

Microplastics in the Great Lakes Workshop Report

FINAL REPORT

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INTERNATIONAL JOINT COMMISSION
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Acknowledgements

This report on microplastics in the Great Lakes is the product of a binational workshop that involved numerous experts from Canada and the United States. The International Joint Commission expresses its sincere appreciation to the many experts from multiple government, academic, non-governmental organizations, and industry who participated in the workshop. Their collaborative efforts have led to recommendations that the Commission may provide for consideration by the governments of Canada and the United States in addressing microplastic pollution in the Great Lakes. This report is based on the workshop report prepared by Barb Sweazey (Stratos, Inc.) that was reviewed and modified by IJC staff.

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1 Executive Summary

The International Joint Commission (IJC) convened a two day workshop on April 26-27, 2016 in Windsor, Ontario, Canada to discuss Microplastics in the Great Lakes. The purpose of this workshop was to develop 5-10 recommendations for the IJC to reflect upon and potentially forward to the governments of Canada and the United States for their consideration to help address the challenges posed by microplastics pollution in the Great Lakes. The IJC held this workshop and developed this report because of the concern posed by the presence of microplastics and their potential to cause impacts to the Great Lakes ecosystem and human health. Furthermore, the IJC recognizes this as an opportunity for the governments to abide by the principles of “prevention” and “precaution” that guides them in achieving the objectives of the Great Lakes Water Quality Agreement.

The workshop brought together 33 experts from diverse sectors and from both countries. The development and prioritization of the recommendations that emerged from the workshop was accomplished through a series of brainstorming sessions followed by a voting process by participants, and is not reflective of a group consensus. Ten recommendations were identified by workshop participants and are listed in order of priority below. The IJC will give consideration to these recommendations in drafting their own recommendations. The IJC will post their draft recommendations on the IJC website for public input before issuing final recommendations to governments.

1. Communicate results of research to share information with the public of all ages and decision makers, through the development of Great Lakes focused educational materials.

Develop educational materials, geared toward the general public, school children and decision makers that promote education and awareness of plastics and microplastics issues in the Great Lakes. This material could include how plastics are used in the Great Lakes, their degradation into smaller particles, where they end up in the environment, their environmental and human health impacts, how plastics are managed and volunteer clean-up programs. The goal would be to enhance environmental literacy to make informed decisions, leading to positive actions and changes in behavior to reduce the amount of plastics (and ultimately microplastics) entering the waters of the Great Lakes.

2. Encourage prevention of plastic marine debris through changing behavior by using education, outreach, policy and market-based instruments.

Plastics provide many useful benefits to society including, improved hygiene, reducing food waste with packaging that extends shelf-life, durability and convenience. However, it is critical to properly manage these products so they do not enter the environment. Prevention of plastic marine debris should be accomplished through a combination of approaches and tools. Using education and outreach to improve environmental literacy of plastic/microplastic issues, including the promotion of proper disposal and recycling of plastic materials, can lead to changes in behavior to reduce and prevent plastics from entering the Great Lakes. Market-based instruments, such as bans and fees for single-use plastic items (e.g. bags, water bottles), may be another useful tool to reduce marine plastic debris. Before instituting such market-based instruments a review of their efficacy, including environmental costs to alternatives, is needed so that those that are most effective and protective of the environment are promoted. The plastics industry in the U.S. and Canada, through the American Chemistry Council and the Canadian Plastics Industry Association, are involved in a number of national and international programs and initiatives to prevent and reduce marine plastics debris. The Operation Clean Sweep Program in particular is a good model that promotes the prevention of pre-production plastic pellets, flakes and powders from entering

the marine environment, from manufacturing to end-use, through the use of best practices. Other efforts should be encouraged to develop and promote industry-driven, rigorous and quantitative plastic capture and reduction initiatives, including a formal certification process that industry can promote and incentivize. The governments should also explore the requirement for industry to use an Extended Producer Responsibility (EPR) framework to promote the prevention of microplastics in the Great Lakes. EPR is an environmental policy approach in which the producer's responsibility for a product extends beyond the manufacturing stage to the management of the products at their end-of-life stage.

3. Assess the impacts of ecological and potential human health impacts using an ecological risk assessment framework (exposure/hazard).

While research on ecological and human health impacts continues to evolve, it is limited in freshwater systems and even more so in the Great Lakes region. There are several gaps in knowledge that exist including, the need for a better understanding of the bioaccumulation of plastics and associated contaminants in food webs and their ecotoxicological consequences; implications of different sizes and shapes of plastic particles; and potential risks to human health through the trophic transfer of plastics and associated toxics. Investments should be made to establish a comprehensive Great Lakes ecosystem risk assessment framework to inform policy and mitigation efforts. Impact studies should test the effects of microplastics and associated toxic chemicals on organisms at environmentally relevant concentrations (i.e. dose matters).

4. Compare and analyze existing programs and policies for reduction and prevention of plastic marine debris and promote those that are good models for plastics management.

There are several programs that currently exist that could serve as models for plastics (and ultimately microplastics) management in the Great Lakes, including the NOAA Marine Debris Program (and associated Great Lakes Marine Debris Action Plan), the EPA's Trash Free Waters Program, Operation Clean Sweep and the Responsible Care Program (Chemical Industry Association of Canada). By comparing and analyzing existing programs and policies, good models for plastics management can be highlighted and promoted in the Great Lakes region.

5. Invest in solution-based research, including innovative product development and water infrastructure improvements.

Investments should be made in research that focuses on solutions to prevent plastics and microplastics from entering the aquatic environment of the Great Lakes. This could include innovative product development, such as research to reduce the shedding of microplastic fibers from textiles through modifications to the manufacturing process or materials used; and improvements to water infrastructure (e.g. green infrastructure or wastewater infrastructure) to capture plastics/microplastics before entering the environment.

6. Conduct modelling to determine the sources and fate of microplastics in the Great Lakes.

Studies have demonstrated the presence of microplastics in various environmental media in the Great Lakes region. Several gaps in knowledge exist with regard to source and fate of plastics in the Great Lakes environment including, the rates and mechanisms by which different plastic debris degrades; the sources, abundance and distribution of microplastics in the environment; and degradation behavior and ultimate fate in the environment. The development of conceptual models for the life-cycle of plastics is needed in order to understand the flux of plastics between environmental compartments. Overall, a better understanding is needed of the sources of microplastics (e.g. fibers, pre-production pellets), their

pathways to the environment (e.g. wastewater effluent, overland runoff, sewage sludge application) and their fate in the environment.

7. Enable the plastic industry, its clients and other Great Lakes stakeholders to enhance effective management and implementation of reduce, reuse, and recycle programs.

The plastics industry in the U.S. and Canada, through the American Chemistry Council and the Canadian Plastics Industry Association, are involved in a number of national and international programs and initiatives to prevent and reduce marine plastics debris. These broader programs and initiatives potentially contain a wealth of best practices and lessons learned that can be shared and promoted in the Great Lakes region. Creating a collaborative environment for the plastics industry and Great Lakes stakeholders, would assist in this sharing effort and encourage continuous improvement for plastics and microplastics management through reduce, reuse and recycle programs. One example of an activity to promote the prevention of microplastics entering the Great Lakes is Extended Producer Responsibility (EPR). EPR is an environmental policy approach in which the producer's responsibility for a product extends beyond the manufacturing stage to the management of the products at their end-of-life stage.

