



TRAPPING TRASH IN THE TORONTO HARBOUR

Plastic pollution, a pervasive and growing threat, has been reported in all five Great Lakes¹. An estimated 10,000 tonnes of plastic waste enters the Great Lakes annually, and can have negative impacts on wildlife^{2, 3}. Like many urban coastal areas, the Toronto Harbour has relatively high plastic contamination. With trash trapping technology, we can clean up and divert plastic and other anthropogenic debris from entering Lake Ontario via the Toronto Harbour. Over a 19-week period from July to October 2020, we diverted an estimated 13.1kg of anthropogenic debris (i.e., plastic and other litter), which included 84,854 pieces of microplastics and other small anthropogenic litter, from three Seabins installed in the Outer Harbour Marina. *Trash traps divert plastic pollution from our lakes while collecting data to inform policy and raise awareness within the community.*

WHERE IS THE MOST EFFECTIVE LOCATION FOR TRAPPING TRASH?

To identify litter hot spots and assess the amount of plastic pollution along the Toronto waterfront, we conducted visual audits from Ireland Park to Sugar Beach (Fig 1). At each location, we counted and categorized visible floating litter that was larger than a bottle cap (Fig 2). We found the most litter at Peter Basin, Marina Quay West, and Portland Slip with an average of 276, 53, and 46 pieces of litter respectively. The top three items were bottle caps, cigarette butts and large plastic fragments (rigid plastic pieces broken off from plastic objects such as packaging). These findings inform where to place future trash capture devices and also inform policy-makers of the types of materials littering the waterfront – all informing mitigation.

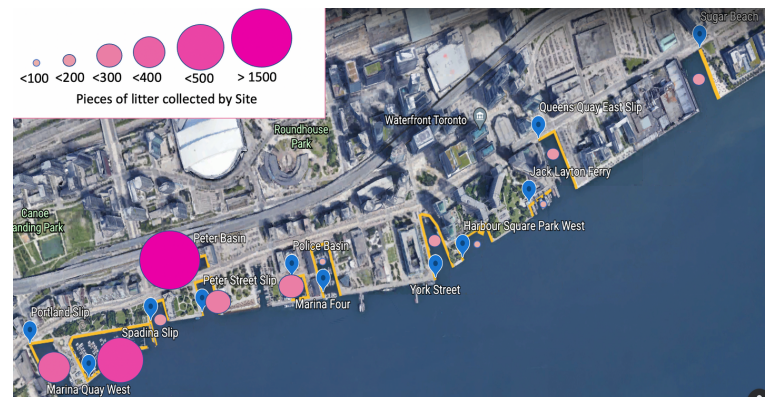


Fig 1: Map of the visual audit sites and the average amount of litter found at each.



Fig 2: Image of the litter found at Site 7: Marina Four along the Toronto waterfront during a visual audit.

SEABINS AT THE OUTER HARBOUR MARINA: WHAT DID WE TRAP?

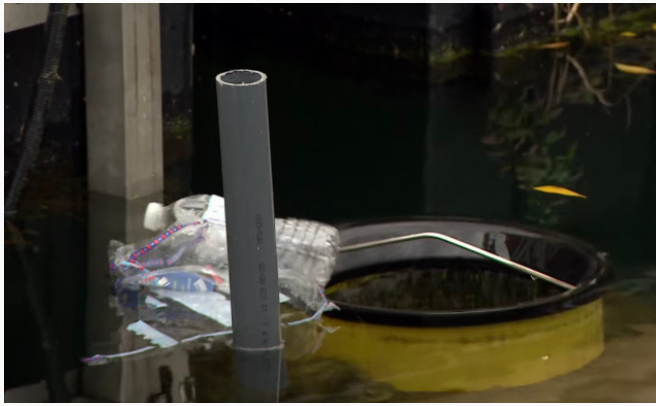


Fig 3: Seabin in the Outer Harbour Marina (CBC Toronto 2020).

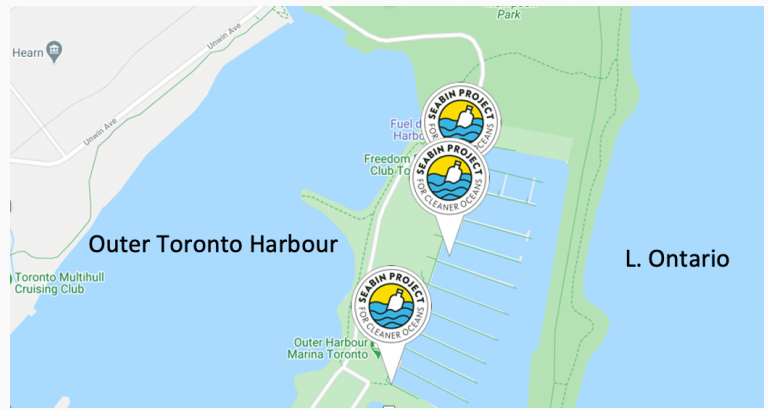


Fig 4: Location of all three Seabins in Toronto's Outer Harbour Marina in Lake Ontario.

