Standing Committee on Environment and Sustainable Development
Study on Freshwater in Canada

Brief prepared by
The International Association for Great Lakes Research (IAGLR)
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For nearly 70 years, International Association for Great Lakes Research (IAGLR) has been promoting science to protect the Great Lakes of the world, including the five Laurentian Great Lakes and their connecting channels. Our organization represents about 800 scientists, practitioners, and decision makers who gather at our annual Conference on Great Lakes Research and publish their scientific discoveries in our peer-reviewed publication, the Journal of Great Lakes Research.

We welcome the opportunity to share with you the main issues and priorities that Great Lakes scientists are reporting for the Laurentian Great Lakes. It is our understanding that this meeting is to focus on federal management of pollution. As such, we leave aside a discussion of many stressors not related to pollution exposure except to note that no stressor acts alone. A full understanding of their impacts acknowledges their cumulative impact.

Context

The Laurentian Great Lakes make up the Earth's largest freshwater system. From its westernmost shore, the system stretches more than 3,700 km to the Gulf of St. Lawrence and the Atlantic Ocean, connecting North America's heartland with ports and markets worldwide. These inland seas contain widely varying habitat types with unique and diverse species. They also provide resources and enjoyment to millions of people for drinking water, fishing, and recreation. The Great Lakes are vital to the economy of both Canada and the United States, supporting billions of dollars in economic activities.

The population of the Great Lakes basin would rank as the world's 12th largest country, while its binational (Canadian/U.S.) production constitutes the fourth highest GDP ($4.1 trillion in 2012) and supports 49 million jobs in North America. The basin is home to 58% of Canada's economy ($1.1 trillion), while $311 billion of Ontario's annual exports derive directly from its natural resources, including municipal and industrial water supply, fish harvesting, and land uses. Indirect uses also generate economic value through beneficial ecosystem services such as nutrient cycling, provision of water, and climate regulation that collectively are valued at $64 billion annually.

However, the vulnerability of the Great Lakes' unique and diverse ecosystems is a major and growing concern. The hydrology, biogeochemistry, and ecology of the lakes are changing dramatically due to both natural and anthropogenic forces. The rate of change is unprecedented and leaves the lakes at risk for sudden, unexpected, and lasting degradation. Ecological problems have resulted in fishing restrictions, drinking water bans associated with harmful algal blooms, beach closures, and contaminated coastlines, all of which decrease value and increase municipal, industrial, and agricultural operating costs. As well, decreased shipping, fishing, and hydroelectric generation capabilities associated with climate change threaten the health and lifestyle of 43 million inhabitants of the basin. The Great Lakes depend on us for their ecological health, just as we are inextricably bound to them for our social, economic, and economic health.

The threats to the Great Lakes caused by past and present human activities continue to require significant time and resource investments from scientists, communities, and decision makers to monitor issues and, when possible, to remediate them. Recent progresses with regards to freshwater management in Canada are notable: The new Canada Water Agency provides an opportunity to better integrate data on freshwater collected by various jurisdictions and organizations. It also offers an opportunity to modernize legislation such as the Canada Water Act. We understand that the Canada Water Agency will adopt a national approach to water management. However, we would like to stress that such an approach is not enough for the lakes and rivers of the Great Lakes

system whose physical complexity is mirrored by the complexity of its governance. Two federal nations, two Canadian provinces, eight U.S. states, nearly 100 Tribal and First Nations, and countless local entities make decisions about the lakes. Numerous disciplines inform these decisions. Managing shared waters must recognize that the Great Lakes social-ecological system is dynamic, complex, and characterized by uncertainty. Efforts must therefore foster the ability for Great Lakes institutions to adapt to this ever-changing complexity, including the ability to readily access data and information to support decision making at all levels.

The recent investment to support restoration of Canadian Areas of Concerns helped to reduce the gap between Canadian and U.S. investment in the cleanup of these pollution hot spots. And while this funding is good news for the priority areas affected by legacy pollution in Canada, it applies to local areas and it does not support funding for other critical pollutions issues, in particular non-point sources such as nutrients and other emerging contaminants.

Key issues related to pollutants.