8. Promote improved waste management and debris removal.

Improvements in waste management can include actions as simple as municipalities providing lids for recycling bins or seeking tools or opportunities that support harmonized waste management. Various waste management tactics employed at municipal and regional levels (e.g. covered recycle bins, single-stream recycling) should be explored and those that are most effective promoted. For example Multi-Material British Columbia seeks to expand materials collected for recycling as well as to expand the access to recycling programs in the province. Additionally, volunteer beach/shoreline clean-up programs are not only an effective tool for the removal of plastics, but the data collected can help in the identification and prioritization of prevention strategies for local issues. The integration of volunteer datasets collected from these clean-up efforts should be integrated with other research to help answer questions about plastic marine debris sources and inform policy makers in developing management efforts in the Great Lakes.

9. Develop and strengthen binational Great Lakes linkages to support sharing of research, education and outreach programs, and best management practices.

Research, education and outreach programs and best management practices for preventing microplastic pollution should be shared broadly with the Great Lakes community. There are several organizations and programs that can help to promote this sharing, including the International Association of Great Lakes Research, NOAA's Sea Grant Program and Marine Debris Program, Great Lakes Beach Association, and other Great Lakes NGOs.

10. Develop and/or adopt standardized sampling and analytical methods for microplastics.

Since this area of research is new, analytically challenging, and evolving, standard operating procedures (e.g., to reduce inadvertent sample contamination, analytical controls) for sampling and analysis need to be developed and/or adopted. The use of standard methods are needed to understand sources, pathways, and potential risks of microplastics in the Great Lakes and for policy makers to be able to take meaningful action and identify what constitutes measurable success. For example, the National Oceanic and Atmospheric Administration (NOAA) has developed sampling and analytical protocols for microplastic particles in the size range of 0.333 mm – 5 mm that can be encouraged to be used in microplastics sampling and research. There is also a need to develop/utilize sampling and analytical methods able to measure plastic particles at sizes smaller than 0.333 mm.

2 Introduction

Studies have documented the occurrence of plastic debris, including plastic bags, bottles, boxes, fibers, microbeads, and cigarette butts, in marine and fresh waters including the Great Lakes (Eriksen, et al.; 2013; Casteneda, et al., 2014; Driedger et al., 2015, Zbyszewski et al., 2014). It is recognized that larger plastic debris can degrade into smaller microplastics, and it is these smaller particles that are of particular concern. While there is no internationally agreed upon size classes for plastic debris, “microplastics” generally refer to particles between 0.33 mm and 5 mm in size, with plastics larger than 5 mm referred to as “macroplastics” (Driedger, et. al., 2015). Microplastics encompass a range of categories including, microbeads from personal care products; fibers from synthetic clothing; pre-production pellets and powders; and fragments degraded from larger plastic products. Little is known about the fate of these smaller plastic particles, but they can potentially be ingested by aquatic organisms, leading to a range of potential impacts including, physical effects; toxicological effects from adsorbed chemicals; and the trophic-transfer of plastics and toxins along the food web, to humans.



Photo Credit: 5 Gyres

Under the Great Lakes Water Quality Agreement (the Agreement) the governments of the U.S. and Canada, in achieving the objectives of the Agreement, are guided by the principles of “prevention” and “precaution”. The two governments have made great strides in addressing the issue of microbeads through legislation enacted in the U.S. and pending legislation in Canada. However, microbeads are a subset of the much broader issue of microplastics, which is a more complex problem requiring more complex solutions. To prevent microplastic debris from reaching the Great Lakes or its tributaries, the entire life cycle of plastic debris needs to be considered, including source reduction, recycling, and collection of refuse. Mechanisms to address this include regulatory and policy change, monitoring and research, along with clean-up efforts, education and outreach. The participation and collaboration of government, environmental organizations, industry, and academia is crucial to effectively address the microplastics issue.

The International Joint Commission (IJC) convened this workshop and developed this report because of the concern posed by the presence of microplastics in the Great Lakes and their potential to cause impacts to the Great Lakes ecosystem and human health. Additionally, the workshop and report also supports some of the IJC’s responsibilities under the Agreement including: identifying emerging issues, providing advice and recommendations to the governments of the U.S. and Canada on matters related to the Great Lakes, and facilitating binational collaboration and cooperation for stakeholders addressing a concern relating to the Great Lakes.

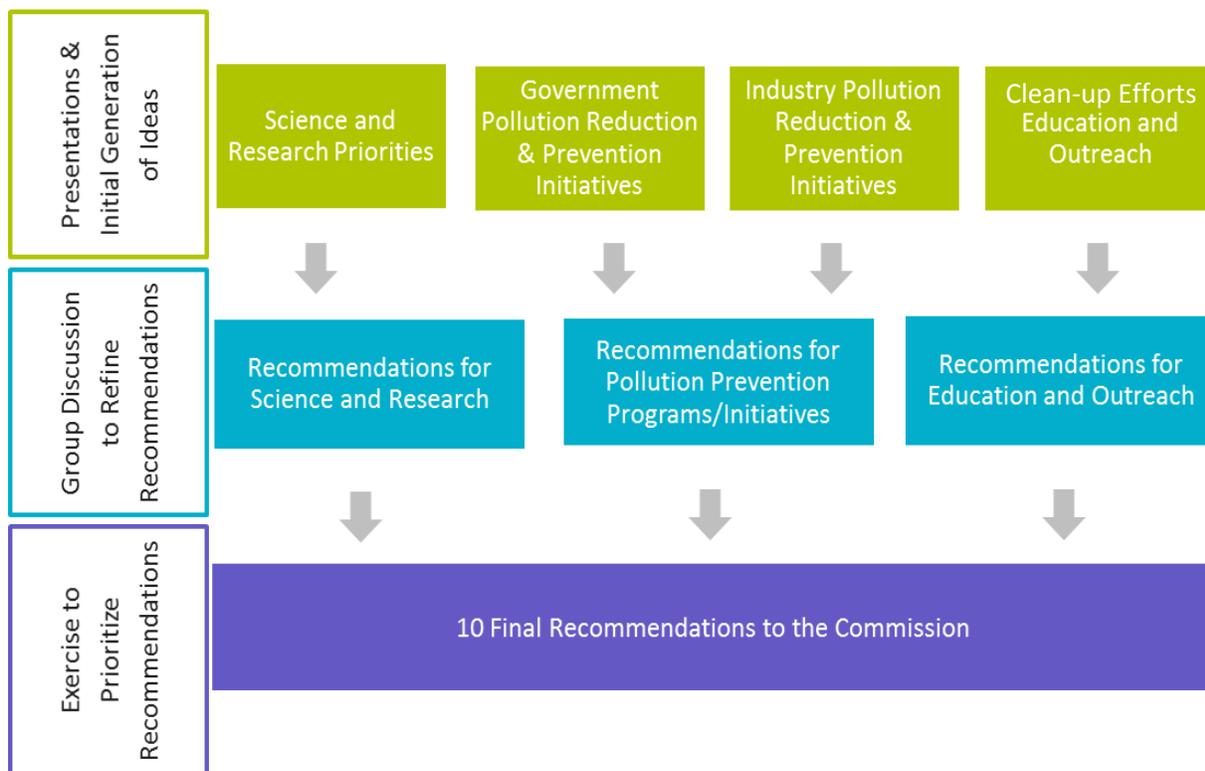
The workshop was held on April 26-27, 2016 and brought together 33 participants representing a broad range of sectors including Federal, State, Provincial, and Municipal governments, industry, non-profit organizations, and academia (Appendix A). The participants had extensive knowledge and experience in the science, policy, and outreach implications of local microplastic pollution. A contingent of Commission staff from Washington, Ottawa, and the Great Lakes Regional Office were also present, including three Commissioners.

