

Microplastics in the Great Lakes

Monitoring, Assessing and Managing Microplastics in the Great Lakes

International Joint Commission
Great Lakes Science Advisory Board

February 12, 2025
1:00 p.m. EST

More than a century of cooperation protecting shared waters

IJC.org



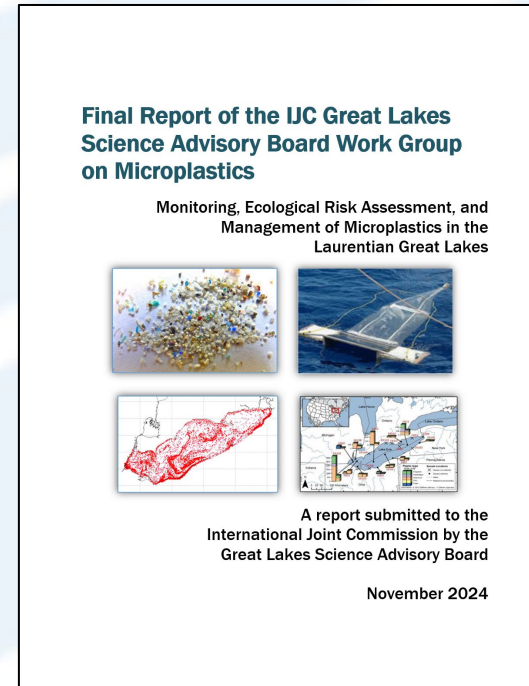
Microplastics in the Great Lakes

Agenda

- Presentation (30 minutes)
- Q & A (30 minutes)

Questions

- On Zoom: Q and A Function
- Via Email: allison.voglesongzejnati@ijc.org



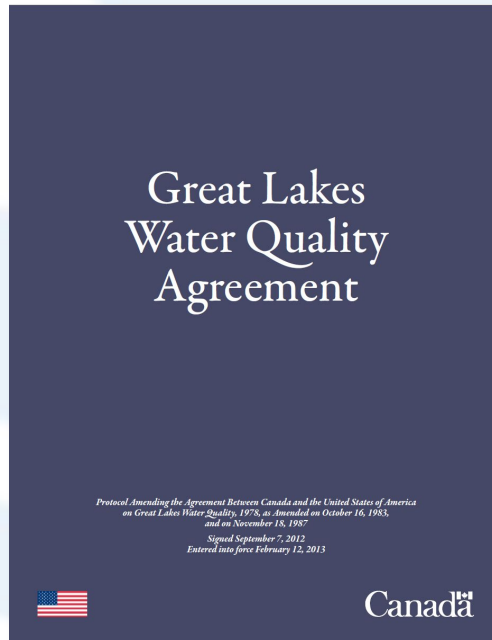
Report available at:



bit.ly/SAB-Plastics

About the International Joint Commission

- Canada-US Great Lakes Water Quality Agreement
- Science Advisory Board (SAB): Advises on research and science:
 - *Research Coordination Committee (RCC)*
 - *Science Priority Committee (SPC)*



Acknowledgements

The IJC SAB Microplastics Monitoring & Risk Assessment Work Group

Work Group Co-Chairs:

- Karen Kidd
- Chelsea Rochman
- Rebecca Rooney
- Eden Hataley

Contractor Team:

- John Bratton, LimnoTech
- Samir Qadir, PHE
- Pedro DaSilva, PHE

Work Group Members:

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IJC Team:

- Matthew Child
- Lizhu Wang (retired)

Special Thanks

- Workshop Participants
- Leah Thornton Hampton & Alvina Mehinto, Southern California Coastal Water Research Project
- Scott Coffin, California State Water Resources Control Board
- The Chesapeake Bay Plastic Pollution Action Team



Chesapeake Bay Program
Science. Restoration. Partnership.



