MIND YOUR PLASTIC

Please note, effective July 4, 2022 we have officially rebranded to Mind Your Plastic!

Mind Your Plastic's mission to eliminate plastic pollution in Canada.Through our work advocating with municipal government for policies that better regulate materials used in our economy, working alongside Canadian businesses to give consumers better plastic-free choices, and our direct action programming, like our Circular Economy Ambassador Program, we are moving towards a plastic pollution-free future for #PlasticFreeLand&Seas.

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PLASTIC™ OCEANS

INFORMING SOLUTIONS THROUGH CANADIAN CLEANUPS

PREPARED BY
Dayanne Raffoul

GOALS OF THIS REPORT

Determine the most numerous type of item polluting Canadian environments.

Consider current and innovative alternatives to mitigate pollution and diminish waste.

Educate the public on actionable steps and programs to reduce waste production.

Present solutions to stakeholders and policymakers to reach the zero plastic waste objective and provide methods to enhance youth's knowledge on the plastic debris issue

PLASTIC™ OCEANS

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EXECUTIVE SUMMARY

Plastic Oceans Canada launched the Circular Economy Ambassador Program (CEAP) in 2021. The CEAP worked with communities and educational institutions serving as a role model to promote the sustainability movement. Through this program, 243 students from schools across Canada conducted cleanups within their communities, collecting and recording a total of 6400 waste items. The success of this program demonstrates that not-for-profit organizations can contribute meaningfully to solving the plastic pollution crisis. The objectives of this initiative were to:

1) Classify and link waste in context to specific sources;
2) Suggest alternatives (i.e., mitigation strategies for waste); and
3) Identify potential alternatives to the status quo for disposal pathways.

The results of the cleanups showed that over 50% of the items collected were composed of plastic materials, in which the majority were plastic pieces and single-use food packaging. More waste was found in green areas, such as inland parks and waterways, compared to residential areas, schools, and coastal areas. Green areas produced more garbage, possibly due to the lack of conspicuous and available bins, and/or possible accumulation of waste due to fewer cleanups. One of the most common waste items collected from all the cleanups was cigarette butts. Several solutions to the most commonly found items were identified at different scales. For example, an effective solution for cigarette butts could be the installation of butts disposal at garbage bins or a recycling program.

Although there is a higher pressure on the government, to achieve effective long-term solutions to the issue of pollution, all the participants within the production and consumption systems need to be engaged, hence, the general public, stakeholders, policymakers, municipal/provincial/federal government officials, NGOs, science community and industries must contribute to the aimed changes.

"One of the most common waste items collected from all the cleanups was cigarette butts"

Furthermore, deeper knowledge on the subject of plastic pollution is required, mitigation and prevention plans need to be developed and a public behavioural change needs to occur, in order to reach the goal of minimizing waste and possibly reaching zero plastic waste in the near future.

WHAT IS THE ISSUE?

Since their creation, plastics have become an essential part of our economy. Plastics are lightweight, versatile and have a long life span, all of which have helped facilitate plastic becoming a global resource. However, today, those same characteristics that have made plastic a resource, also have made plastic become one of the main pollutants in the air, on land and within aquatic ecosystems. Plastic fragments have been found in all ecosystems across the globe (Barnes et al., 2009, Sul et al., 2011). Microplastics (plastic particles <5mm) are the most abundant type of plastic present within our oceans. Contaminants associated with plastics can enter the food web through microplastic ingestion (Rochman et al., 2014). Macroplastics (plastic particles >5 mm) are an internationally well-known pollutant, with notorious negative impacts such as entanglement of marine life, habitat destruction, ingestion and bioaccumulation of contaminants, which threatens marine animals and poses a health risk to humans (Pettipas et al, 2016). Although there is existing legislation to prevent marine plastic pollution, an estimated 10% of global plastics will still reach our oceans (Pettipas et al., 2016). In addition, globally, there are limited policies related to microplastic toxicity and impacts (Pettipas et al, 2016). Furthermore, land-based plastics are responsible for 80% of the plastics present within our oceans, and it has been negatively impacting all organisms from the bottom of the food chain to humans (Walker and Xanthos 2018).