This report provides an overview of the presentations, discussion highlights and recommendations generated at the workshop. Ten prioritized workshop recommendations (discussed in Section 6 of this report) emerged for the IJC to reflect upon and potentially forward to the governments of Canada and the United States for their consideration. Given the diversity of stakeholders present at the workshop, it is recognized that not all participants agree with or endorse all information, conclusions or recommendations developed through the workshop.

3 Workshop Overview

In advance of the workshop a request was sent to participants for initial ideas of possible recommendations. Based on this input, a list of preliminary recommendations was provided to participants as part of the pre-workshop package (see Appendix C). These preliminary recommendations formed the basis of session discussions and the further development of workshop recommendations around three broad themes: (1) Science and Research; (2) Pollution Prevention and Reduction Programs/Initiatives; and (3) Clean-up Efforts, Public Education and Outreach. These recommendations were modified, augmented and added to throughout the workshop.

The workshop consisted of presentations; group brainstorming sessions to create additional recommendations; and a voting process to prioritize the recommendations. The first phase of group brainstorming was done by diverse teams made up of participants from governments, industry, non-profit, and academia. A second phase of group discussion was completed by groups composed of participants with the same area of speciality (science, pollution prevention, or clean-up efforts, public education and outreach). This second phase allowed for the initial recommendations to be refined and grouped into key, overarching recommendations. These speciality groups then presented 3-4 key recommendations in plenary. Finally, participants engaged in an individual voting exercise to prioritize the recommendations produced by all of the speciality groups (see Section 6). This workshop overview is illustrated in the figure below.



4 Problem Statement

In order to guide the workshop discussion, a problem statement was framed in advance of the workshop and was discussed by the participants at the opening of the workshop. The problem statement has since undergone limited revision for clarity purposes.

“Microplastics come from many sources that are part of our everyday lives and are present in the Great Lakes. These microplastics may cause a range of adverse environmental and human impacts which we are only beginning to understand.”

Participants expressed both support as well as comments for consideration on the draft problem statement. Although there was no consensus in modifying the problem statement, individual workshop participants provided the following views:

- The statement needs to convey more urgency.
- Some adverse impacts have been demonstrated in laboratory and field studies; the word ‘potential’ should be removed.
- Agreement that plastics do not belong in waterways and litter should be reduced
- Enough is now known for a common-sense approach to be taken.
- Design and stewardship practices to reduce the amount of plastic products manufactured, to potentially reduce their release to the environment, is needed.
- Socio-economic impacts should be added to the list of impacts in the problem statement

- Microplastics are difficult or impossible to remove once they enter the lakes and cause adverse environmental and human impacts.
- There is a need to develop continual bi-national policies that focus on reducing the problem.

5 Presentations and Initial Generation of Recommendations

This section of the workshop consisted of presentations by expert speakers grouped into four topic areas:

- Science and research
- Pollution reduction and prevention programs led by government
- Pollution reduction and prevention programs led by industry
- Clean-up efforts, public education and outreach

When creating their recommendations, participants were encouraged to:

- **Be specific**
- **Be pragmatic and realistic**
- **Be objective**
- **Be clear, concise and action-oriented**

Following each set of presentations, participants brainstormed potential recommendations based on the topic of the presentation in plenary. Below are key messages conveyed by each of the presenters.



Science and Research

Presentations

5.1.1 A Review: Plastic Debris in the Great Lakes

Presentation by Hans Dürr from the University of Waterloo

- Plastic debris of many sizes, including microplastics, have been found in surface waters as well as sediments of all of the Great Lakes, comprising quantities at least as elevated as in high-concentration areas (gyres) of the oceans. On beaches of the Great Lakes, generally more than 75% of all debris items found consisted of plastics. The largest share of the debris is made up of material related to recreational activities or smoking of beachgoers. Data collected by volunteer beach cleanups was invaluable in establishing these findings. The cost of combating litter in the Great Lakes has been roughly estimated to be upwards of US\$ 400 million annually.
- A limited amount of literature has been published on plastics in freshwater systems, and even less for the Great Lakes specifically, versus the oceans.
- Gaps in knowledge exist in understanding, the spatial and temporal distribution of plastic debris, its sources and environmental fate, and the ecotoxicological consequences of microplastics and associated contaminants on food webs, including humans.

5.1.2 Absorption of POPs on Microplastics and Impacts on Fresh Water Aquatic Organisms

Presentation by Lorena Rios-Mendoza from the University of Wisconsin Superior

- Plastics contain chemicals added during their manufacture and plastics can also adsorb persistent organic pollutants (POP), with an increasing ability to accumulate, transport and release POPs as the size of plastic fragments decreases.
- Both PCBs and PAHs have been found to be present on microplastics found in the Great Lakes and additional chemical analysis is currently underway.
- Gaps in knowledge exist in understanding: The implications of the different sizes of the plastic debris on the Great Lakes aquatic ecosystem; the impact of toxic chemicals (both adsorbed and those added during manufacture) and their transfer through the food web after these microplastics are ingested; and in standardizing the collection and quantification of microplastics.

5.1.3 Microplastics in Nearshore Waters of the Lower Great Lakes

Presentation by Paul Helm from the Ontario Ministry of Environment and Climate Change

- Preliminary results of sampling conducted in Lakes Ontario and Erie indicate that microplastics are present in the Great Lakes, both in the water and sediments, in greater numbers adjacent to and downstream of urban areas, where microplastics are entering the lakes via runoff in urban streams and wastewater treatment plant effluents.
- Important categories of microplastics, by percent of total number of particles, include fragments, rigid foam, microbeads and fibers.
- Gaps in knowledge exist in understanding:
 - If plastics accumulate in Great Lakes organisms;
 - Investigating occurrences, sources and fate of smaller particle sizes; and
 - In improving methods for monitoring and identification of plastic particles in aquatic systems.



Science & Research Priorities

Discussion

Following the presentations about the state of science and research in the Great Lakes, participants were asked to brainstorm any additional science/research priority recommendations.

The following recommendations were generated:

- Examine microplastic concentration at various depths of the water column and in sediments.
- Increase funding for interdisciplinary research, including social science research on behaviour changes.
- Do brittle plastics break apart when tumbling around in sampling nets?

Participants were asked:

- ***What additional science / research priority recommendations they might suggest for the IJC's consideration in forwarding to governments?***

This could potentially lead to inaccuracies in measuring the abundance of plastic particles by:

- overestimating plastic particle numbers or
- underestimating plastic particle numbers if particles smaller than the mesh size pass through sampling nets
- Research is needed to develop new methods for textile manufacture so that clothes will not shed plastic microfibers when washed (or shed degradable fibers that degrade in aquatic environments).
- Support efforts to summarize and educate on existing research.

- Develop an estimate of regional socio-economic costs of microplastics to justify monitoring, continue research and support behavior change and policy development.
- Develop and/or adopt methodology for sampling and analysis of plastics smaller than 0.33mm.
- Determine the fate of microplastics from cosmetics in the environment.
- Develop conceptual models for the life-cycle of plastics in order to understand mechanisms of movement of material.
- Impact studies should test the effects of microplastics/POPs on organisms at concentrations found in aquatic systems (i.e., dose matters).
- Encourage the use of standardized monitoring to better understand sources, pathways and potential risks of microplastics in the Great Lakes (e.g. NOAA Marine Debris Monitoring & Assessment: Recommendations for Monitoring Debris Trends in the Environment for size range 0.333 mm- 5 mm).
- A life-cycle approach needs to be included in the consideration of any policy recommendations.



