



# 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-government organizations and students.

*This project is funded by Environment and Climate Change Canada's Atlantic Ecosystem Initiative (AEI)*



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## INTRODUCTION

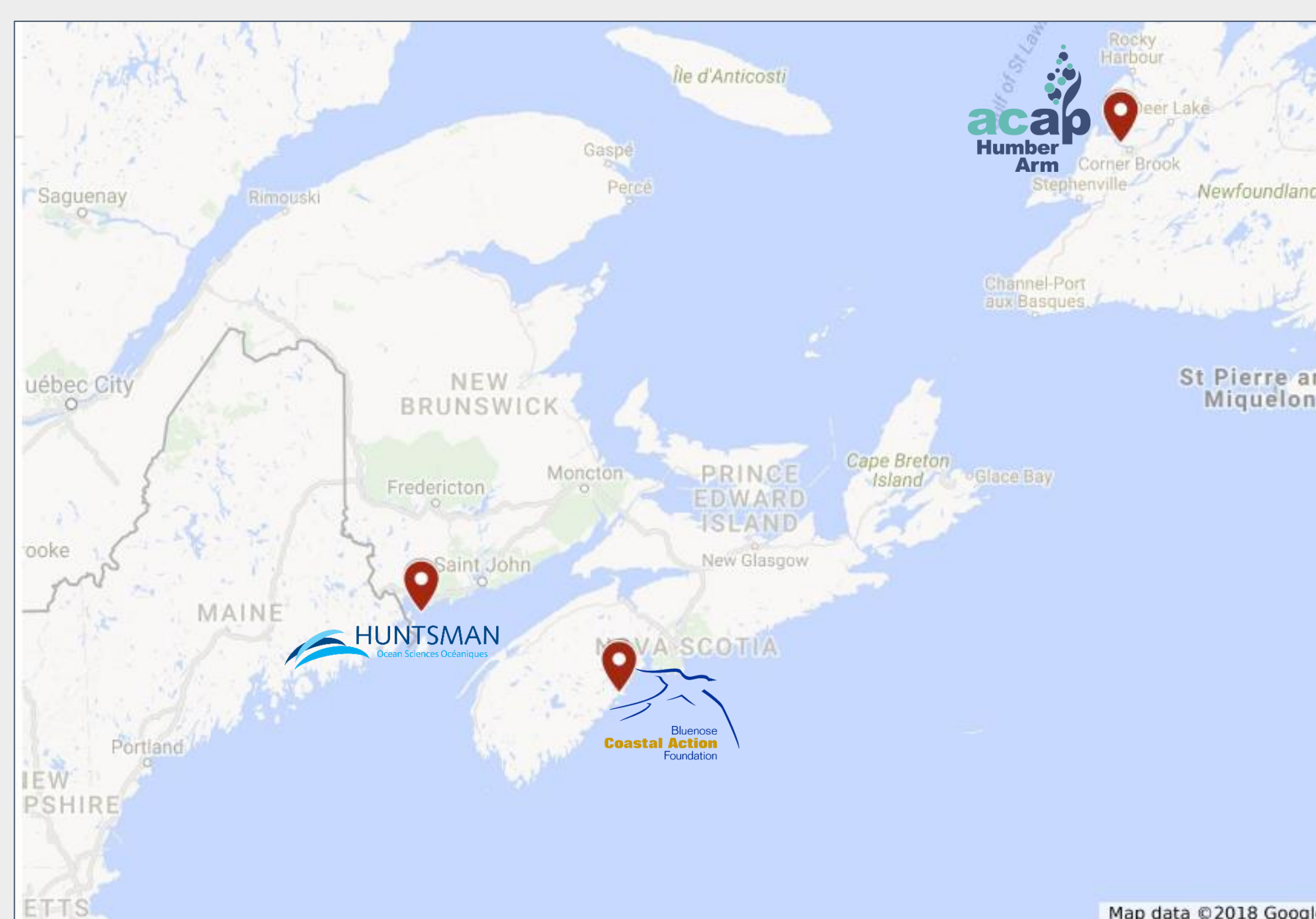
Since large-scale production of plastics began in ~1950, the synthetic material has been synonymous with the Anthropocene (Munier and Bendell, 2018). This project will sample microplastic, <5 mm, which can be described in two categories. *Primary microplastics* are manufactured as small beads or 'nurdles' 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 microplastic 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).**

