PILOT PROJECT

COMMUNITY SCIENCE AND TECHNOLOGY

TO TACKLE MICROPLASTIC POLLUTION

Authors: Iselle Flores Ruiz, Sean Yang, Ethan Edson, Dean Wenham, Anna Posacka

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Environment and Climate Change Canada
Environnement et Changement climatique Canada

OCEAN DIAGNOSTICS

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A PILOT PROJECT IN PARTNERSHIP WITH OCEAN DIAGNOSTICS AND ENVIRONMENT AND CLIMATE CHANGE CANADA

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ABOUT

In 2021, in partnership with Environment and Climate Change Canada, Ocean Diagnostics Inc. developed microplastics sampling and analysis protocols and technology for community science applications. Over 50 local volunteers used the tools to sample 10 Greater Victoria Region sandy shorelines once per month between April and November. A total of 240 sand samples were processed with visible microplastics rapidly counted and characterized by a new technology, the Saturna Imaging System, and a subset analyzed at the lab for chemical identity. The project generated the most extensive scientific dataset on microplastics on sandy shorelines of B.C. The results show that Community Scientists empowered with simple protocols and technology can produce information on the patterns and potential sources of microplastic pollution to guide local action. The project led to the development of a Community Science Toolkit with protocols, technology, an open-source data platform and educational resources to engage schools, beach cleanup organizations and the general public in research and action on plastic pollution.

THE PROBLEM

Plastic pollution has become a global threat to ecosystems, human health[1] and the economy[2]. Microplastics are defined as plastic particles ranging from five millimeters to one micrometer in size. They have many sources and are a major form of plastic pollution (Figure 1). Microplastics can stay in the environment for a very long time[3], are ingested by wildlife, accumulate in food webs and can carry toxic chemicals[4]. One of the main challenges to fight microplastic pollution is an insufficient understanding of their abundance, sources and fate in the environment.

Engaging members of the public in microplastics data collection can accelerate knowledge about the problem and promote a public role in solution building. In the past, collecting robust data on microplastics by non-professional scientists has been a challenge. The goal of this project was to develop resources and tools to increase the value and impact of publicly-collected data and help the public drive positive change at a local level. We developed a technology for rapid and standardized analysis of microplastics on sandy shorelines and validated it through a six-month pilot study on Vancouver Island, B.C. The study examined the shorelines of the Salish Sea, one of the world's most biologically diverse ecosystems and home to the iconic and endangered southern resident killer whales and Chinook salmon. Community Scientists helped to create the first and most detailed scientific dataset on sandy shoreline microplastics in British Columbia which can support local strategies and further monitoring of these pollutants.