Pollution Reduction & Prevention Programs/Initiatives – Government

Presentations

5.1.4 Microplastics in the Great Lakes

Presentation by Elizabeth Murphy from the Environmental Protection Agency Great Lakes National Program Office

- The US EPA's Trash Free Waters (TFW) Program, complementary to NOAA's Marine Debris program, has a goal to "significantly reduce the amount of trash entering U.S. water bodies and the ocean through actions taken by government (at all levels), the business community, and individual citizens, approaching zero loadings of trash entering aquatic ecosystems within 10 years", by focusing on four areas of (i) research on ecological and human effects from macro and microplastics, (ii) engagement on multinational initiatives, (iii) initiating and facilitating state and municipal trash prevention programs and (iv) facilitating public-private partnerships to promote anti-litter campaigns and trash prevention.
- The US EPA's Great Lakes Human Health Fish Fillet Tissue Study is currently sharing samples, from all five lakes, with the TFW program for the assessment of microplastic in the gut and samples from the EPA Great Lakes Fish Monitoring and Surveillance Program will be shared in future years.
- Microplastics research has also been funded through the EPA's Great Lakes Restoration initiative on the presence/abundance of microplastics in Lake Michigan and presence/abundance and loading of microplastics in the tributaries to the Great Lakes (United States Geological Survey).
- A US EPA sponsored expert discussion forum on possible human health risks from microplastics in the marine environment found that the current state of the science does not allow an assessment of possible human health risks from the ingestion of seafood contaminated with microplastic-derived chemicals and further identified research priorities to more clearly demonstrate the potential pathway of these chemicals from microplastics to seafood tissue to human tissue (US EPA, 2015). A recent journal paper (Koelmans, et al., 2016) also concluded, through the use of models, that "the flux of hydrophobic organic chemicals (HOCs) bioaccumulated from natural prey overwhelms the flux from ingested microplastic for most habitats, which implies that microplastic ingestion is not likely to increase the exposure to and thus risks of HOCs in the ocean environment."

5.1.5 Microplastics & Marine Debris in the Great Lakes

Presentation by Sarah Lowe from the National Oceanic and Atmospheric Administration, Marine Debris Program

- The NOAA Marine Debris Program, established through the Marine Debris Act, along with regional partners, has developed the Great Lakes Land-based Marine Debris Action Plan (2014). This action plan, which is a framework with goals, objectives, and action strategies to promote coordinated action to address the significant threats posed by land-based marine debris, in the Great Lakes from 2014 through 2019.
- The Great Lakes Marine Debris Action Plan currently has 30 organizations from the US and Canada participating in the action plan, which consists of 53 actions centered around four goal themes of research, policy and management, prevention and removal of land-based marine debris.
- The NOAA Marine Debris Program has been heavily engaged in the microplastics issue at the regional, national, and international levels through funded research and the participation in national and international working groups, including the Honolulu Strategy, the UNEP Global Partnership on Marine Litter, GESAMP 40 Working Group, and G7 planning efforts.
- Some recommendations to address microplastics include: governments focusing on the prevention of plastic marine debris of all sizes through the support of outreach and education efforts targeted at behavioural change; governments continuing to support research efforts to better understand microplastics in the Great Lakes; and governments continuing to support action-oriented collaboration opportunities through existing regional planning efforts.

5.1.6 Government of Canada Efforts Related to Microplastics

Presentation by Nav Khera, Mary Ellen Perkin and Sarah DaSilva, from Environment and Climate Change Canada

- In July 2015 Environment and Climate Change Canada (ECCC) published a science summary on microbeads that showed they may be of environmental concern in contributing plastic litter in lakes and rivers and met the definition of toxic under the Canadian Environmental Protection Act. ECCC has subsequently proposed regulations that would prohibit any person to manufacture, import, sell or offer for sale microbead-containing personal care products.
- Prevention is the key to success in addressing land and water based sources of litter and is a shared effort between all levels of government, industry, NGOs, and the public.
- Domestically the Government of Canada collaborates with other jurisdictions to improve waste management (e.g., Canada-wide Action Plan for Extended Producer Responsibility and Strategy for Sustainable Packaging) and internationally has commitments on marine litter through the G7 Action Plan to Combat Marine Litter, United Nations 2030 Agenda for Sustainable Development, and G7 Science Ministers.



Pollution Reduction & Prevention Programs/Initiatives – Government

Discussion

Following the presentations about pollution prevention from government representatives, participants were asked to brainstorm any additional pollution prevention priority recommendations.

The following recommendations were generated:

- Improve education/outreach to operators in industry on waste capture.
- Use “pollution prevention” approaches, not “pollution control” (e.g., better filters are not good enough).
- Enhance post-consumer tracking for recovery of plastic products – set goals to continually increase recovery.
- Start with the NOAA Marine Debris Great Lakes Action Plan and expand based on results.
- Look for tools or opportunities that support/lead to harmonized waste management (e.g., Multi-Material British Columbia in Canada, but may not work in U.S.)
- Explore various waste management tactics employed at municipal, regional, etc. levels (e.g., covered recycle bins, single stream recycling).
- Encourage municipalities to use lids on recycling and garbage lids on bins.
- Increase support of park maintenance (i.e., beach/shoreline cleaning).
- Government should procure items that will not contribute to the generation of marine debris. Increase support for volunteer beach/shoreline cleanup programs effective at removing, monitoring, educating and inspiring (next step integrate collection data to policy makers).
- Encourage promotion of plastic reduction through policies that will change behavior. These can include bag bans, Operation Clean Sweep, bottle bans, etc. (Operation Clean Sweep is a program to develop/promote industry – driven, plastic “capture and reduction” initiative with a certification process)
- Review efficacy of bans and fees for single-use plastics (e.g., bag bans) and promote those policies that are effective
- Disincentivize single-use plastics (butts, polystyrene, etc.); reduce polystyrene in the recycle stream

Participants were asked:

- *What **Programs / Initiatives** are successful that others could learn from?*
- *What about these Programs / Initiatives could be **adopted** by others as potential models for jurisdictions in the Great Lakes basin? What **led to their success** that is considered good practice for pollution prevention and reduction programs/initiatives?*



Pollution Reduction & Prevention Programs/Initiatives – Industry Presentations

5.1.7 Plastic Makers Contributing to Marine Debris Solutions

Presentation by Keith Christman from the American Chemistry Council Plastics Division

- Plastics provide societal benefits (such as reducing food waste and reducing GHG emissions, energy use and waste versus alternatives), however their presence in the environment is

unacceptable, and plastics need to be properly recovered so they do not threaten the environment.

- Common plastic packaging can also help to reduce energy use and greenhouse gas emissions over the life cycle of the product versus alternative materials (Franklin Associates, 2014)
- Improving waste management is the key to preventing the introduction of plastics to the environment and the American Chemistry Council (ACC) supports this through engagement on the following example efforts:
 - Recycling education and energy conservation (e.g., Wrap Recycling Action Program for public education/awareness to increase recycling of plastic wraps, bags and films, which has resulted in 1.2 billion lbs of plastic film recycled in 2014.)
 - Waste management – ACC commissioned the development of a guidance manual highlighting best available technologies and best environmental technologies for waste management to prevent marine litter
 - Policy – ACC supported the Microbeads Free Waters Act, 2015 and reauthorization of the Marine Debris Act Product Stewardship
 - Partner in the development and promotion of Operation Clean Sweep, a series of best practices to contain plastic pellets, flakes and powders (i.e., pre-production plastics) from manufacturing to end use, which is now an international model.