1. **Nutrients.**

Although the Great Lakes water quality has improved in several lakes, Lake Erie continues to remain a priority area with regards to nutrient management from both point sources (direct input: urban area) and non-point sources (agriculture). The GLWQA (Annex 4, section B) includes reduction targets for phosphorus loading (40% reduction from 2008 levels by 2025). Reductions in point source nutrient have been achieved through improved wastewater treatment technologies, but the reduction in non-point source nutrients through adaptive management and best practices poses more challenges.

2. **Contaminants of Emerging Concerns (CECs)**

Pharmaceutical and personal care products (PPCPs), pesticides and per-and polyfluoroalkyl substances (PFAS) are increasingly detected in the waters of the Great Lakes, including in urban surface waters. Understanding the human and ecological impacts of exposure to persistent CECs is critical for both specific compounds but also as complex mixtures.

3. **Microplastics**

They are now widespread throughout the Great Lakes Basin: they can be measured in water, sediments, and wildlife. In the last decade, scientists have been working on developing methods to measure microplastics. These methods differ within and between matrices, and as such, comparing results and assessing trends in contamination is challenging.

Recent research has been conducted to assess the toxicity to microplastic exposure in the Great Lakes. Risk assessments found that microplastic concentrations measured across the Great Lakes exceed proposed risk thresholds for water samples, and not for sediments.

Proposed recommendations to contribute to an improved pollutant management at the federal level in the Great Lakes

1. **Consider adding CECs and Microplastics to the list of contaminants of concerns** in Annex 3 of the Great Lakes Water Quality Agreement.

2. **Invest in research** to better understand the fate, behavior, and toxicity of emerging contaminants to support informed regulations. Such studies may be needed for specific chemicals which are poorly studied and should consider cumulative effects. Consumers are exposed to several contaminants at once and understanding the cumulative effects of multiple exposures deserves further research.

3. **Consider climate change as an accelerator** for pollutant production and toxicity.
   Higher temperatures increase respiration rates, causing oxygen depletion and, subsequently, creating toxic conditions for the biota. Higher water temperatures also favor the growth of Harmful Algal Blooms (HABs), able to release cyanotoxins such as microcystin.
   Significant efforts are being invested to reduce nutrient runoff from agriculture and urban sources in Lake Erie. Even under the proposed nutrient reduction, the lake water will continue to see nutrients being released from its sediments because of climate change. As stated by the Editor of our journal, Dr. Robert Hecky, "Lake Erie's shallow western and central basin will be most strongly affected by changing climate and interact with already higher nutrient concentrations. Erie is the canary in the Great Lakes climate mine." In this context, the urgency of reducing nutrient inputs from the land becomes even more critical.

4. **Engage with First Nations and Métis** on water monitoring and management. This recommendation is reflected in the *2023 Third Triennial Assessment of Progress on Great Lakes Water Quality* released by the International Joint Commission (IJC) to the parties earlier this month. Pollutants are affecting Indigenous communities to a much higher degree than the non-indigenous population because sources of pollution were placed close to reserves and settlements and because diets of indigenous peoples often result in higher consumption of bioaccumulative toxins. In the context of toxicity to mercury exposure via fish consumption, existing guidelines produced for the general population may not apply for Indigenous populations: novel research conducted in the St Lawrence River is underway to produce community-specific guidelines. Overall, growing evidence illustrates the value of bridging knowledge systems to support better, lasting, and adopted management practices and policies at both local and regional levels.

5. **Adopt a comprehensive approach for Great Lakes Science.** As mentioned earlier, the Great Lakes are inland seas and as such, they call for management approaches that are similar to those developed for marine ecosystems. Faced with an aging research infrastructure, Great Lakes science has fallen behind in its ability to understand the physical, chemical, and biological features of these ecosystems and to report on how quickly they are changing. Several organizations are working together to develop a decadal science plan for the Great Lakes. This initiative, led by the IJC, has identified six priorities for the Great Lakes and will next focus on a blueprint for its implementation.

We thank you for your time, and for allowing us to share insights on the threats that pollution poses to the Great Lakes. Please contact IAGLR should you have any questions about science and the Great Lakes, or require support in your future work.