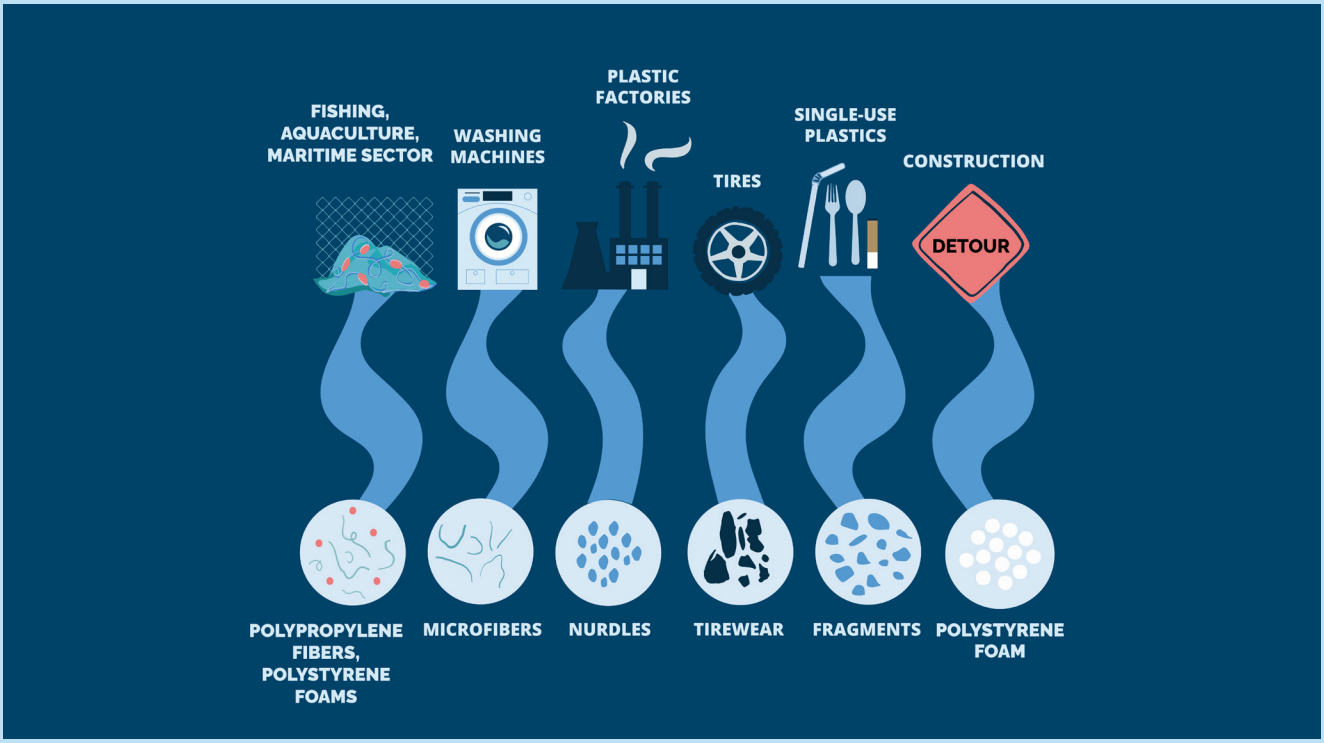


Figure 1. Microplastic types and examples of their sources

METHODOLOGY

The study took place on Southern Vancouver Island in British Columbia, Canada between April–November 2021.

Fifty-one volunteers visited ten different shorelines on a monthly basis. They collected sand from four 0.5 x 0.5 m square areas of the beach and sieved the sand to separate microplastic particles of 0.5-5 mm in size.

Microplastics were cleaned and analyzed by Ocean Diagnostics' scientists. The first analysis step was rapid counting and physical characterization using a new AI-based imaging technology called the Saturna Imaging System. The second step was to identify the particles' chemical type using a technique called Raman spectroscopy. Finally, Ocean Diagnostics' scientists checked the data for accuracy and assessed the data patterns across the beach sites and over time (Figure 2).

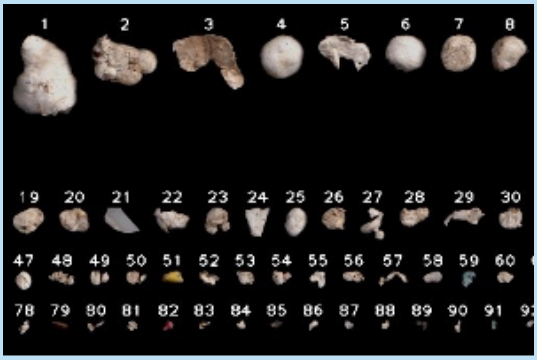
METHODS

1. FIELD COLLECTION

10 SITES, 4 QUADRATS, 6 MONTHS

2. LAB PREPARATION

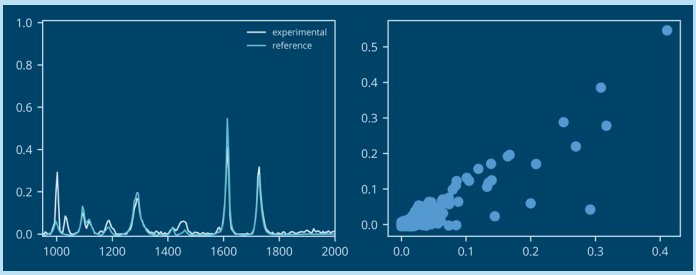
3. SATURNA IMAGING



2,426
PARTICLES

ANALYZED AND AI TRAINED

4. RAMAN SPECTROSCOPY



23% (560 particles)

5. DATA QA-QC

ABUNDANCE
SIZE
COLOUR
TYPE
CHEMISTRY
WEATHERING

Figure 2. Methodology used in the pilot project

RESULTS + OUTCOMES

A total of **2,426 microplastic particles** were found in the study of which the majority were foam (81.4 %), while lines (6.5%), films (1.8%), pellets (1.8%) and fragments (8.5%) were significantly less abundant.

Microplastic abundances ranged from **0-801 particles per m²** and were most abundant at beaches surrounded by marinas. Microplastics were dominated by polystyrene foam (Figure 3).

Polystyrene in the form of pieces and large dock float blocks is the major type of litter removed by B.C. cleanup organizations and communities[5]. It is also one of the most common types of global shoreline litter[6]. Our study, together with existing cleanup data, suggests that reducing inputs of expanded polystyrene to local coastal waters, particularly from marine uses, is needed to address microplastic pollution.

We then developed a **Community Science Toolkit** consisting of a field sampling protocol, the Saturna Imaging System, the open-access Mariana data portal for data sharing and analysis, and educational resources to support STEM learning, advocacy and community-based solution building to combat plastic pollution.