5.1.8 Increasing Plastics Diversion and Reducing Marine Debris

Presentation by Krista Friesen from the Canadian Plastics Industry Association

- Plastics provide societal benefits (such as reducing food waste and reducing GHG emissions, energy use and waste versus alternatives), however their presence in the environment is unacceptable, and plastics need to be properly recovered so they do not threaten the environment (*same view as ACC*).
- The Canadian Plastics Industry Association (CPIA) represents the majority of companies in Canada's plastics industry, from across the value chain (feed stocks to processing to energy from waste) and works with stakeholders to improve sustainability of products; increase the types and volumes of plastics diverted from landfill; and increase the plastics recycling capacity within Canada.
- CPIA has three strategic priorities, Post-use Plastics Recovery Leadership; Public Outreach; Issues and Opportunities Management and engages on the following efforts in support of those priorities:
 - Great Lakes pilot project investigating the types of plastic waste being generated and disposed of at commercial fisheries and to establish a recycling program focused on webbing/netting and rigid fish boxes
 - Support and participate in a number of public education/awareness campaigns, including the Great Canadian Shoreline Clean-up
 - Promote the Operation Clean Sweep Program to Canadian companies in the plastics value chain.



Pollution Reduction & Prevention Programs/Initiatives – Industry

Discussion

Following the presentations about pollution prevention by industry representatives, participants were asked to brainstorm any additional pollution prevention priority recommendations.

The following recommendations were generated through the table discussions:

- Use Canadian Plastic Industry Association’s approach for life-cycle management of plastics
 - i.e. industries from across the value chain (e.g., from feed stock to processing to recycling).
- Build upon “Operation Clean Sweep” program to develop/promote industry – driven, rigorous and quantitative plastic “capture and reduction” initiatives; have formal certification process.
- Expand Operation Clean Sweep and “responsible care” to fabricators, smaller operations.
- Develop solutions to minimize the risk to municipalities of recycling programs due to commodity market volatility.
- Create and require single reporting repository.
- Provide product manufacturer incentive/programs to reduce “no need” or “low need” packaging (e.g., blister packs, foil wraps).
- Conduct further assessment by industry as a source of microplastics (from cuttings and trimmings).
- Encourage post-consumer fees (like 5 cent plastic bags) to reduce consumption and change stewardship behavior and expand infrastructure.
- Conduct research on plastic textiles to reduce shedding.
- Promoting more zero-waste-to-landfill events (includes increasing commercial composting).
- Conduct recreational fishing industry analysis similar to commercial fishing analysis.
- Explore incentives to increase value of recycled plastic as a commodity.

Again, participants were asked:

- *What **Programs / Initiatives** are successful that others could learn from?*
- *What about these Programs / Initiatives could be **adopted** by others as potential models for jurisdictions in the Great Lakes basin?*
- *What **led to their success** that is considered good practice for pollution prevention and reduction programs/initiatives?*



Clean-up Efforts, Public Education and Outreach

Presentations

5.1.9 Reducing Plastic Pollution in the Great Lakes through Stewardship, Education and Advocacy

Presentation by Jamie Cross from the Alliance for the Great Lakes Adopt-a-Beach Program

- Adopt-a-Beach™ is a volunteer-based program that has been in operation for 25 years conducting Great Lakes beach clean-ups and is an integral component in the reduction of marine debris, by helping to establish a baseline in understanding the abundance of marine debris on beaches and can also aid in the identification of local priorities and prevention strategies.

- In 2015 85% of the debris items collected were plastic materials, of that 88% was tiny trash (<2.5 cm).
- Some recommendations for addressing microplastics through beach-cleanups include:
 - Improving removal efforts of small plastic marine debris by volunteers through improved training of volunteers
 - Integrating citizen science into research that can inform solutions and drive action
 - Refining, enhancing and coordinating data collection protocols among volunteer programs and researchers to link citizen science data to academic research.

5.1.10 The Great Canadian Shoreline Clean-up

Presentation by Susan Debrececi from the Great Canadian Shoreline Clean-up

- The Great Canadian Shoreline Clean-up promotes understanding and awareness of shoreline litter issues by engaging Canadians to rehabilitate shoreline areas through cleanups.
- In 2015, in the Great Lakes, over 15,000 kg of beach debris was collected, with plastics having the largest categories of debris, by number of items (e.g., food wrappers, plastic bottle caps, straws, plastic/foam packaging).
Some recommendations to further address the litter and plastic debris issue include: supporting litter cleanup activities around the Great Lakes, including associated educational activities around “refuse, reduce, reuse and recycle”; and supporting education and research around macro- and microplastics in lakes and flowing water as well as sediments, including sources, environmental impacts and health impacts.

5.1.11 Creating Public Policy to Reduce Plastic Pollution in the Great Lakes

Presentation by Nate Drag from the Alliance for the Great Lakes

- As of the end of 2015, Illinois, Wisconsin and Indiana had microbead legislation in place, which has been pre-empted by the signing of the federal Microbeads Free Waters Act in December 2015.
- In order to promote and ensure success, public policy should:
 - Be based on and developed from current peer reviewed scientific research focused on specific sources of microplastics in the Great Lakes
 - Engage stakeholders including manufacturers, retailers, consumers, government agencies, elected officials, and resource users in order to identify and communicate where collaborative messages can emerge to support policy development and advocacy
 - Include risk analysis for reasonable potential alternatives to the regulated product during policy development
 - Use regional government networks such as Great Lakes Legislative Caucus, the Great Lakes St. Lawrence Cities Initiative, or regional non-governmental networks to communicate options for using municipal and state policy to address local impacts of microplastics.



Clean-up Efforts, Public Education and Outreach

Discussion

Following the presentations about education and outreach, participants were asked to brainstorm any additional recommendations regarding clean-up, education and outreach efforts.

The following recommendations were generated through the table discussions:

- Communicate results of research and environmental and human impacts in education/outreach programs for K-12, public and decision makers that includes: common definitions, sources, impacts and targeted Refuse Reduce Reuse Recycle (RRRR) programs supported with funding.
- Require regulated education programs/environmental curriculum on waste and connection to broader environmental issues.
- Develop agreed upon common definition of plastics and its secondary products and biodegradability.
- Determine how plastics are used in the Great Lakes: how much is sold in the basin, how they are managed, where they end up and what are priority sources.
- Use social media to inform on pollution caused by personal choices.
- Increase environmental literacy in schools so students can make informed decisions (consider regulation).
- Focus on behaviour change, solutions and measures of success in outreach/education (not just awareness of the problem).
- Emphasize education on zero-waste, refuse and reduce first – measure your plastic footprint.
- Conduct research to measure the effectiveness of mitigation to inform public policy.
- Promote and assist successful programs to continue increasing scale.
- Address the problem of logistics – who to enlist to cover 10,000 miles of Great Lakes coastline.
- Build diverse (science, community, industry, government) coalitions/participation to enhance education activities
- Standardize data reporting and information sharing across the basin. Work with Annex 2 (LAMPs) and Annex 10 (science) of the Great Lakes Water Quality Agreement
- Invest in technology to deliver data from clean-up programs to researchers and policy makers

Participants were asked to discuss:

- *What makes microplastic reduction and prevention Education / Outreach efforts effective?*



6 Synthesis and Prioritization of Recommendations

Following the presentations and the initial brainstorming sessions, participants gathered in groups based on their area of expertise (i.e., science, pollution prevention programs/initiatives, or clean-up efforts, education and outreach). These 'specialist' groups then refined and categorized both the preliminary list of recommendations created before the workshop (Appendix C), and the recommendations created in the earlier brainstorming sessions (Section 5). The specialist groups then selected and presented their top 3-4 key recommendations in a plenary session.