Canada produces about 34 million tonnes of solid waste annually (Environment and Climate Change Canada (ECCC), 2021), in which over 3 million tonnes is composed of plastic (ECCC 2020). In Canada, there are limited management strategies for micro- and macro-plastics (Kershaw et al., 2011), the vast majority being shipped overseas for recycling. A major source of microplastics in the environment is the degradation of plastics, forming secondary microplastics within our environment. Canada has the longest coastline in the world and a high number of waterways, hence it has a high likelihood of transporting land-based waste into waterways. Therefore, priority should be given to educating the population on the impacts of plastic pollution, encouraging behavioural changes such as the use of reusable dishware, and promoting plastic reduction initiatives to prevent land-based plastic which will contaminate the environment.

About 20% of Canada's current population is composed of students within Elementary, Secondary Schools, and Post-Secondary schools (Statistics Canada, 2021). Educational institutions can play a major role in waste reduction, by promoting a circular economy within our communities.

CEAP 2021

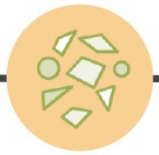
WHAT DID WE DISCOVER?

Plastic Oceans Canada launched the CEAP in 2021 to educate youth on the subject of plastic pollution and increase awareness of waste management strategies by introducing the concept of a circular economy within their communities. The program developed materials to aid teachers in the introduction of plastic pollution within an array of school subjects. Plastic Oceans Canada provided the participants with the necessary equipment and a step-by-step handbook to conduct one or more sustainable cleanups within parks, waterways, coasts, and residential/school zones within their communities. 243 participants across Canada fulfilled cleanups within their communities, where they collected, sorted and recorded the quantity and characteristics of each item (n = 6400), to divert waste from landfills where possible. This program allowed students to witness the debris that can be found within the environment, identify potential sources, consider risks and determine possible solutions. Students were inspired to make behavioural changes through the CEAP program. Therefore, by implementing changes to our educational system we can address the concerns linked to waste management, including plastic pollution.

2021 CEAP Collection Results

PLASTIC OCEANS

PLASTIC PIECES



- Plastic Pieces Small (0-10 cm) (15%)
- Plastic Pieces Medium (10-30cm) (5%)
- Plastic Pieces Large (>30cm) (1%)

21%

CIGARETTES BUTTS

- Cigarette Butts (19%)

19%

COMMONLY FOUND ITEMS

- Paper (7.8 %)
- Bottle caps (2.8%)
- Can Tabs (1.4%)
- Straws (1.3%)
- Plastic Cutlery(1.1%)
- Other (3.4%)

18%

MISCELLANEOUS

- Aluminiun/Tin Foil (3.19%)
- Unknown Wrap (0.5 %)
- Rubber Pieces (0.4%)
- Rope (0.4%)
- Other (6.7%)

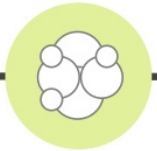
11%

FOOD PACKAGING

-Food Packaging (9.3%)

9%

STYROFOAM PIECES



- Styrofoam Pieces Small (0-10 cm) (3.8%)
- Styrofoam Pieces Medium (10-30cm) (1%)
- Styrofoam Pieces Large (>30cm) (0.2%)

5%

GLASS

- Glass Fragments (3.6%)
- Glass Bottle (0.5%)

4%

PLASTIC BAGS

- -Unknown Bag (0.7%)
- Ziploc Bag (0.4)
- Shopping Bag (0.3%)
- Garbage Bag (0.3%)

2%

FACE MASKS

- Disposable (1.8%%)
- Reusable (0.2%)

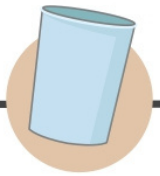
2%

CANS

- Can (2%)

2%

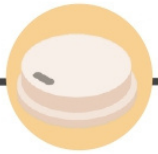
CUPS



- Hot Drink Cup (1%)
- Cold Drink Cup (1%)

2%

LIDS



- Hot drink Lid (0.7%)
- Cold Drink Lid (0.7%)

1.4%

PLASTIC BOTTLES

-Plastic Bottle (1%)

1%

TAKE-OUT CONTAINERS

-Take –Out Containers (1%)

1%

Total Waste= 6400 items | **53% Plastic** | **27% Single-Use Plastic**

Participants filled out the tally sheets with the quantities and details of the items, along with location details such as the presence of roads, stores, restaurants, storm drains, and other activities that occurred around the cleanup location. The data collected was organized and analyzed by Plastic Oceans Foundation Canada (POFC). The total number and percentages of items collected within each category and cleanup location were calculated.

