; Ballent et al., 2016). Data collection will take place in the coastal waters of three provinces (Nova Scotia; New Brunswick; Newfoundland) and will inform actions on the growing issue of microplastic accumulation and help foster solutions by collaborating with stakeholders across a variety of sectors.

**RESEARCH QUESTIONS**

- What is the quantity of surface microplastic and benthic (sediment) microplastic quantified in three near-shore marine environments of Atlantic Canada?
- Where are the concentrated ‘hotspots’ (i.e., high microplastic levels) of microplastics across three locations in Atlantic Canada (Bay of Fundy, Gulf of St. Lawrence, coastal Atlantic Ocean)?
- How can this data inform feasible action initiatives aimed at solutions to mitigate microplastic accumulation waste management strategies?

**STUDY LOCATIONS**

LaHave River Estuary, Nova Scotia Led by Coastal Action (Map 1).
Bay of Fundy, New Brunswick Led by Huntsman Marine Science Centre (Map 2).
Newfoundland, Bay of Islands Led by ACAP Humber Arm (Map 3).

**TIMELINE**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
<th>Dates</th>
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<tbody>
<tr>
<td>YEAR 1: Research &amp; Development</td>
<td>Conference attendance, literature review, presentations, expert consultation, training, and finalising sampling procedures.</td>
<td>September 2017 to May 2018</td>
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<tr>
<td>YEAR 2: Sampling</td>
<td>Surface water and benthic sediment samples at each location. Preparing and shipping samples for lab analysis done by Civic Laboratory for Environmental Action Research (CLEAR) at Memorial University.</td>
<td>June 2018 to September 2018</td>
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<td>Lab work &amp; analysis</td>
<td>Quantification of plastic particles (CLEAR).</td>
<td>August 2018 to December 2018</td>
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<tr>
<td>Data organization &amp; Preparation</td>
<td>Data sharing and organization, reporting and mapping results for Year 2.</td>
<td>January 2019 to May 2019</td>
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<td>YEAR 3: Sampling</td>
<td>Using Year 2 data, hot-spots with high microplastic concentrations will be investigated further.</td>
<td>June 2019 to August 2019</td>
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<tr>
<td>Lab work &amp; analysis</td>
<td>Quantification of plastic particles (CLEAR); Chemical composition analysis (Surface Science Western).</td>
<td>August 2019 to December 2019</td>
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<tr>
<td>Assessment of Impacts; Workshop</td>
<td>Final reporting; Lead workshop with stakeholders to discuss results, determine feasible action initiatives, and develop public engagement strategies.</td>
<td>January 2020 to March 2020</td>
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**REFERENCES**