In Section 6.1 the recommendations are sorted into three specialty groups or themes:

- 1) Science and Research

- 2) Pollution Prevention Programs/Initiatives
- 3) Clean-up Efforts, Public Education and Outreach

Recommendations in each theme are supported by several specific examples or precise recommendations that were developed during the brainstorming sessions or during the specialist group sessions. For instance, under the Science and Research theme, the recommendation “Assess the impacts of ecological and potential human health impacts using an ecological risk assessment framework (exposure/hazard)” is supported by several examples of work that could be done to achieve this recommendation.

Note: In some cases there was disagreement in the discussions leading up to and during the specialist group sessions as to the key recommendations developed. For example, in the pollution prevention programs/initiatives session a list of bans and fees were identified by the group that were felt could be effectively implemented; however, there was some disagreement regarding the inclusion of these specific recommendations. Some members felt that there was not enough known or data available on whether any of these were an effective means of reducing plastic pollution. To try to capture both views the language of “market-based instruments” was used in crafting the recommendation language (see Section 6.1). In the science group there was some disagreement among members as to the inclusion of “water infrastructure improvements” in one of the recommendations. Some felt that this was an “end-of-pipe” solution and focus should be on prevention measures. Additionally, such an investment would be quite large and not justified based on the current level of knowledge regarding the distribution of microplastics and the hazard they may pose. However, “water infrastructure improvements” was ultimately included in the recommendation presented in plenary (see Section 6.1).

Finally, the participants engaged in a voting exercise, allowing each participant to prioritize the key recommendations that emerged from the three themes. Each participant was allowed a total of eight votes and was required to place a minimum of one vote within each of the three themes (i.e. Science and Research; Pollution Prevention Programs/Initiatives; and Clean-up Efforts, Public Education and Outreach). Participants were then able to cast multiple votes (up to two) on any other recommendations in any theme. The table below provides a summary of the key, overarching workshop recommendations and the associated number of total votes it received. The number of votes that each recommendation received has been recorded to the right of each recommendation (noted by a check mark ✓).



Summary of Workshop Recommendations Arranged by Most to Fewest Votes

Category	Recommendation	Votes
Clean-up Efforts, Public Education & Outreach	Communicate results of research to the public of all ages and decision makers, through development of Great Lakes focused educational materials	32
Pollution Prevention	Encourage prevention of plastic marine debris through changing behavior by using education, outreach, policy and market-based instruments	32
Science	Assess the impacts of ecological and potential human health impacts using an ecological risk assessment framework (exposure/hazard)	31
Pollution Prevention	Compare and analyze existing programs and policies for reduction and prevention of plastic marine debris and promote those that are good models for plastics management	26
Science	Invest in solution-based research, including innovative product development and water infrastructure improvements	21
Science	Conduct modelling to determine the sources and fate of microplastics in the Great Lakes	20
Clean-up Efforts, Public Education & Outreach	Enable the plastic industry, its clients and other Great Lakes stakeholders to enhance effective management and implementation of reduce, reuse and recycle programs	19
Pollution Prevention	Promote improved waste management and debris removal	16
Clean-up Efforts, Public Education & Outreach	Develop and strengthen binational Great Lakes linkages to support sharing of research, education and outreach programs, and best management practices	11
Science	Develop and/or adopt standardized sampling and analytical methods for microplastics	11

6.1 SCIENCE AND RESEARCH PRIORITIES



Assess the impacts of ecological and potential human health impacts using an ecological risk assessment framework (exposure/hazard)

31



- Impact studies should test the effects of microplastics/POPs on organisms at concentrations found in the aquatic systems (i.e., dose matters).
- Investments should be made to establish a comprehensive Great Lakes ecosystem risk assessment framework to inform policy and mitigation and elicit behavioural changes (e.g., improved green infrastructure to better capture mismanaged plastic debris before it enters the watersheds). The ideal goal of behavioural change is zero mismanaged plastic debris.
- Develop an estimate of the regional socio-economic costs of microplastics to justify monitoring, continued research and support behavior change and policy development.

- Estimate the level of toxic chemicals associated with microplastics and also determine their fate, behaviour, and impacts on the Great Lakes ecosystem.



Invest in solution-based research, including innovative product development and water infrastructure improvements

21 ✓

- Increase funding for interdisciplinary microplastics research.
- Encouraged focus on research in areas of greatest management opportunities using interdisciplinary emphasis.
- Monitoring of post policy implementation should be conducted to show effectiveness of policy.
- Support efforts to summarize and educate on existing research.
- Conduct research to develop new methods of textile manufacture so that clothes will not shed plastics microfibers when washed (or shed degradable fibers that degrade in aquatic environments).
- Effective filters should be added to washing machines to prevent microfibers from entering aquatic habitats.
- Work with manufacturers to create a filter for washing machines to prevent microfibers from entering the environment.
- Manufacturers of synthetic clothing should bear the responsibility for microfibers, including the costs of prevention (e.g., retrofitting washing machines) or clean-up.



Conduct modelling to determine the sources and fate of microplastics in the Great Lakes

20 ✓

- The consideration of the full life-cycle of microplastics is essential to restore and protect the Great Lakes from microplastic pollution.
- The IJC should encourage governments to undertake research to identify and assess the chemicals that contribute to the microplastic pollution in the Great Lakes and determine if microplastics meet criteria for virtual elimination.
- Invest in the development conceptual models for the life-cycle of plastics in order to understand the flux of plastics between environmental compartments.
- Conduct additional research to better understand the sources of microplastic fibers and the most common type of microplastic (e.g., how do they get into waterways? Effluent? Runoff from overland sludge application? Atmospheric deposition followed by runoff? How are fibers getting into the atmosphere? Are there other sources of fibers, beyond clothing and textiles?).



Develop and/or adopt standardized sampling and analytical methods for microplastics

11 ✓

- The sampling and processing techniques and protocols used to monitor microplastics needs to be improved in order to advance the environmental monitoring required for assessing this issue.
- Standard methods are required to better understand sources, pathways, and potential risks of microplastics in the Great Lakes.
- Since this area of research is new, analytically challenging, and evolving, standard operating procedures (e.g., to reduce inadvertent sample contamination, analytical controls) for sampling

need to be developed, particularly if regulations are put in place for the management of microplastics in the aquatic environment.

- Examine microplastic concentrations at various depths of the water column and in sediments
- Improve/enhance measurement and characterization techniques in order for policy makers to be able to take meaningful action and identify what constitutes measurable success.
- Determine if sampling nets cause artifacts. Do brittle plastics break apart when tumbling around in nets?
- Investment should be made in investigating the smaller size classes (smaller than 0.333 mm) in the environment and in organisms, especially in our food and water supplies.
- Develop methodologies for plastics smaller than 0.33 mm and their fate from use in cosmetics.
- Development of ecotoxicity (hazard) tests which are more relevant to particulate matter.

6.2 POLLUTION PREVENTION PROGRAMS/INITIATIVES



Encourage prevention of plastic marine debris through changing behavior by using education, outreach, policy and market-based instruments

32



- Build upon “Clean Sweep” to develop/promote industry-driven, rigorous and quantitative plastic “capture and reduction” initiatives; have formal certification process that industry can promote and incentivize.
- Product manufacturer incentives/programs to reduce “no-need” and “low-need” packaging (e.g., blister packs, foil wraps).
- Governments should explore the polluter pays principles and extended producer responsibility framework to promote the prevention of microplastics to the Great Lakes ecosystem.



Compare and analyze existing programs and policies for reduction and prevention of plastic marine debris and promote those that are good models for plastics management

26



- Start with NOAA Marine Debris Action Plan and expand based on results.
- Expand upon EPA’s Trash Free Waters program, “Operation Clean Sweep” and “Responsible Care” to fabricators and smaller operations.



