

# From Shopping Carts to Cigarette Butts

## Mapping marine litter in Canada's Great Lakes using citizen science

Starting in September 2018, I did four months research for my final thesis, the last part of my study in Delta Management at the HZ University of Applied Sciences in the Netherlands. I was lucky to do this research project at the Water Institute of the University of Waterloo, in Ontario, Canada. In this story I share the most striking results of my research, where the main question was; "How can citizen science be utilized to measure marine litter in Canada's Great Lakes?"

The term "citizen scientists" refers to volunteers who participate as field assistants in scientific studies. Citizen scientists help monitor wild animals, plants or other environmental markers, but they are not paid for their assistance, nor they are necessarily even scientists (Cohn, 2008). Citizen science exists since 1900, where it started with the National Audubon Society's Christmas Bird Count. This is a national bird count project which started as an alternative for the annual Christmas hunt, and is now world's largest citizen science project (Silvertown, 2009). By applying citizen science, data on large time- and geographical scale can be collected.

The Great Canadian Shoreline Cleanup organises shoreline cleanups throughout Canada. They collect data about these cleanups via the volunteers who are asked to submit data cards after each cleanup. For this research a dataset containing information of all shoreline cleanups in Ontario during the period 2010-2017 was provided by the Great Canadian Shoreline Cleanup.

Within this dataset the information of all shoreline cleanups is linked to coordinates, which enables visualization of the information on ArcGIS maps. On the map in figure 1 all shoreline cleanups in Ontario in the period 2010-2017 are shown. The red and orange dots show the former shoreline cleanups, the green and blue dots show more recent shoreline cleanups. The number of

shoreline cleanups has almost doubled in the period 2010-2017.

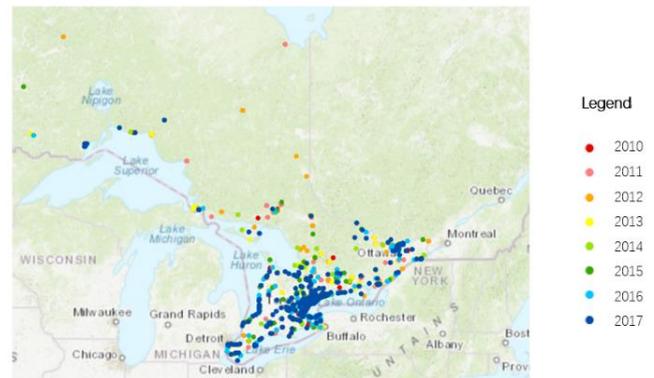


Figure 1 All shoreline cleanups in Ontario in the period 2010-2017, divided per year.

On the map, you can see most shoreline cleanups occurred in south-west Ontario, near Toronto. This is not a surprise since this is Ontario's most densely populated area. During most shoreline cleanups, less than 100 kg of waste was found, however in some shoreline cleanups more waste was found. Shoreline cleanups where more than 100 kg of waste was found occurred every year in the period 2010-17. In the last years, the number of cleanups where more than 100 kg of waste was found even increased. In several shoreline cleanups more than 1000 kg of waste was found. The shoreline cleanups where more than 1000 kg of waste was found mostly occurred in the years 2010-13, however in 2014 and 2016 this large amount of waste was found as well. The largest amount of waste was 4000 kg, which was found during a shoreline cleanup in 2011.

In December I presented my research results to staff who oversee the Great Canadian Shoreline Cleanup from World Wildlife Fund-Canada and Ocean Wise, organized by my colleague of the Water Institute. After I presented my results - a literature study on citizen science and the results of the analysis of the dataset provided by the Great Canadian Shoreline Cleanup - we first discussed citizen science. The Great Canadian Shoreline

Cleanup uses citizen science to collect and process data gathered by the volunteers of the shoreline cleanups. They said their most important goal is to organise shoreline cleanups serving as a social activity cleaning the neighbourhood and at the same time increase awareness about pollution of the environment rather than collecting scientific data about marine litter.