Presenters



Rebecca Rooney

SAB RCC co-chair and Professor
University of Waterloo



Chelsea Rochman

Assistant Professor
University of Toronto



Karen Kidd

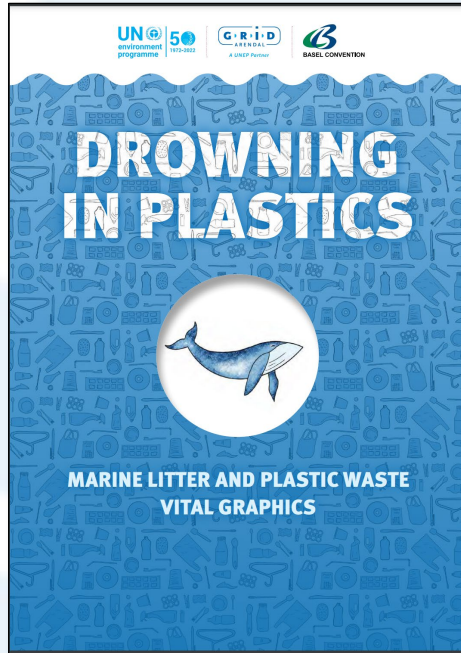
SAB SPC member and Professor
McMaster University



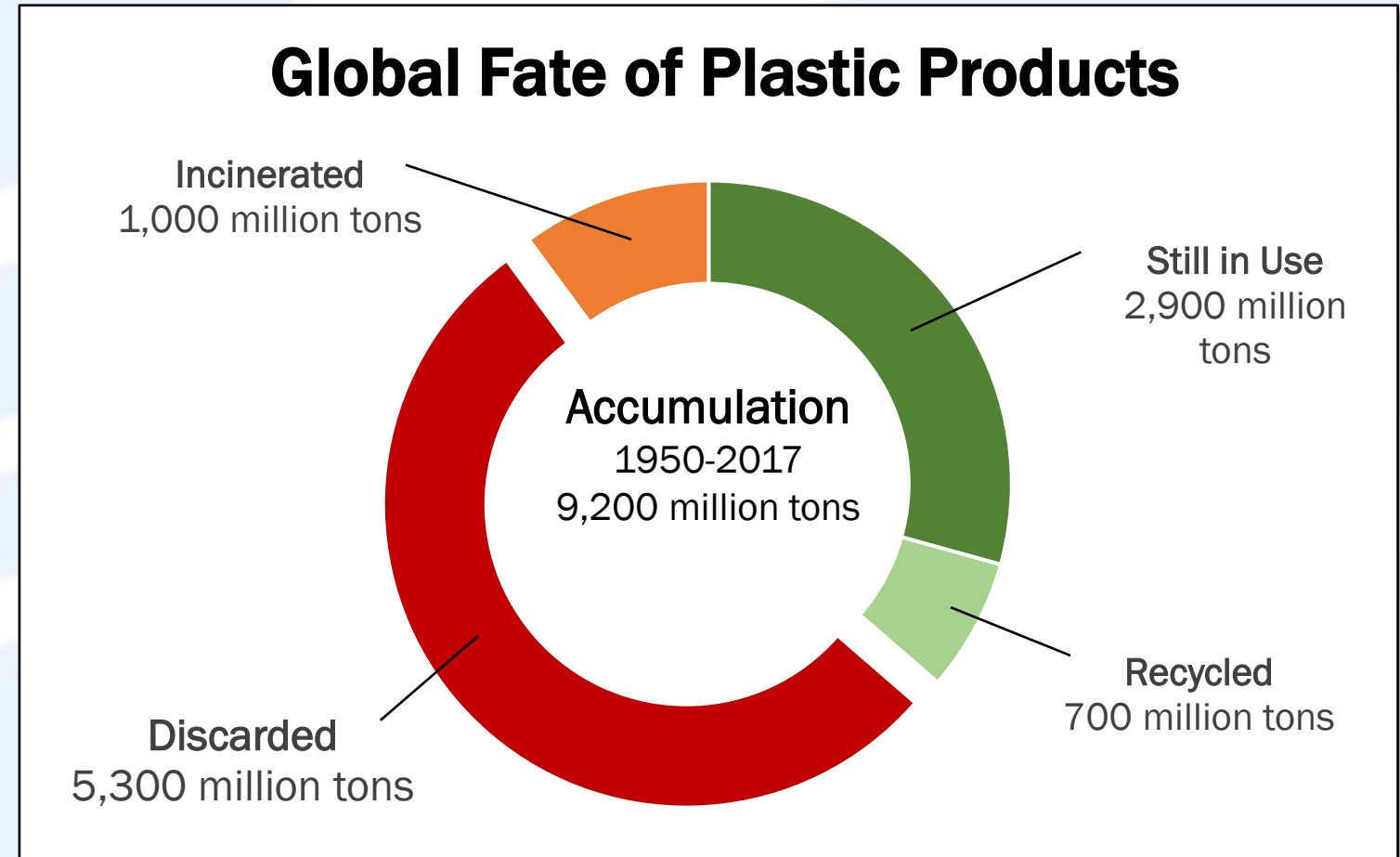
Eden Hataley

PhD candidate
University of Toronto

UN Report on Plastic Pollution



Adapted from *Drowning in Plastics – Marine Litter and Plastic Waste Vital Graphics* (UNEP, 2021)



1st Friday Focus on the Environment: The growing problem of microplastics and marine debris in the Great Lakes

By David Fair, Lisa Wozniak

Published August 2

OCTOBER 7, 2024

Stalking a pollutant: Researchers call for secrets of Great Lakes microplastics

Researchers find dozens of microplastics in Lake Ontario fish caught near Toronto

On average, the researchers found 138 microplastic particles in fish taken from Lake Ontario at Humber Bay — one contained 1,300 pieces of rubber.

Updated July 17, 2024 at 4:07 p.m. | July 17, 2024 | 2 min read

Plastics found in remote areas near Great Lakes in 'new study'

27, 2024 5:30am EDT | Environment | FOX 2 Detroit

Local/Regional News

Michigan doesn't have a plan for preventing microplastic pollution. Could that change?