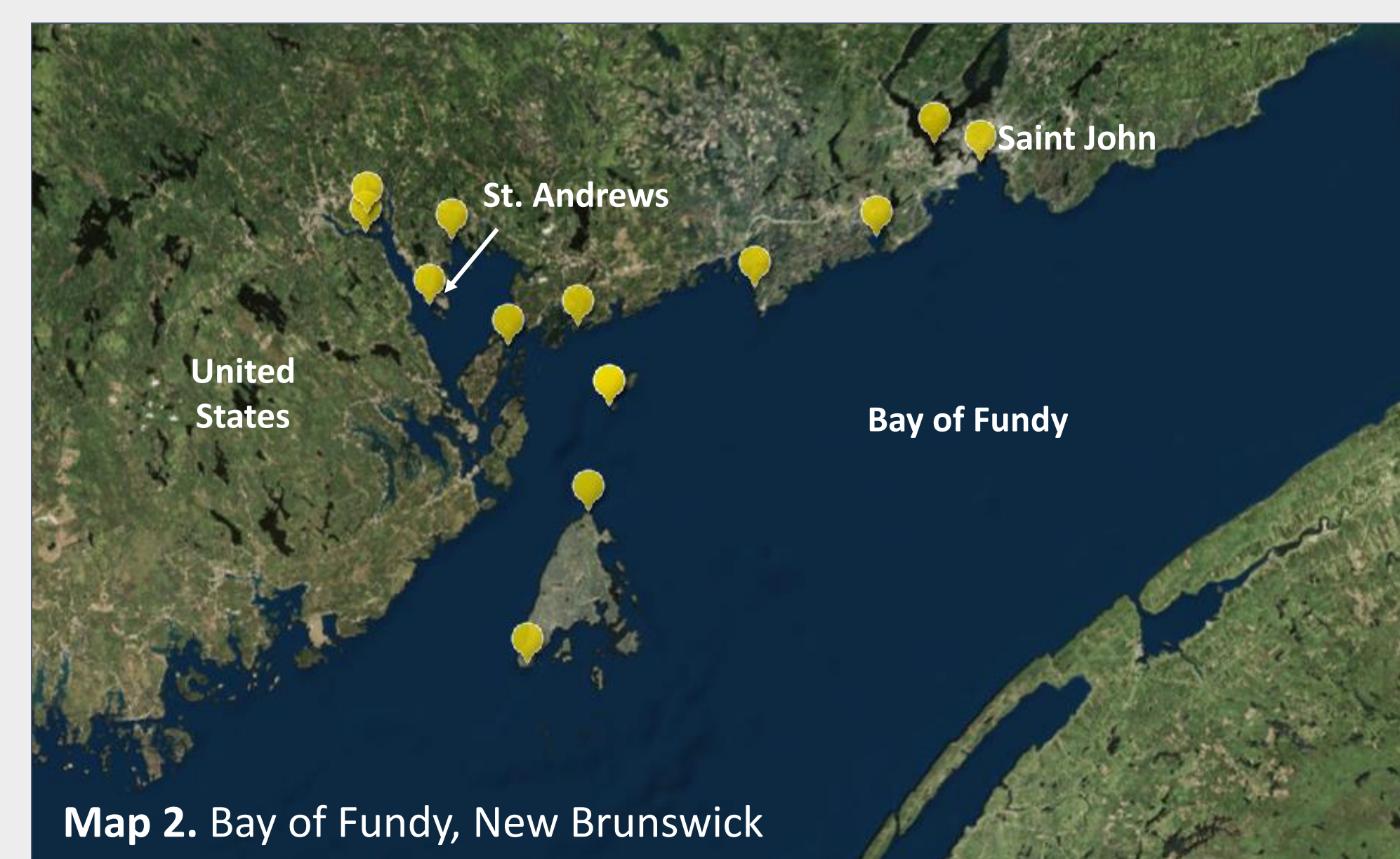


**Bay of Fundy, New Brunswick  
Led by Huntsman Marine Science Centre (Map 2).**



**Newfoundland, Bay of Islands  
Led by ACAP Humber Arm (Map 3).**

## SAMPLING SITES



The above maps are preliminary site assessments and are subject to change.

## TIMELINE

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

## METHODOLOGY

### Surface Water Sampling (Summer 2018 & 2019)

Due to the density of saline water, approximately half of all microplastic debris (called 'neuston') will float on the surface of the water body. This will be the debris collected.

- At each study location, partners will build and use Civic Laboratory for Environmental Action Research's (CLEAR) Low-tech Aquatic Deployment Instrument (LADI) trawl (Figure 1).
- Samples will be taken by skimming the water's surface, collecting roughly 30 water trawl samples (at each study location) over the course of the sampling season.