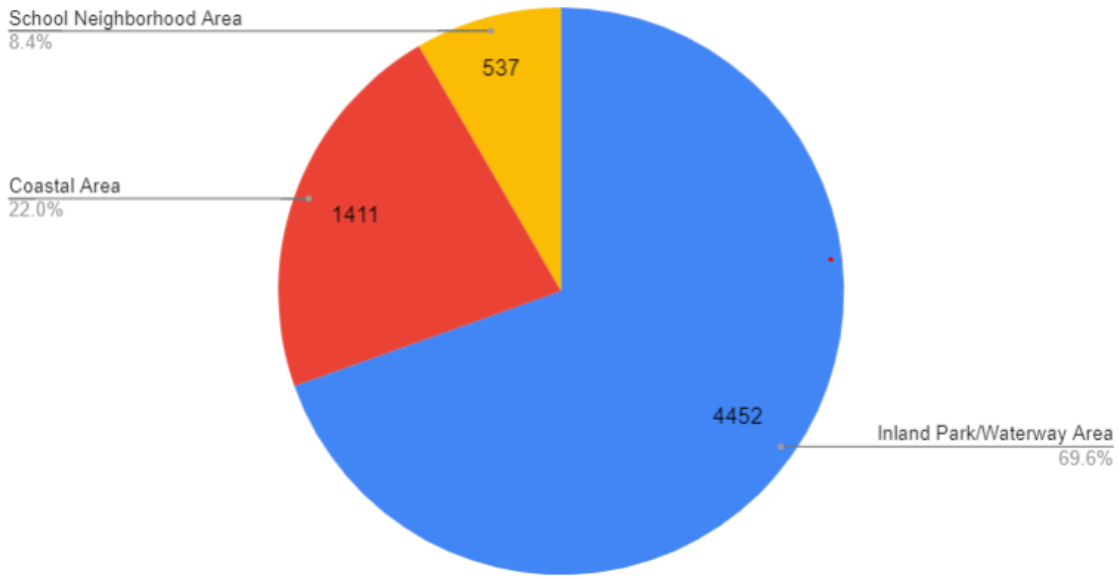


Figure 2: Comparison between the type of location and total counts/percentage of items collected. The ten different cleanup locations were combined under a common type of locations.

POTENTIAL SOURCES

A total count of 6400 items was collected across all cleanup locations in the CEAP. It must be considered that this number is only a fraction of what can be within the environment as a whole.The participants conducted cleanups in ten different locations chosen by the students based on their accessibility to the location. These were inland parks and/or waterways, coastal areas and school neighbourhood areas. The locations with the most waste collected were areas within inland parks/waterways (n = 4452) where participants collected 2158 items composed of plastic material. Coastal areas had the second most amount of collected waste (n = 1411) where 896 were composed of plastic. School neighborhood areas had the least amount of waste collected (n = 537) of which 305 were composed of plastic.

Inland Park/Waterway areas had the most collected waste count (n = 4452). This is possibly due to the fact that the population is higher within these areas, and garbage/recycle bins were not always available within these cleanup areas. In addition, at least one of the top three categories with the highest number of items collected within each location were composed of plastic-based items or recyclable items. Possibly the lack of knowledge on recycling and the importance of waste management could also be a factor that is causing recyclable materials to be littered. Several Canadians may still be unaware of what exact items are recyclable. Further education on the topic may be necessary to prevent confusion on this matter.