Interlochen Public Radio | By Ellie Katz

Published February 15, 2024 at 6:24 PM EST



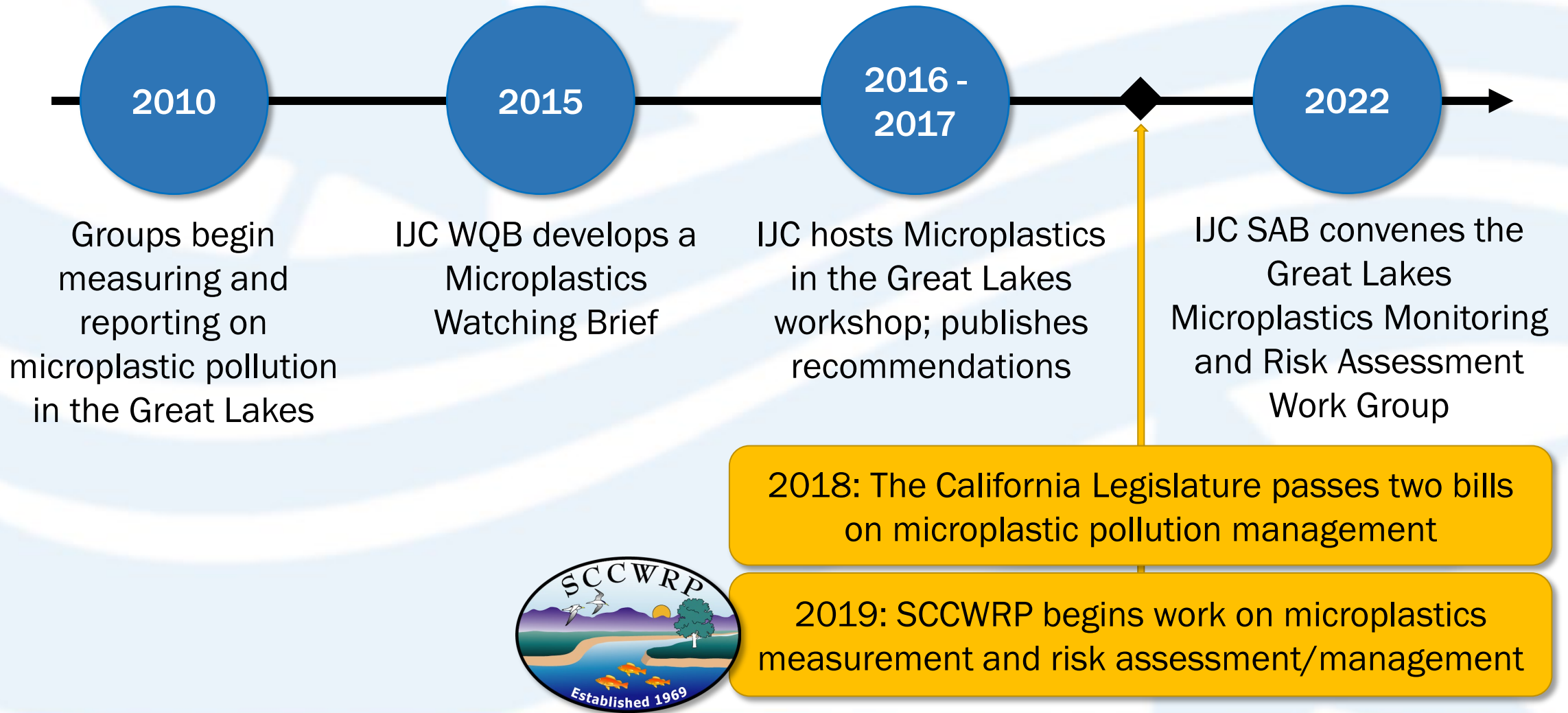
Great Lakes beaches, cleanup group

Col Thompson

Detroit News

a.m. ET April 11, 2024 | Updated 12:01 a.m. ET April 11, 2024

IJC Work on Great Lakes Microplastics



Microplastics Work Group Objectives



Synthesize recent advances and knowledge on Great Lakes microplastics science



Develop a framework for monitoring microplastics to enable harmonized monitoring and reporting



Develop a coordinated ecological risk assessment and management framework



Synthesis of Science

Objective outcomes

- Session at IAGLR 2023
- Literature review
- Uploaded data into publicly accessible databases

