

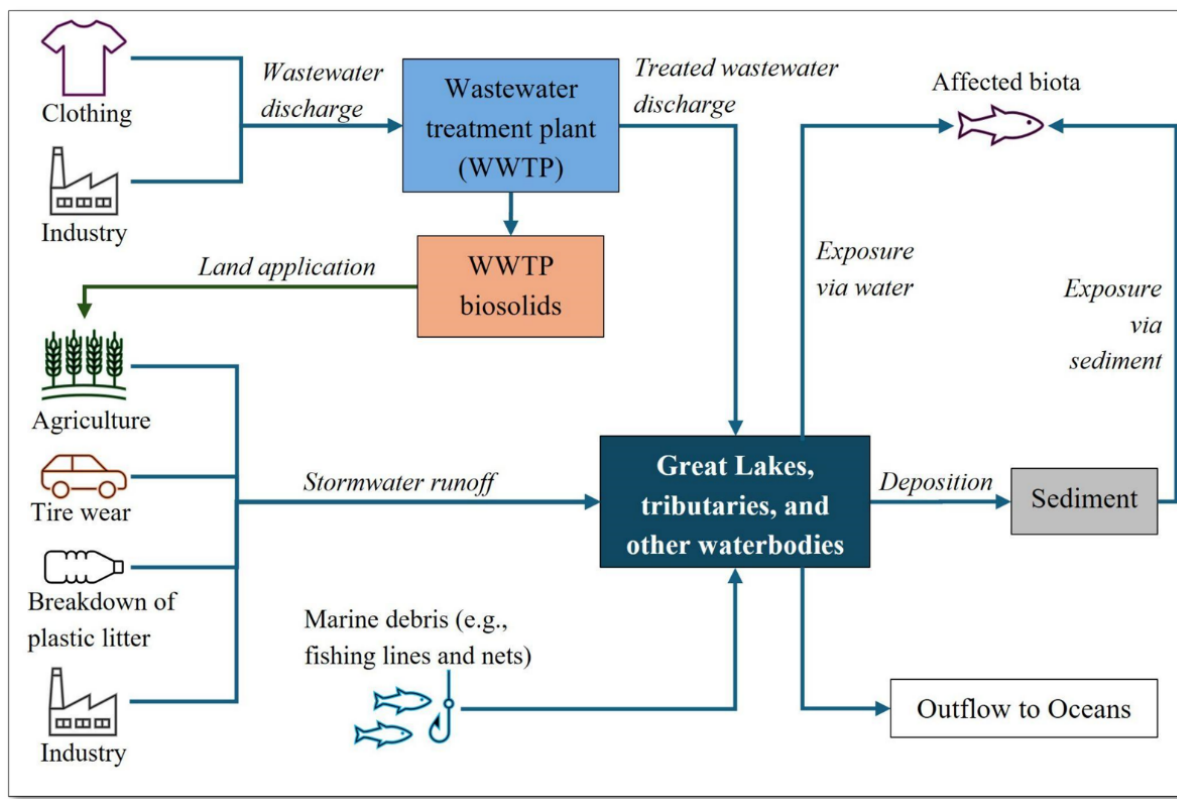
How long would microplastics remain in the Great Lakes ecosystem before fully degrading?

Currently, it is not possible to tell how old plastic is when sampled. However, degradation is a slow process, during which plastics fragment into microplastics. Plastics are thought to remain in the water for decades to hundreds of years.

What are the major sources of microplastics?

It is not always possible to determine the source of microplastics; often, what is found in the environment is too small or misshapen to understand where it come from.

This report explored the sources of microplastics, and how they travel through the environment from both land-based and aquatic pathways (see graphic below). Common sources include tire and road wear particles, microfibers from textiles, microbeads from personal care and cleaning products, pre-production resin from industrial facilities, as well as mismanaged plastic waste and litter from urban and agricultural areas. Aquatic sources include recreational activities, like beach visits, fishing, and boating, and other activities like commercial fishing and shipping.