POTENTIAL SOLUTIONS AND/OR ALTERNATIVES

Every year, over 240 million tons of plastic waste is produced globally, where about half is composed of single-use materials (Mathalon and Hill, 2014). Over half (52.3 %) of the waste collected by the participants of the CEAP was composed of plastic. The most common items were plastic pieces (21%; mostly small plastic pieces (0-10cm)), and single-use plastic items (27 %; mostly single-use food packaging;). Identifying and collecting plastic items is much easier for macroplastics than small plastic due to their size and ability to identify the item, which is not the case for microplastics that can be further fragmented resulting in their current abundance in the environment. In addition, identifying the source of microplastics and the time it has been present in the environment is still a challenge. According to Lebreton et al., 2019 about 79 % of macroplastics found on shorelines were produced in the last 15 years, while offshore microplastics were produced in the 1990s or earlier. Therefore, plastics are persistent and may take decades to fragment and accumulate in the marine environment.

Paper is another material that has become essential within our economy and society. However, its production and transportation have a detrimental impact on our environment. This marine issue has a land-based solution, since marine debris originates from land sources. The majority of the most commonly found items within the cleanups are recyclable, reusable and/or have sustainable options. Hence, the motives which are currently preventing these items from being appropriately disposed of need to be identified, so that individuals, government officials and stakeholders can provide solutions to prevent waste from reaching our ecosystems.