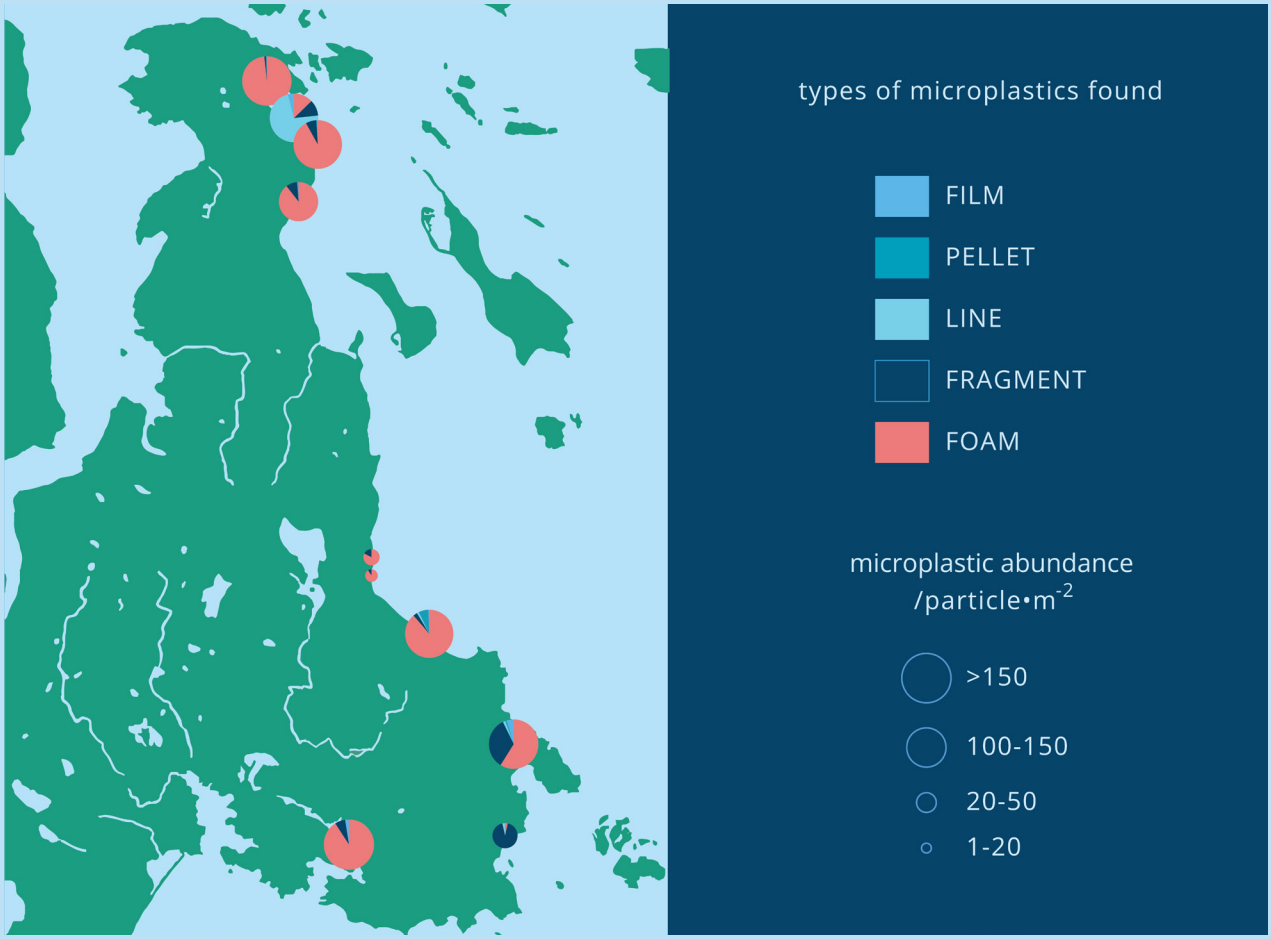


Figure 3. The patterns of microplastic abundance and composition in the study

NEXT STEPS

Through collaborations with Canadian and international beach cleanup organizations and schools, additional microplastics data will be collected using the Community Science Toolkit in the fall of 2022. The long-term program goal is to establish an international network of communities collecting visible shoreline microplastics data with standardized tools. This initiative will contribute to a better understanding of microplastic patterns in coastal ecosystems, engage communities in research and action and contribute to the UN Sustainable Development Goals.

Visit www.oceandiagnostics.com
to learn more or become a Community Scientist!

ABOUT OCEAN DIAGNOSTICS

Ocean Diagnostics is an environmental impact company that works with academia, government, industry, foundations, environmental firms and citizens to understand and address plastic pollution and biodiversity loss. We develop innovative technology, methods, lab capabilities and data platforms to assess abundances, sources, transport and fate of plastics, microplastics and microfibers for informed decision making.

ACKNOWLEDGMENTS

This study would have not been possible without the generous support of our volunteers who collected samples, tested procedures and contributed valuable input into tool and protocol design. We would also like to thank Dr. Peter Dietsch, Donald Gordon, The University of British Columbia's Oceans Leaders program and Ocean Legacy Foundation for helpful discussions on the polystyrene pollution problem in coastal British Columbia. This project was carried out with the support of Environment and Climate Change Canada.

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