Examples of Microplastic Sources and Pathways in the Great Lakes.

(International Joint Commission Great Lakes Science Advisory Board, Monitoring, Ecological Risk and Management of Microplastics in the Laurentian Great Lakes, 2024)

Summary of Questions and Answers from IJC - SAB Microplastics in the Great Lakes Webinar – February 12, 2025

Studies have found that the most common types of microplastic found in the Great Lakes are microfibers. Microfibers are thought to come from people laundering their clothing, through wastewater treatment plants. While wastewater treatment plants do treat microplastics, the volume of microfibers is so large that still some gets through.

Studies also identified fragments as a common type of microplastic pollution. Fragments are harder to attribute to a source, as they can come from many things, such as takeout food containers or other plastics that enter the environment from litter.

What role do waste water treatments plants play in monitoring and treating microplastics?

Wastewater treatment plants do treat microplastics. There have been many studies looking at how many microplastics are in wastewater, at different levels of treatment; about 5% or less of it goes out with treated effluent into the environment. Questions remain around the cost to a city to upgrade systems to effectively treat stormwater.

Other tested treatments for urban runoff, such as rain gardens, bio-retention cells or permeable pavement, help to keep microplastics out of out of wastewater as well.

Can microplastics be filtered?

Microplastics can be filtered, to prevent their entry into the Great Lakes watershed. Research performed at the University of Toronto tested washing machine filters, finding that they remove about 80% or upwards of the microplastics down to a certain size range. However, it is important that waste collected by filters should be disposed of with household garbage. Aftermarket filters are available for consumers to install in their homes.

Have microplastic been nominated as a Chemical of Mutual Concern under the Great Lakes Water Quality Agreement? How can the public and other organizations support this nomination?

The [Great Lakes Executive Committee](#) under the [Great Lakes Water Quality Agreement](#) are currently considering the nomination package to consider microplastics as a Chemical of Mutual Concern (it was received August 2023). Sending the secretariat an email is currently the direct way to communicate with those decision-makers about that nomination process. They also have meetings twice a year that can be attended by the public. Canadian and US governments update binational.net with information.

Questions regarding the Chemicals of Mutual Concern program can be directed to:

US Environmental Protection Agency Great Lakes National Program Office: glwqa@epa.gov

Canada Water Agency Great Lakes National Program Office: glwqa-aqegl@ec.gc.ca

Are microplastics of greater concern than other contaminants? Do the governments prioritize contaminants for action?

The [Great Lakes Water Quality Agreement](#) commits Canada and the United States to protect, preserve and enhance Great Lakes water quality. While the governments' work to monitor and mitigate a large variety of pollutants which threaten water quality, the governments' do not currently prioritize threats for action.

Could microplastics be added to existing Remedial Actions Plans?

Question about changes to existing Remedial Action Plans or other activities Areas of Concern program that is linked to the implementation of remedial action plans should be directed to:

US Environmental Protection Agency Great Lakes National Program Office: glwqa@epa.gov

Canada Water Agency Great Lakes National Program Office: glwqa-aqegl@ec.gc.ca

Is anyone researching the impacts of ingesting microplastics by zebra or quagga mussels?

There have been enough studies that have found microplastic beyond the gut content of organisms, suggesting that microplastics, through some mechanism, get into different tissues of aquatic organisms—also known as translocation. Microplastics have been reported in livers of fish, as well as in the muscle or the fillet of fish. Currently, we are trying to understand the rate of translocation and whether or not microplastics bioaccumulate or increase over time as organisms age. This is a widespread phenomenon that we're starting to get a better handle on through these kinds of research projects.

Interested reader could also review the 2020 work on microplastics and quagga mussels by Pedersen et al. (Microplastic ingestion by quagga mussels, *Dreissena bugensis*, and its effects on physiological processes. *Environmental Pollution*, 260, p.113964) and Merzel et al (Uptake and retention of nanoplastics in quagga mussels. *Global Challenges*, 4(6), p.1800104).