2021 CEAP – Solutions and Alternatives

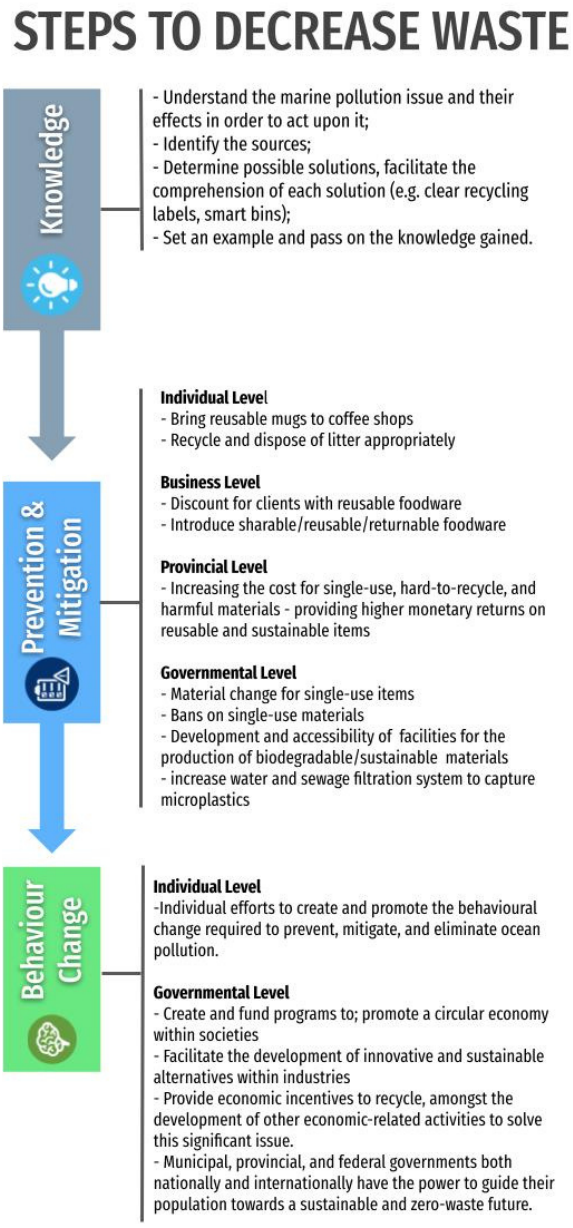
PLASTIC OCEANS

	CANADA	CEAP	POTENTIAL SOLUTIONS	ALTERNATIVES
PLASTIC & SINGLE-USE ITEMS	➢ About 50% of the annual plastic waste in Canada is composed of single-use plastic products	➢ Over one-third (36%) of the waste collected by CEAP participants was composed of single-use materials; ➢ in which 27% was composed of plastic single-use items ➢ Food Packaging was the most collected single-use item and it was present within all cleanups locations	➢ Environment and Climate Change Canada (ECCC) used the Management Framework for Single-use Plastics to consider the elimination or restriction of the following: ➢ Plastic checkout bags, stir sticks, 6-pack rings, plastic cutlery, straws and food service ware.	➢ Smart food packaging, usage of recyclable or sustainable material in food packaging. ➢ Encourage the establishment of zero-waste shopping stores/aisles, such as the NU Grocery in municipalities. ➢ Where plastic is not phased out (health care), plastic can be reused by repurposing materials to make new items (e.g. bedding, clothing, footwear, etc.)
CIGARETTE BUTTS	➢ Canadians litter about 8,000 tonnes of cigarette butts annually (TerraCycle 2021). ➢ Similar to plastics, cigarette butts are not biodegradable and require several years to break down and decompose	➢ Cigarette butts were the most collected single item within the CEAP's cleanups and it was also the most collected item within the Great Canadian Shoreline Cleanup. ➢ The source could possibly be due to the fact that the cleanup areas may have lacked cigarette butt disposal	➢ Municipalities could invest in butt stations near garbage cans to decrease the fire-hazard of cigarette butts disposal in garbage bins and to prevent littering. ➢ Create awareness on programs such as TerraCycle's "UNSMOKE Cigarette Recycling Program", which recycles cigarette butts into plastic pallets, ashtrays and benches.	➢ Provide pocket ashtrays with the purchase of cigarette packs, and/or a reward program that provides a discount on the purchase of cigarettes when the consumer returns the cigarette waste to be recycled. ➢ Promote a circular economy within communities.
PAPER	➢ In order to produce 1 kg of paper about 324 L of water is required ➢ Out of the 6 million tons of paper products used annually in Canada, only 25% is recycled. ➢ While two large trees produce enough oxygen for a human to breathe within a year, about 19 trees are needed to produce one ton of paper.	➢ Businesses have removed/replaced plastic single-use materials to paper alternatives, increasing the demand for paper materials. The increased usage of paper foodware along with the demand for take-out due to the pandemic, could be possible reasons for the high presence of this material within all the cleanup locations.	➢ Increase paper recycling in communities is essential to divert from landfills, it benefits our health and well-being by diminishing deforestation, water contamination and waste. ➢ There are several reusable, digital, and sustainable alternatives to paper material items.	➢ Go paperless in the office and at school by storing/submitting documents online ➢ Bring reusable containers and mugs to coffee shops ➢ Use washable napkins/cloths ➢ Use a french press instead of coffee cups/filters. ➢ Use the zero-waste Terra Cycle's Loop platform program to decrease packaging waste.
ALUMINUM / TIN FOIL	➢ The capital of Canada, Ottawa, accepts both clean and food-soiled aluminum foil within its blue recycling bin	➢ It is thought that aluminum/tin foil is recyclable only if it has not come in contact with contaminants, such as food. This could be the possible reason for finding so many aluminum/tin foil-based items within the different cleanup locations.	➢ Scientists in Ireland led by Ahmed Osman (2017) discovered that soiled aluminum waste can be used to produce aluminum chloride crystals to make alumina catalysts with higher surface area, higher purity, and more financially accessible.	➢ If the Canadian population is informed about the soiled tin foil recycling process, and municipalities adopt this recycling option the littering of this material can potentially be prevented.

WHAT IS NEEDED TO DECREASE WASTE?

Students were inspired to make behavioural changes through the CEAP program. A certain number of students identified their local waste and wrote letters to local businesses responsible for the items that had been found during the cleanup, to advocate for a change of the material being used. Therefore,

By implementing changes to our educational system we can address the concerns linked to waste management, including plastic pollution.



The scientific community has established that land-based activities are mostly responsible for marine debris (Thompson et al., 2009). Litter can be easily transported from land-based activities, through our waterways, storm drains, weather, accidental loss during transportation of waste and products (Hartley et al., 2018). Hence, this significant marine issue has a land-based solution in which the Circular Economy Ambassador Program aims to raise awareness by educating the youth within Canada, by providing them with a personal experience with the presence of litter within their communities.