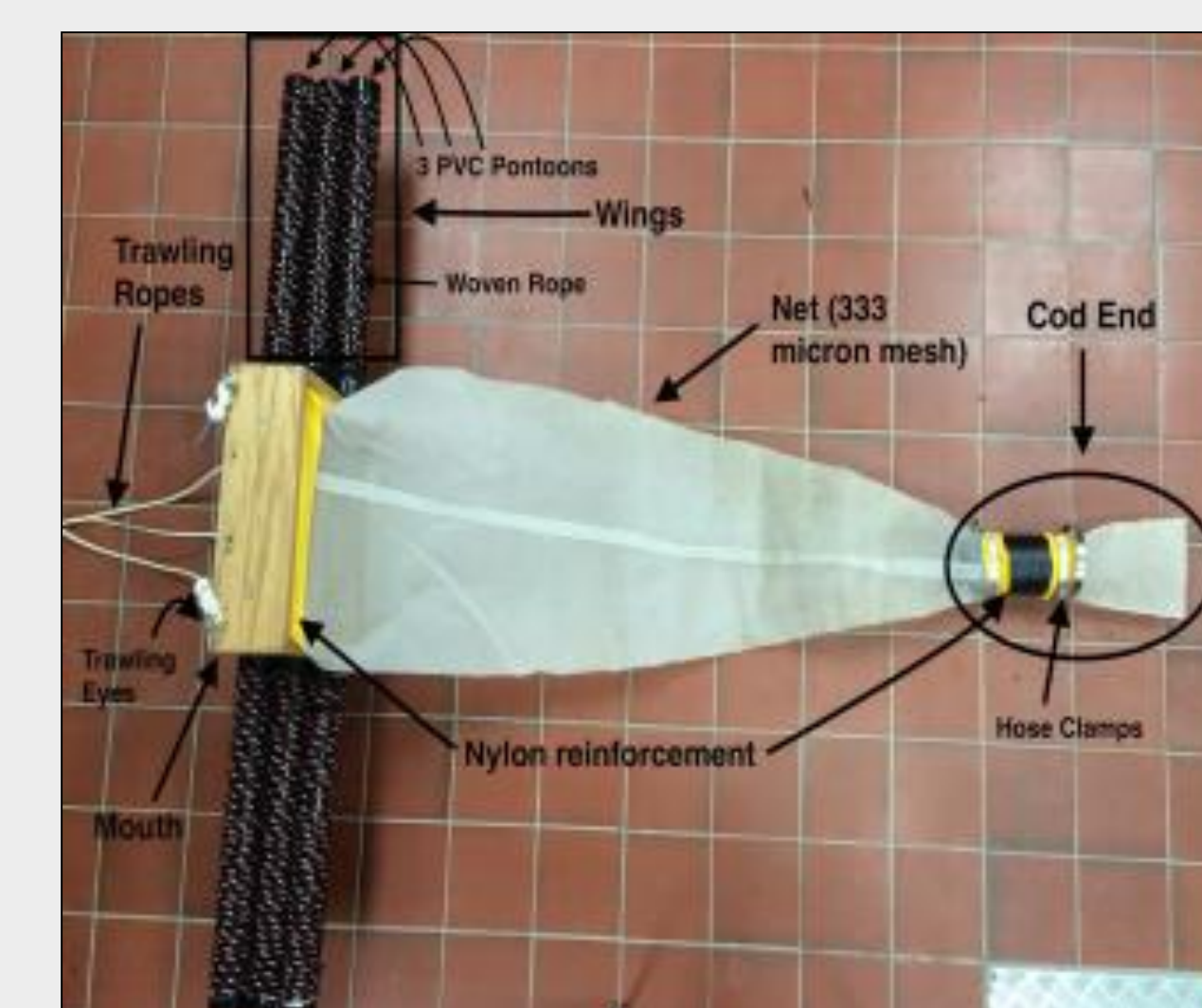


Figure 1. Low-tech Aquatic Debris Instrument (LADI) developed by CLEAR at Memorial University.



Figure 2. Microplastic fragments from CLEAR's LADI sample.

### Sediment Sampling (Summer 2018 & 2019)

Basing benthic sediment sampling on the methods used by Castañeda et al., 2014, Corcoran et al., 2015 and Ballent et al., 2016, microplastic concentration will be quantified in the sediment of each study location.

- Using a grab sampler, samples will be taken at near-shore, tributary and beach locations (in accordance with Ballent et al., 2016).
- Roughly 30 sediment sites per study location will be collected, at a depth of 10-15 cm.

### Identifying Hot-Spots & Chemical Analysis (Fall 2019)

In the final year of the project, focused sampling efforts will be conducted at sites with high microplastic concentrations or 'hot-spots' (using Year 2 data).

- At each hot-spot, *Fourier-transform infrared spectroscopy (FTIR)*, performed by Surface Science Western at the University of Western Ontario, will analyze the chemical composition of the plastic particles.
- Analyzing particles in this stage will point towards microplastic source and aid in determining appropriate action initiatives during the workshop in 2020.

## REFERENCES

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