What is the state of knowledge on microplastics' ability to accumulate and transport other contaminants throughout an ecosystem? How might microplastics remediation efforts also address accumulated contaminants?

Like sediments and biota, microplastics accumulate chemicals in the environment. There is scholarship on how plastics sorb and transport environmental contaminants. For example, when fish consume contaminated plastic, the chemical will accumulate in the fish.

While studying how plastics interact with environmental chemicals is a beneficial area of research, policies should be more related to the plastics themselves, which can be inherently toxic. All policies that keep plastics out of the water will also prevent them interacting and combining with other pollutants.

Are the concentrations shown in this report an accurate reflection of microplastics in each lake? Or does data reflect the impacts of non-unified, sporadic monitoring efforts?

Sampling efforts for microplastics in the Great Lakes are uneven, not just across the lakes but also in different media like tributary waters, sediment and aquatic life. Where the sampling efforts are low, like Lake Superior, there is more uncertainty around the environmental concentrations of microplastics. Lake Michigan is one of the best sampled lakes, resulting in higher confidence in the report concentrations. Lake Ontario is somewhere in the middle, and more monitoring would help to better understand the spatial and temporal distribution of microplastics.

This uncertainty in the concentration of microplastics underlines the need for systematic monitoring and harmonized sampling methods across the basin. The current “patchwork” system of sampling is not yet adequate to assess the status of microplastics in the Great Lakes. More rigorous monitoring efforts are needed to inform management actions.

What factors might impact microplastic concentrations across the Great Lakes?

Microplastics concentrations have been associated with population density and urban land use, more so than other land uses like agriculture. This is true even when agriculture is a known source of plastic pollution for a lake basin. The size and location of lake will also impact the concentration of microplastics. For example, Lake Ontario is home to several large urban centres, is smaller than other lakes and receives outflows from the other lakes on route to the St Lawrence River. As a result, Lake Ontario is relatively more contaminated.

How do microplastics concentrations in the Great Lakes compare to other watersheds?

Given the uncertainty in microplastics concentrations presented by the current “patchwork” monitoring efforts, it is difficult to compare the Great Lakes to other watersheds. However, Great Lakes fish are reported to have among the highest concentrations of microplastics in the world.

Are there any approaches for monitoring nanoplastics? How were nanoplastics considered in this report?

Nanoparticles, plastic particles smaller than 1 micrometer in size, were not considered in this report. Techniques to monitor nanoplastics are in their infant stages, as are lab techniques for analysis; nanoplastics are much harder to see with traditional microscopes or detect using chemical analysis techniques. We anticipate seeing much more literature on nanoplastics in the next 5 to 10 years.

As microplastics breakdown into nanoplastics overtime, efforts to monitor and mitigate microplastic pollution in the Great Lakes will help mitigate nanoplastics in the lakes.

Is there any research on microplastic concentration in the human population in the Great Lakes region? Is the IJC or its advisory boards investigating the human health impacts of microplastics?

While there is ongoing research on the human health impacts of microplastics, that topic was outside the scope of this report. Some studies have measured microplastics in the fillets of species of fish that are caught and consumed by people. Microplastics in finished drinking water was not examined in this report, only microplastics in river and lake water that may serve as sources of water for drinking water plants.

The current science within the Great Lakes is currently limited to looking at the impacts of microplastics on the ecosystem; much less is known about human exposures in the Great Lakes basin. The report recommends that the International Joint Commission's [Health Professionals Advisory Board](#), which studies current and emerging public health issues impacting Canadian and US shared waters, investigate the topic as a potential Phase 2 for this project.

How can other level of government (state/provincial, municipal, or regional) support efforts to mitigate microplastics?

With their responsibility to oversee wastewater treatment, regional and municipal governments can plan an important role in mitigating microplastics.

Wastewater treatment plants do treat microplastics. There have been many studies looking at how many microplastics are in wastewater, at different levels of treatment; about 5% or less of it goes out with treated effluent into the environment. Other tested treatments for urban runoff, such as rain gardens, bio-retention cells or permeable pavement, help to keep microplastics out of out of wastewater as well. Questions remain around the cost to a city to upgrade systems to effectively treat stormwater.