KNOWLEDGE

Basic knowledge on the issue of marine litter and its effects are required to establish solutions. The participants gained deeper knowledge on this subject by conducting cleanups. The study by Torres et al. (2019), showed that upon understanding the marine litter problem and its sources, students were willing to adopt sustainable behaviours, such as making an effort to recycle, or prevent littering by placing waste in garbage bins. In the same study, students identified sources, such as laziness and absence of trash bin near vicinity, and it was discovered that adult behaviour influenced the youth's understanding and action on waste management.

However, the lack of understanding and clear recycling labels may be associated with littering. Therefore, government officials should facilitate the comprehension of recycling through clear recycling instructions on all products. Municipalities can also adopt the approach developed by Intuitive AI, the usage of smart bins that scan items and inform users if the item is recyclable, compostable, or if it should be placed in the waste bin. Further educational activities and conspicuous recycling instructions are necessary to involve both adults and youth to create an effective behavioural change towards enhancing waste management through a circular economy.

PREVENTION AND MITIGATION

Although several international guidelines and legislations exist, such as the Ocean Conservancy's Ocean Climate Guide to Action and Save Our Oceans Act, enforcement of policies against marine plastic pollution is still limited. In addition, further national and international policy on plastic pollution is required, especially targeting microplastics. Enhanced actions will be needed to prevent plastic pollution, but there are several possibilities, including material redesign, bans, and improved waste management. For example, improved product design and biodegradable materials can reduce plastic emissions. Action can be taken at different scales, from small actions within individual homes to changes at the industrial-level. As Howard Zinn would say, "Small acts, multiplied by millions of people, can transform the world."

When plastics enter the environment their removal is challenging. Although there have been numerous creative and innovative methods to aid in the waste and plastic removal from oceans, if the origin of the problem is not solved, marine litter will continue to be produced. Additionally, the waste removal activities inland, coastal, and offshore are costly and are only short-term solutions (Newman et al., 2015). The current linear economy established by several countries requires an unsustainable quantity of resources that negatively impacts our environment, health and economy (Williams and Rangel-Buitrago, 2019). The alternative of a circular economy allows products to be manufactured to have longer life spans to increase their usage time, resources are shared within the community, while retailers manufacture, reuse and recycle items into valuable options to be reinserted into the economy (ECCC, 2021) providing long-term solutions for waste management.

If plastic waste is managed within the circular economy, by 2030 the positive impacts are numerous, for example, 1.8 million tons of carbon pollution will have been reduced, 42,000 jobs will be created and revenue worth billions of dollars within Canada will be provided (ECCC, 2021). This is possible because the circular economy maintains valuable materials and resources within the economy itself instead of disposing them. Yet, since this is still an innovative concept, Ministries of Education across the country need to insert introductive courses within the education curriculum on the subjects of waste management, circular economy, and ocean education, which are still required. The educational background can encourage behavioural changes within youth (Kershaw et al., 2011) to teach the future generation, from an early age, that a single item can be utilized in different settings prolonging its life span and usage.

BEHAVIOUR CHANGE

Individual efforts are essential to create and promote the behavioural change required to prevent, mitigate, and eliminate ocean pollution. However, as seen throughout this study, governmental action is crucial. Government members, policymakers, and stakeholders have the resources to educate, promote change, and reinforce changes through policymaking.

FUTURE CONSIDERATIONS

GOVERNMENTAL ACTIONS

The presence of marine debris is not a recent issue, but its detrimental effects have increased exponentially in the past few decades, hence urgent solutions are required to prevent further harm to our ecosystems, health and economy. Throughout the Circular Economy Ambassador Program by Plastic Oceans Canada, it was noted that within all the cleanup locations, at least one of the top three categories with the highest number of items collected, were composed of plastic-based items. These results verify that plastic is the dominant pollutant. Several possible sources for items collected were identified and potential solutions were discussed to prevent further littering. However to reach the goal of Zero-Waste by 2030 the Canadian government needs to establish and be involved in several activities. While NGO's, stakeholders, companies can continue to conduct shore cleanups to identify the most commonly found items, to develop a plan to eliminate or develop sustainable alternatives that can be further funded and promoted by governments (Waters et al., 2009). Mitigation plans need to be established with urgency, since reversing the current situation will be a slow process.