Promote improved waste management and debris removal

16



- Volunteer beach/shoreline clean-up programs are effective at removal, educations and inspiration. Next step should be to integrate collection data and provide to policy makers.
- Explore incentives to increase value of recycled plastic as a commodity.
- Promote recycling lids on bins at the municipal level.
- Improve collection of shoreline or coastal debris.
- Look for tools or opportunities that support/lead to harmonized waste management (e.g., Multi-Material British Columbia in Canada).

6.3 CLEAN-UP EFFORTS, PUBLIC EDUCATION AND OUTREACH

	Communicate results of research to the public of all ages and decision makers, through development of Great Lakes focused educational materials	32 ✓
<ul style="list-style-type: none">▪ Plastics 101; common understanding of plastics – definition, secondary products, biodegradability.▪ Sources – how plastics are used in the Great Lakes, where they end up/what is sold in the basin, how plastics are managed, priority sources of plastics.▪ Impacts – environmental and human health.▪ Targeted 4R programs (refuse, reduce, reuse, recycle) with funding and support by governments/agencies/markets.▪ Public – volunteer cleanups, training for cleanups, community based social marketing (CBSM), environmental justice of personal actions.▪ Decision makers – social media, science information coordination and flow.▪ K-12 – environmental literacy for informed decisions, focus on impacts and positive action (behavior change), use social media for ages 8-16.▪ All messaging should be positive.		
	Enable the plastic industry, its clients and other Great Lakes stakeholders to enhance effective management and implementation of reduce, reuse and recycle programs	19 ✓
<ul style="list-style-type: none">▪ Secondary industries to focus on include cigarettes, plastic bags.▪ Encourage and support statewide mandatory recycling programs that are self-sustaining.▪ Extended producer responsibility.▪ Involve alternative products industries.		
	Develop and strengthen binational Great Lakes linkages to support sharing of research, education and outreach programs, and best management practices	11 ✓
<ul style="list-style-type: none">▪ Build on Great Lakes Water Quality Agreement’s precautionary principle and Lakewide Action and Management Plans.▪ Binational beach cleanups/coastline.▪ Great Lakes Marine Debris Action Plan.▪ Science-education organization linkages.▪ Great Lakes Beach Association (binational).▪ Case studies for the Great Lakes.▪ International Association of Great Lakes Research, Sea Grant (U.S.), NOAA Marine Debris Program, Great Lakes NGOs, Aquariums and zoos (Canada’s Accredited Zoos and Aquariums/Association of Zoos and Aquariums).		

7 Next Steps

The two-day Microplastics in the Great Lakes workshop achieved its goal of bringing together representatives from diverse sectors and developing recommendations which the IJC may use to help the governments of Canada and the United States address the challenges posed by microplastics pollution in the Great Lakes. Participants identified 10 recommendations in the themes of science; pollution prevention; and clean-up efforts, public education and outreach.

The table below provides the results of a survey completed by 25 of the workshop participants about their desires for next steps.

Next Steps	# of Interested Participants
Receive a copy of the report and/or provide input on the workshop report	22
Participate in a follow-up meeting (3- 5 years) to discuss progress	17
Stay connected with colleagues you met today (e.g., Community of Practice, distribution list)	15
Receive updates on the progress that has been made with regard to the recommendations discussed at the workshop	14
Other: <ul style="list-style-type: none"> ▪ Show information down the line if and when recommendations were taken-up by the governments. ▪ Continue the conversation through social media platforms, perhaps quarter webinars. ▪ Create an on-line community of participants (e.g., e-mail list, webinars, etc.) ▪ Share presentations and meeting minutes. 	4

At the close of the workshop Commissioner Glance presented the IJC's plan for next steps:

- Develop a workshop report (May/June 2016)
- Provide participants an opportunity to review the workshop report and provide brief comments and edits (June/July 2016)
- Completion of final report on microplastics in the Great Lakes by IJC staff (Summer 2016)
- Review of report by Great Lakes Advisory Boards (Summer 2016) and Commissioners (Fall 2016)
- IJC to determine path forward for communicating workshop input to governments

IJC appreciates the contribution of the workshop participants including pre-workshop materials, workshop presentations and discussions, and review of the draft workshop report. This report reflects the completion of the final report by IJC staff.

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Appendix A – Participant List

First Name	Last Name	Organization
Austin	Baldwin	US Geological Survey Wisconsin Water Science Center
Jill	Bartolotta	Ohio Sea Grant
Elizabeth	Beckwith	Global Silicones Council
Keith	Christman	American Chemistry Council
Debbie Lee	Cohen	Cafeteria Culture
Jamie	Cross	Alliance for the Great Lakes, Adopt-a-Beach
Sarah	DaSilva	Environment and Climate Change Canada
Iain	Davies	Personal Care Products Council
Susan	Debreceni	Great Canadian Shoreline Clean-up
Paul C.	DeLeo	American Cleaning Institute
Nate	Drag	Alliance for the Great lakes
Melissa	Duhaime	University of Michigan
Hans	Dürr	University of Waterloo
Lisa	Erdle	Ontario Streams
Krista	Friesen	Canadian Plastics Industries Association
Paul	Helm	Ontario Ministry of Environment and Climate Change
Chris	Hilkene	Hilkene International Policy
John	Jackson	ENGO Representative
Charlotte	Jameson	Michigan League of Conservation Voters
Nav	Khera	Environment and Climate Change Canada
Sarah	Lowe	National Oceanic and Atmospheric Administration
Andrea	Morden	McGill University
Elizabeth	Murphy	Environmental Protection Agency, Great Lakes National Program Office
Jennifer	Nalbone	New York State Office of the Attorney General
Mary Ellen	Perkin	Environment and Climate Change Canada
Dale	Phenicie	Environmental Affairs Consulting
Jeff	Ridal	St. Lawrence River Institute
Lorena	Rios-Mendoza	University of Wisconsin-Superior
Chelsea	Rochman	University of Toronto

First Name	Last Name	Organization
Alan	Sovran	Scout Environmental
Michael	Twiss	Clarkson University
Judith	Weis	Rutgers University
Jill	Wingfield	Great Lakes Fisheries Commission
Antonette	Arvai	International Joint Commission
Frank	Bevacqua	International Joint Commission
Pierre-Yves	Caux	International Joint Commission
Mathew	Child	International Joint Commission
Sally	Cole-Misch	International Joint Commission
Dereth	Glance	Commissioner, International Joint Commission
Ankkita	Mandelia	International Joint Commission
Trish	Morris	International Joint Commission
Lana	Pollack	Commissioner, International Joint Commission
Victor	Serveiss	International Joint Commission
Michael	Toope	International Joint Commission
Gordon	Walker	Commissioner, International Joint Commission
Lizhu	Wang	International Joint Commission
Barb	Sweazey	Facilitator, Stratos Inc.