Providing safe drinking water is also a common responsibility of regional and municipal governments. Microplastics in finished drinking water was not examined in this report, only microplastics in river and lake water that may serve as sources of water for drinking water plants. The report recommends that the International Joint Commission's [Health Professionals Advisory Board](#), which studies current and emerging public health issues impacting Canadian and US shared waters, investigate the topic as a potential Phase 2 for this project.

Has the Great Lakes Science Advisory Board seen support for the report's recommendations?

The Science Advisory Board has seen interest in the findings and recommendations of this report from a wide variety of audiences, including the public and municipal stakeholders. The board continues its work to educate relevant stakeholders and decision makers about value of actioning the report's recommendations.

Is there any action to prevent producers from including known microplastics in their products (i.e., using microbeads as an added exfoliant in face wash)?

There have been past successful efforts to remove and prevent the inclusion of microplastics in commercial products. For example, bans in Canada and the United States were successful in removing microbeads from skincare products. Efforts are underway to remove microbeads from other products; in the state of California, new legislation has been introduced to ban microbeads from cleaning products, leave-on cosmetics and paints.

Have there been any efforts to track the movements of microplastics in the Great Lakes?

There have been efforts to track the movement of microplastics in the Great Lakes. The Canadian federal government has contracted two reports to assess and compile monitoring efforts to characterize microplastics across the Great lakes.

Tracking the movement of microplastics have largely been academic endeavors, published in peer-reviewed publications. This body of work supported the creation of a database of monitoring efforts, to which this report contributed data. The available data enables users to locate hotspots, which tend to be in urban areas.

How do sampling methods differ for different media (surface water, sediment, rivers, oceans)?

The IJC Great Lakes Science Advisory Board's report provides information about the microplastics found in surface water, sediment, and biota (living organisms); monitoring methods are very similar for all water or sediment sampling, regardless of whether they are done in fresh or marine waters. Sampling in sediment is important, as sediments are a large sink for microplastics in the Great Lakes. However, care must be taken as there is likely resuspension of the particles back into the water column if the sediments are disturbed.

Are there standardized protocols for sampling microplastics? What efforts are needed to support a standardized approach to monitoring?

One of the report's key recommendations is the adoption of microplastics as a Chemical of Mutual Concern and as a Toxic Chemicals subindicator under the [Great Lakes Water Quality Agreement](#). If adopted, this would commit Canada and the United States to not only develop plans to mitigate plastic pollution in the Great Lakes, but ensure the routine monitoring needed to confirm the actions plans are effective. These monitoring efforts would focus on providing data across the Great Lakes basin.

To support a routine, unified microplastics monitoring program, the Science Advisory Board proposes a series of Standard Operating Procedures (SOPs) sampling in the Great Lakes. These SOPs include guidance for sampling in a variety of media, including surface waters, tributaries, sediment and aquatic life like fish and plants. These SOPs can be found on [the report's webpage](#).

How are microplastic currently being monitored? Would adapting current monitoring efforts to include microplastics be difficult?

Currently, efforts to monitor and sample for microplastics in the Great Lakes are uneven, not just across the lakes but also in different media like tributary waters, sediment and aquatic life.

This report offers Standard Operating Procedures for sampling, which could be incorporated into existing sampling efforts and generate quality data is followed. The incorporation of microplastics monitoring into existing efforts will depend on the equipment that is used and putting quality assurance protocols in place. Details on how this is done for water samples is available in the Standard Operating Procedure that was published as [Appendix C of the report](#) by the Science Advisory Board. There are also new technologies and techniques, such as automated technologies to measure microplastics in water in a lab setting, which could enhance monitoring effort. However, this work is not currently being done in the Great Lakes.

Are there standard operating procedures for analyzing microplastic samples? What investments in science infrastructure are needed to support increased monitoring?