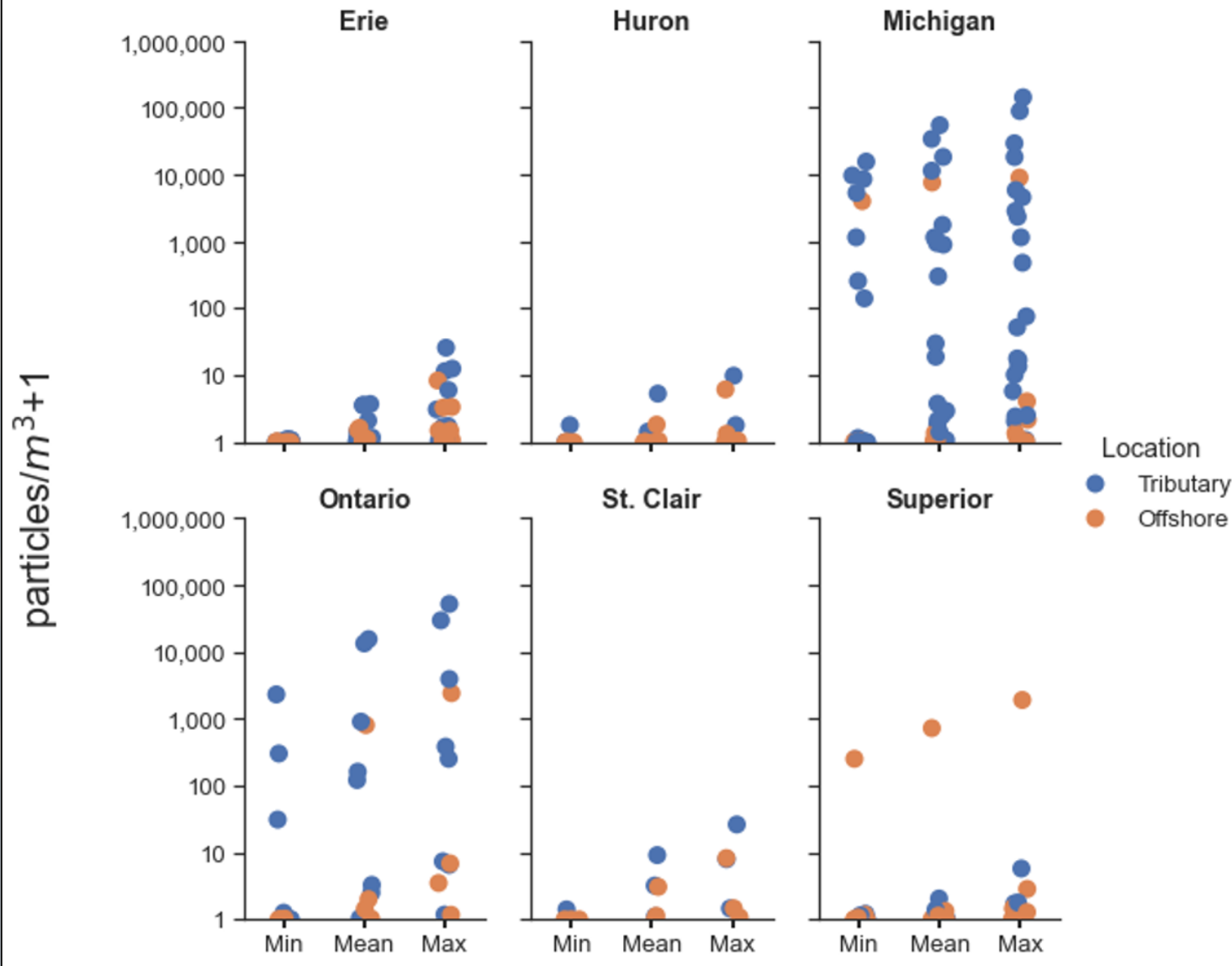


Monitoring Database



*ToMEx 2.0 (to be released
early 2025)*

Concentration of Microplastics in Great Lakes Surface Water (including Lake St. Clair)