During the summer of 2020, Ports Toronto deployed three Seabins (Fig 3) at their Outer Harbour Marina (Fig 4). Seabins, one type of trash trapping device, are like a floating garbage can that traps floating litter as it floats by. Throughout a 19-week period, we trapped and diverted an estimated 13.1kg of plastic and other anthropogenic litter, including 84,854 pieces of microplastics and other small anthropogenic debris. More than 11,000 of these microplastic pieces were pre-production plastic pellets from industry.

Although Seabins are designed to capture large debris, 84.5% of what we found was small anthropogenic litter. The top three items found were all categories of microplastics: hard plastic fragments, plastic film, and pre-production plastic pellets (Fig 5). Why? Good question! We discovered that floating algae and plant material, common in shallow and sheltered marinas, collect and accumulate small anthropogenic litter (Fig 6). Acting as a natural mesh, algae and plant material help capture the smaller size fraction of plastic litter. This is an important consideration when cleaning out a trash trapping device for two reasons: 1) investigating the organic material uncovers many trapped plastics, and 2) the organic material should be thrown away instead of tossed back into the lake. Combined, these results demonstrate the potential of trash trapping technologies, like Seabins, for cleaning urban bodies of water and diverting litter away from aquatic ecosystems.



Fig 5: Images of a fragment, film and pellet under a microscope.

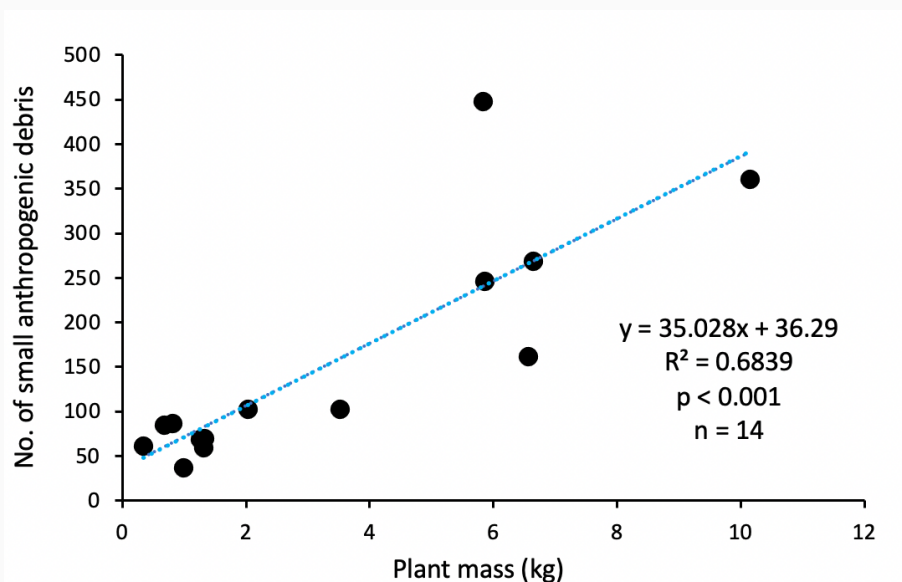


Fig 6: Regression plot depicting the positive correlation between the weight of the plant material and the number of small anthropogenic debris captured in the Seabin; Images depicting anthropogenic litter entrained in the plant material collected by a Seabin.



TRAPPING DATA TO INFORM POLICY:

The Toronto waterfront is littered with litter hot spots. Here, we demonstrate an effective solution for clean-up and diversion: Trash capture devices! These devices not only trap trash, but they collect information to inform next steps and relevant policy options.

1. Continue research on the potential sources and transport of plastic pollution in Toronto waterways.
2. Increase deployment of trash capture devices on the Toronto waterfront and across the Great Lakes.
3. Harmonize data collection from trash capture devices and create a network to collect and curate the data across all locations.
4. Use data collected from trash capture devices to inform policies around preventing plastic pollution (e.g., work with local industry to prevent plastic pre-production pellet loss to the Great Lakes).
5. Encourage collaboration between private industry and environmental stakeholder groups to understand how much of their waste leaks into the environment and prevent it from becoming pollution.
6. Increase public awareness and waste literacy to reduce plastic waste and pollution.
7. Encourage participation in community science with simple protocols and data collection apps.

INTERESTED IN GETTING INVOLVED?

We have created resources for local projects and partners and encourage anyone interested in trapping trash to use them as they can be applicable across the world. Check out our [resource page](#) for data collection protocols and tools for uploading your data.

REFERENCES:

1. Driedger et al., 2015, Marine Pollution Bulletin
2. Hoffman et al., 2017, Marine Pollution Bulletin
3. Earn et al., 2020, Journal of Great Lakes Research