This report did not develop standard operating procedures (SOPs) for analysis. The project work group did help support the development of standardized analytical protocols by the Southern California Coastal Waters Research Project Authority (SCCWRP), a close partner for this project. As part of the project's second workshop, the project workgroup created samples of clean and dirty water, sediment and biota spiked with microplastics. These samples were sent to labs with standard operating procedures for analysis for labs to follow. The results for this process were examined, and results shared to inform the work of SCCWRP. SCCWRP has completed the analytical SOPs for clean water and are currently in the process of developing ones for dirty water, sediment and biota.

Specialized analytical equipment is needed to identify plastic particles in samples. This equipment is available in some commercial and academic labs in Canada and the United States. It is difficult to determine how many labs have this capability, but commercial analyses are also available.

Are there more details about the studies included in the literature review, which informed the report's findings?

The literature review included with the report includes sections on the physical and chemical characteristics of microplastics, field and lab methods, environmental occurrence data for the Great Lakes, toxicity data for freshwater species, and regional policy and management considerations. Much of review focused on peer-reviewed literature, as there is limited grey literature on microplastics. All of the publications are listed in the appendix of the report.

Most studies took samples from surface or near-surface waters. Some studies measured particles down to 40 microns (um), but the methods used in the field and lab make it difficult to generalize about the size of microplastics in different media. The work group feels confident about the findings on particles down to about 20 or 50 um.

Microplastics tend to be reported in particles per litre, as these characteristics, relevant to particles, are most relevant to toxicity. However, the water data are reported as particles per cubic meter as it was a way to standardize results across studies for the literature review.

Is there a relationship between microplastics' size distribution and its potential risk?

Smaller microplastics are more likely to be eaten and are more likely to get into tissues of different aquatic species. There is some information on the size distributions of microplastics in water and sediment in the Great Lakes, but it is very limited at present and is affected by the methods used to collect the samples.

Where can I access the databases to view microplastics data?

As part of this project, the Science Advisory Board added the most recent environmental and toxicity data to publicly accessible databases. Data on microplastics in the Great Lakes is available on the University of Toronto Dataverse:

<https://borealisdata.ca/dataset.xhtml?persistentId=doi:10.5683/SP3/MSXET0>

For toxicity data for freshwater species, this project work group helped update an existing database of microplastics toxicity studies, called the Toxicity of Microplastics Explorer (ToMEx). Originally developed by the Southern California Coastal Water Research Project, ToMEx 2.0 now includes toxicity data from over 300 studies on marine and freshwater species. This update should be made publicly available in 2025:

https://sccwrp.shinyapps.io/aq_mp_tox_shiny/

Given their size and abundance in the Great Lakes ecosystem, can microplastics be removed from the lakes or should efforts focus on management, containment and prevention?

Given the challenges presented by the size of microplastics and the scale of the Great Lakes ecosystem, efforts to clean up microplastics would need to occur on a large scale. Presently, preventing the introduction of microplastics in the ecosystem should be prioritized.

Are there any international protocols on microplastics?

As part of this project, the Science Advisory Board has recommended protocols for monitoring microplastics in lake water, river water, sediment and species in the Great Lakes. The standard operating procedures (SOPs) for all but the river water were originally developed by the Southern California Coastal Water Research Program (SCCWRP) group and were modified to be used in the Great Lakes. This information is [available in Appendix C](#).

Is there any current legislation on monitoring microplastics in the environment? How does the IJC support these efforts?

Presently, there is no policy for monitoring. The board's report suggests that legislative efforts could be initiated through including microplastics as a Chemical of Mutual Concern under Annex 3 and as a subindicator for toxic chemicals under Annex 10 of the [Great Lakes Water Quality Agreement](#).

Is there any work on the economic or cultural impacts of microplastics in the Great Lakes?

While the project work group is not aware of any current research on the topic, studying the socio-economic impacts of microplastics would be an interesting area of possible research.

How can I connect with other knowledgeable people on microplastics in the Great Lakes?

Please email allison.voglesong-zejnati@ijc.org with more information about your work and interests and we can try to connect you with appropriate contacts.