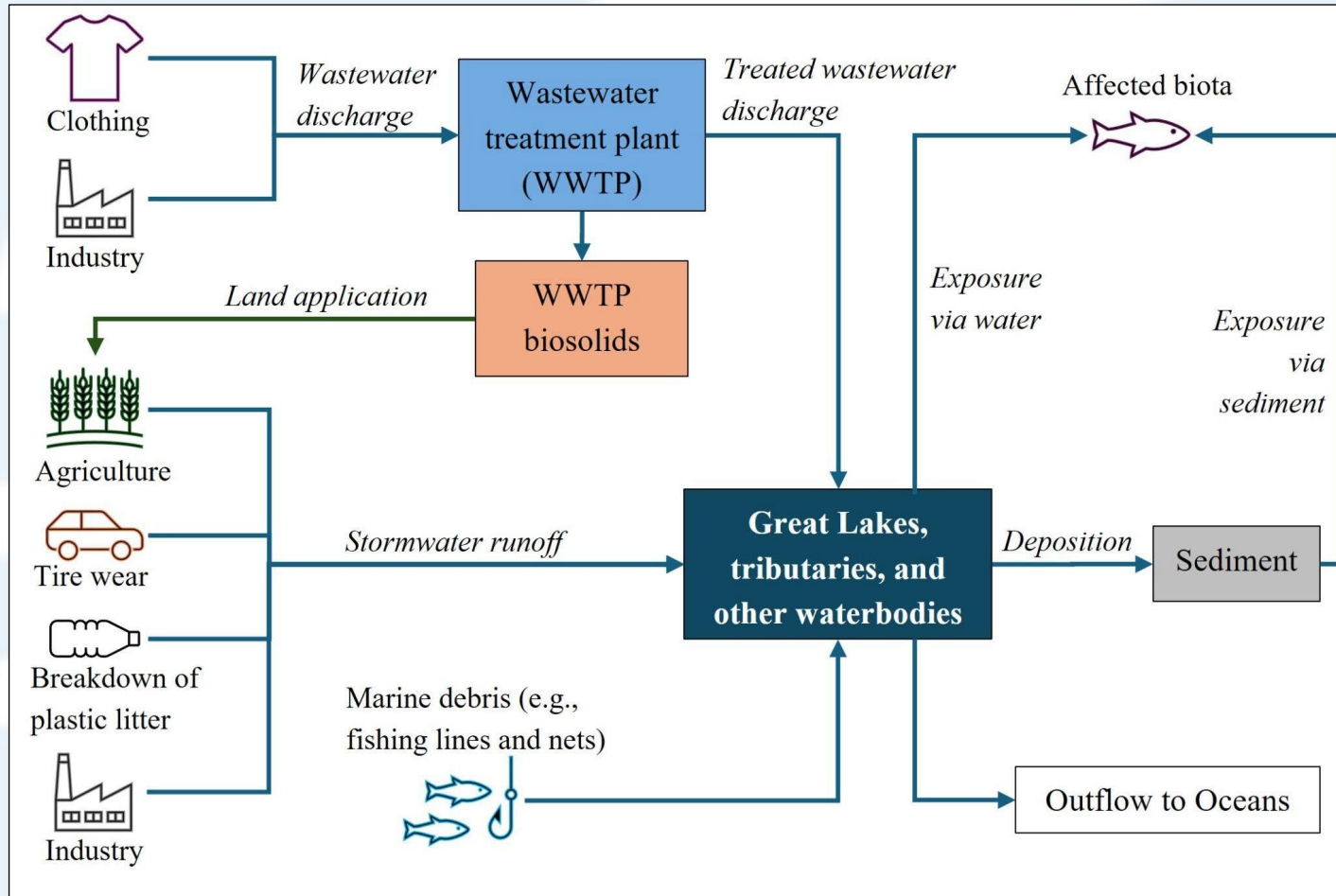
Microplastics Concentrations in Surface Water, by Lake, including Lake St. Clair.

Concentrations data represented here come from published studies reviewed by the work group.

(IJC SAB, Microplastics report, 2024)



Microplastics Sources and Pathways



Examples of Microplastic Sources and Pathways in the Great Lakes

(IJC SAB, Microplastics report, 2024)



Proposed Definition of Microplastics

“Microplastics are defined as solid polymeric materials to which chemical additives or other substances may have been added, which are particles greater than 1 μm and less than 5,000 μm in all three dimensions. Polymers that are derived in nature that have not been chemically modified (other than by hydrolysis) are excluded.”

— *Adapted from the California State Water Resources Control Board*



Monitoring Framework

Objective outcomes

- Developed a harmonized monitoring framework for sampling microplastics, including advice on:
 - Field methods and QA/QC,
 - Reporting requirements,
 - Monitoring program design, and
 - Incorporation of microplastics into existing programs



Experts participated in a two-day workshop to provide insights on microplastics monitoring, held in September 2023.



Standard Operating Procedures



Standard Operating Procedures for the Collection of Ambient Water Samples for Microplastics Analysis

Prepared by
Southern California Coastal Water Research Project Authority
27 June 2024

DRAFT



Standard Operating Procedures for the Collection of Riverine Water Samples for Microplastics Analysis

23 July 2024



Standard Operating Procedures for the Collection of Aquatic Biota Samples for Microplastics Analysis

Prepared by
Southern California Coastal Water Research Project Authority
27 June 2024



Standard Operating Procedures for the Collection of Aquatic Biota Samples for Microplastics Analysis, Great Lakes Addendum

Primary reference SOP:
Southern California Coastal Water Research Project Authority Working Group (SCCWRP), 2023. Standard Operating Procedures for the Collection of Aquatic Biota Samples for Microplastics Analysis, v4, 15 p.