Next, we discussed the maps with the information of the shoreline cleanups I created. All the dots on the map contain information of only one shoreline cleanup at one specific moment. This does not give information about the flows and accumulation of marine litter. To research this, a designed monitoring program should be set up, where the same spots will be researched over a longer period. In some shoreline cleanups much more waste is collected than in others. This could be caused by different factors. First, the number of volunteers is important. It is understandable that a group of 150 volunteers can collect more waste than a group of two volunteers. Also the rate of pollution of the location of the shoreline cleanup matters. When this spot is not very crowded and there is no or little marine litter washing ashore, it is likely less waste will be collected in this shoreline cleanup. Finally, the kind of event where the shoreline cleanup is organised is important. Some shoreline cleanups where more than 1000 kg of was found were part of a large event, where even divers helped cleaning. Although those factors clarify the number of waste found, sometimes strange items are being found during shoreline cleanups.

The weirdest items found during shoreline cleanups, the top 10 most common items and more facts of the shoreline cleanups are visualized in an infographic. With WWF and Ocean Wise we discussed which data is most important and how this could be presented best to the volunteers of the shoreline cleanups. On the next page you can find the infographic.

.View the infographic and read the “Water Institute intern visually depicts seven years of shoreline cleanup data” story by the Water Institute.

### *Contact*

Would you like to receive more information about my research? Feel free to send an email to [imvanderwater@gmail.com](mailto:imvanderwater@gmail.com)

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### *References*

- Cohn, J.P. (2008). Citizen Science: Can Citizens Do Real Research? *BioScience* 58 (3), 192-197. <https://doi.org/10.1641/B580303>
- Silvertown, J. (2009). A new dawn for citizen science. *Trends in Ecology & Evolution* 24 (9), 467-471. <https://doi.org/10.1016/j.tree.2009.03.017>

# The Great Canadian Shoreline Cleanup

## Ontario

2010 - 2017

This infographic contains most important outcomes from the shoreline cleanups of the Great Canadian Shoreline Cleanup in Ontario in the period 2010 till 2017. This could not be done without the help of all volunteers, thank you!



Nearly **95,700** volunteers

Almost **263,000** kg of waste

In **3,947** shoreline cleanups



**6** trucks

... could be filled with all the waste found during the shoreline cleanups in Ontario.



**1.4** ha

... of land could be covered with the plastic bags found in Ontario. That is almost 3 soccer fields.

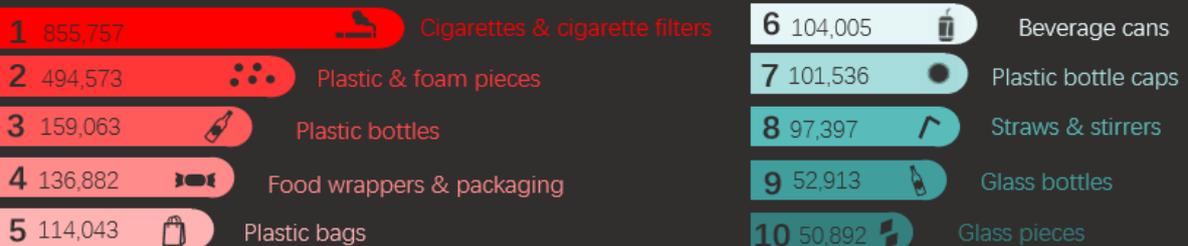


**156** animals

... were entangled in waste. 21 of them were alive and could be saved. Fish, birds, mice crayfish and other animals are found in plastic bags, jars, fishing lines, balloon tires and ribbons.

## The 10 most common items found during shoreline cleanups

\* These numbers are the total amount of litter items recorded by volunteers during shoreline cleanups in Ontario from 2010 – 2017.



## The most unusual items found during shoreline cleanups...

Cell phones & laptops    Artificial Christmas tree    Chairs    Shopping carts    Microwave  
Tires    Hair extensions & fake nails    Phone chargers    A truck door    Toys & dolls  
Underwear    Toothbrushes    Bikes & parts    Jerry cans    DVD's    Vacuum cleaner  
Pregnancy tests    Tents    A bed frame    Clothes    Diapers    Golf balls    & much more...