Appendix B – Workshop Agenda

DAY 1: APRIL 26, 2016 (12:30 PM – 5:00 PM)

Time	Topic
11:30	Registration & Networking Opportunity
12:30	<p>Welcome Commissioner Gordon Walker, IJC</p> <p>Microplastics Through the Lens of the IJC Commissioner Dereth Glance, IJC</p>
12:55	<p>Workshop Guidance, Overview and Introductions Barb Sweazey, Facilitator</p>
1:20	<p><u>Presentations: Insights into the State of Knowledge in Great Lakes</u></p> <p>A Review: Plastic Debris in the Great Lakes Hans Dürr, University of Waterloo</p> <p>Adsorption of POPs on Microplastics and Impacts on Fresh Water Aquatic Organisms Lorena Rios-Mendoza, University of Wisconsin Superior</p> <p>Microplastics in Nearshore Waters of the Lower Great Lakes Paul Helm, Ontario Ministry of Environment and Climate Change</p>
2:20	<u>Plenary Discussion: Science & Research Priorities</u>
3:00	<i>Break</i>
3:15	<p><u>Presentations: Pollution Reduction & Prevention Programs/Initiatives – Government</u></p> <p>Trash Free Waters Program Elizabeth Murphy, Environmental Protection Agency Great Lakes National Program Office</p> <p>Microplastics & Marine Debris in the Great Lakes Sarah Lowe, National Oceanic and Atmospheric Administration, Marine Debris Program</p> <p>Government of Canada Efforts Related to Microplastics Nav Khera, Mary Ellen Perkin and Sarah DaSilva, Environment and Climate Change Canada</p>
4:15	<u>Plenary Discussion: Pollution Reduction & Prevention Programs/Initiatives</u>
4:55	<p>Day 1 Wrap-up Barb Sweazey, Facilitator</p>
5:00	<i>Adjourn (optional networking until 6:00 PM)</i>

DAY 2: APRIL 27, 2016 (8:30 AM – 3:00 PM)

Time	Topic
8:00	<i>Morning Refreshments & Networking Opportunity</i>
8:30	<p>Welcome Commissioner Lana Pollack, IJC</p> <p>Agenda Overview Barb Sweazey, Facilitator</p>
8:40	<p><u>Presentations: Pollution Reduction & Prevention Programs / Initiatives – Industry</u></p> <p>Plastic Makers Contributing to Marine Debris Solutions Keith Christman, American Chemistry Council Plastics Division</p> <p>Increasing Plastics Diversion and Reducing Marine Debris Krista Friesen, Canadian Plastics Industry Association</p>
9:20	<u>Plenary Discussion: Pollution Reduction & Prevention Programs/Initiatives</u>
9:50	<i>Break</i>
10:10	<p><u>Presentations: Clean-up Efforts, Public Education and Outreach</u></p> <p>Reducing Plastic Pollution in the Great Lakes through Stewardship, Education and Advocacy Jamie Cross, Alliance for the Great Lakes Adopt-a-Beach Program</p> <p>The Great Canadian Shore Line Clean-up Susan Debreceni, Great Canadian Shoreline Clean-up</p> <p>Creating Public Policy to Reduce Plastic Pollution in the Great Lakes Nate Drag, Alliance for the Great Lakes</p>
11:10	<u>Plenary Discussion: Clean-up Efforts, Public Education and Outreach</u>
11:40	<p><u>Concurrent Break-out Sessions (Small group discussions, reporting back to plenary):</u></p> <p>A. Science & Research Priorities</p> <p>B1. Pollution Prevention & Reduction Programs/Initiatives</p> <p>B2. Pollution Prevention & Reduction Programs/Initiatives</p> <p>C. Clean-up Efforts, Public Education and Outreach</p>
12:30	<i>Lunch (provided)</i>
1:15	Reporting to Plenary: Top Recommendations from each Break-out Group
2:15	<u>Plenary: Synthesis and Prioritization of Recommendations for Commission</u>
2:45	<p>Closing Remarks & Next Steps Commissioner Dereth Glance, IJC</p>
3:00	<i>Adjourn</i>

Appendix C – Preliminary Participant Recommendations

Below is a list of preliminary recommendations provided by participants in advance of the workshop. These recommendations formed the basis of session discussions and the further development of workshop recommendations around three broad topic areas: (1) Science and Research Priorities; (2) Pollution Prevention and Reduction Initiatives; and (3) Education and Outreach. These recommendations were modified, augmented or added to throughout the workshop and helped to inform the advice offered to the IJC.

TOPIC AREA: SCIENCE AND RESEARCH PRIORITIES

- More work is needed to better understand the source(s) of microplastic fibers, the most common type of microplastic (e.g., how do they get into waterways? Effluent? Runoff from overland sludge application? Atmospheric deposition followed by runoff? How are the fibers getting into the atmosphere? Are there other sources of fibers, beyond clothing and textiles?).
- Improve/enhance measurement and characterization techniques in order for policy makers to be able to take meaningful action and identify what constitutes measurable success.
- The sampling and processing techniques and protocols used to monitor microplastics needs to be improved in order to advance the environmental monitoring required for assessing this issue.
- Since this area of research is new, analytically challenging, and evolving, standard operating procedures (e.g., to reduce inadvertent sample contamination, analytical controls) for sampling need to be developed, particularly if regulations are put in place for the management of microplastic in the aquatic environment.
- The consideration of the full life cycle of microplastics is essential to restore and protect the Great Lakes from microplastic pollution. The IJC should undertake research to identify and assess the chemicals that contribute to the microplastic pollution in the Great Lakes. Determine if microplastics meet criteria for virtual elimination.
- The IJC should estimate level of toxic chemicals absorbed by microplastics and determine their impact to the Great Lakes ecosystem.
- Investment should be made in the following research areas:
 - Investigation of the smallest size classes (e.g., nano-size plastics) in the environment and in organisms, especially in our food and water supplies.
 - Analysis of plastic debris life-cycle for improved modeling of plastic flux between environmental compartments.
 - Establishment of a comprehensive Great lakes ecosystem risk assessment framework to inform policy and mitigation and elicit behavioral change (e.g., improved green infrastructure to better capture mismanaged plastic debris before it enters our watersheds). The ideal goal of behavioral change is zero mismanaged plastic debris.

TOPIC AREA: POLLUTION PREVENTION AND REDUCTION INITIATIVES

- Filters should be added to washing machines to prevent microfibers from entering aquatic habitats.
- Manufacturers of synthetic clothing should bear the responsibility for microfibers, including the costs of prevention (e.g., retrofitting washing machines) or clean-up.
- Work with manufacturers to create a filter for washing machines to prevent microfibers from entering the environment.
- As with personal care products containing microbeads, phase out or ban cleaning agents, abrasives and other products that contain or shed microplastics.
- Increase the retention of microplastics at point source discharges – both municipal and industrial – by recognizing microplastics as a form of pollution and regulating their discharge.
- The US and Canadian governments should consider microplastics as chemicals of mutual concern in the Great Lakes Ecosystem under the Great Lakes Water Quality Agreement
- The IJC should recommend that the US and Canadian governments apply the polluter pays principles and extended producer responsibility framework to promote the prevention of microplastics to the Great Lakes ecosystem.
- Provide incentive to industry to use less plastic in both product material and packaging, as well as to develop smarter plastic products (e.g., non-fiber-shedding garments, more appealing biodegradables).
- Change behavior in policy development and management, such that effective industry incentives are in place and consumers are empowered to realize the changes they are invested in making.

TOPIC AREA: CLEAN-UP EFFORTS, PUBLIC EDUCATION AND OUTREACH

- Educate people on fleece materials as a source of microfibers and ways to prevent their release, such as hand washing or washing less.
- Investment in public engagement and education initiatives aimed at maximizing the responsible recovery and recycling of post-consumer macroplastics (such as cigarette filters and plastic food containers) before they enter the watersheds that feed into the Great Lakes.
- Increase the public awareness of Great Lakes research on microplastics through education and awareness programs.
- Reduce the input of plastic pollution into our waterways by supporting litter clean-up projects and reducing the use of disposable plastic items (including disposable water bottles, plastic bags or cutlery).
- The operators of sewage treatment plants in the Great Lakes Basin should be required to report publicly every year on their release of microplastics. This reporting is necessary so the IJC can publish an annual report on micro plastic releases from all sources.
- Changing behavior of consumers, such that they are invested in a plastic-free environment, and as a result, plastic-free food and water supplies.