In order to promote a circular economy government officials can consider the following approaches:

PROMOTING CIRCULAR ECONOMY	
ECONOMIC ASPECTS	**POLICY-MAKING & LEGISLATION**
1. Increase costs on single-use materials (Williams and Rangel-Buitrago, 2019). 2. Increase monetary incentives for users of recyclable and reusable items. 3. Fund and provide incentives to companies for the development of innovative technologies that use less plastic. 4. Apply household taxes based on lack of waste diversion or subsidies to improve material capture 5. Increase the fine values of littering. 6. Provide funding to install numerous garbage/recycling/compost bins with the cities' green areas. 7. Develop the necessary infrastructure needed to produce, process and recycle sustainable materials and increase its accessibility to municipal services. 8. Establish funding through grants towards the development of primary and secondary school courses on waste management, ocean pollution, and the importance of a circular economy.	1. Transfer the pollution responsibility and cost to the industry producing the pollutants (e.g., Extended Producer Responsibility). 2. Increase the consequences for littering both inland and on water. 3. Promote the deposit-refund programs to be used by the public. 4. Encourage the diffusion of waste-free stores/aisles. 5. Enhance the reinforcement and monitoring of legislation and regulations of litter/recycle/composting. 6. Gradually prohibit certain types of wastes, helping the public to slowly adjust to a circular economy concept. 7. Create campaigns alongside the media, and develop programs to further educate the public on the issue, or promote current programs and associations, 8. Develop a policy in which infrastructures are required to consider the disposal/recycle/reuse, and environmental impacts before choosing the products' material and design preventing harm to the environment and its inhabitants. 9. Use scientific research to aid in the decision-making process when developing policies to introduce and maintain a circular economy within national and international communities.

PLASTIC OCEANS CANADA
CIRCULAR ECONOMY AMBASSADOR PROGRAM

The limitations within the 2021 CEAP program should be considered and incorporated in the following cycle of the program. Spatial distribution of items should be included within the data collection in order to determine the amount of waste found within a specific area. Greater significance on the data collection on plastic types and colour should be encouraged. Furthermore, a possible comparison between the amount of waste collected, spatial distribution within the location, participants' age, number of participants and cleanup durations should be considered.

Further scientific research is necessary to attempt to identify the sources of the items collected within cleanups. Primary focus should be given to small plastic pieces, since identifying the precise source was a challenge within this initiative.

CONCLUSION

Source identification of the items found within the Circular Economy Ambassador Program was essential in order to find solutions to mitigate, reduce and eventually prevent plastic pollution. The data collected here shows the most common items, and can help inform policies and product design modifications to reduce waste. It was discovered that 50% of the items collected were composed of plastic materials, in which the majority were plastic pieces and single-use food packaging. However, the most collected single item was cigarette butts. It was also distinguished that more waste was found in green areas such as inland parks and waterways and paper was the most collected item under the category of Commonly Found Items. Although cleanups are effective, they are short-term solutions. In order to achieve long-term results, a structural change is required.

Despite the fact that Canada has several NGOs which focus on ocean education, sustainable use of resources, promotion of a circular economy, and awareness creation on the impact of pollution on ecosystems, the secondary educational system lacks courses that prioritize environmental studies. Therefore, promoting waste management and ocean education within schools can aid in the mitigation of ocean plastic pollution. Youth can acquire skills, such as conducting efficient waste disposal, which can eventually develop into a habit that can be diffused within their community and be passed down to the next generation. Furthermore, youth can demand changes from industry and government to implement changes in materials and policy. However, in order to achieve effective long-term solutions to this issue, all the participants within the production and consumption systems need to be engaged, hence the general public, stakeholders, policymakers, municipal/provincial/federal government officials, NGOs, science community and industries must contribute to the aimed change. Since to reach the goal of minimizing waste and possibly reaching zero plastic waste, knowledge on the subject is required, mitigation and prevention plans need to be developed and a public behavioural change needs to occur.

ACKNOWLEDGEMENTS

We would like to thank all the participating schools that took part in the CEAP cleanups. We are appreciative of our supporting partners and all the members within the Plastic Oceans Canada team.

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