Medium Introduction

The analysis protocol and many of the collection techniques described in the primary reference SOP (SCCWRP, 2023) are applicable to the Great Lakes, but there are some important differences in sampling methods and species that are described here. The primary aquatic organisms of interest for the Great Lakes are fish and benthic invertebrates. The latter were prioritized given that microplastics accumulate in sediments and exposures in this habitat will likely be higher than those of pelagic habitats. The primary reference SOP and this addendum would enable long-term, consistent monitoring of microplastics in organisms to understand spatial and temporal trends. Offshore sampling of biota can take advantage of long-running biota monitoring programs (e.g., USEPA Great Lakes Monitoring [Barbiero et al., 2018]). Several investigators have performed prior studies of microplastic exposure, ingestion, and risk in biota using a variety of sampling methods and organisms. Studies on microplastics in fish in the Great Lakes include work by Munro et al. (2022). Studies of microplastic ingestion by cugaiga mussels, the primary Great Lakes filter feeder, have been published by Pedersen et al. (2020). Bam et al. (2023) published a recent review, and Hestley et al. (2023) performed a risk assessment. Future collection of aquatic biota samples for microplastics analysis would build on this prior work.

Modifications to primary reference SOP by section

1.0 Scope and Application

No additions or modifications.

2.0 Summary of Method

No additions or modifications.

3.0 Definitions

No additions or modifications.

4.0 Interferences

No additions or modifications.

5.0 Safety

No additions or modifications.

6.0 Taxa Selection

The general principles of this SOP section (see SCCWRP, 2023) are applicable, but recommended taxa are modified below

- What is the exposure of pelagic organisms to microplastics?
 - Recommended taxa: forage fish (e.g., alewife, bloater, sculpin, and rainbow smelt)



Standard Operating Procedures for the Collection of Sediment Samples for Microplastics Analysis

Prepared by
Southern California Coastal Water Research Project Authority
27 June 2024



Standard Operating Procedures for the Collection of Sediment Samples for Microplastics Analysis, Great Lakes Addendum

23 July 2024

Primary Reference SOP:
Southern California Coastal Water Research Project Authority Working Group (SCCWRP), Nov 2023 draft. Standard Operating Procedures for the Collection of Sediment Samples for Microplastics Analysis, v4, 15 p.

Medium Introduction:

Microplastics in sediment may be of concern for benthic organisms (Koelmans et al., 2023), particularly in the biologically active zone of the surface sediment. Continued monitoring through standardized sampling protocols will enable the assessment of temporal trends in exposure risk. This protocol is intended to support sediment monitoring that evaluates exposure risk for benthic organisms and is not to assess loading rates or to extrapolate temporal trends from a single sampling event. There are several different methods for sampling settling microplastics to quantify loading rates, which include deploying sediment traps. Sampling methods should be selected to correspond to the monitoring objective and thus, the monitoring objective should be considered when choosing a sampling method. This monitoring could be supplemented by research studies to understand the transport, fate, and variability of microplastic temporal and spatial patterns and processes over weekly to multi-decadal time scales.

Modifications to Reference SOP by Section:

1.0 Scope and Application

No modifications. Note the addition of details below related to sediment coring in deep water (Section 9).

2.0 Summary of Method

No additions or modifications.

3.0 Definitions

No additions or modifications.

4.0 Interferences

No additions or modifications.

5.0 Safety

The primary reference SOP (SCCWRP, 2023) does not give specific guidance for sampling from vessels, but appropriate safety protocols for this type of sampling should be followed, especially in large tributaries or nearshore and open waters of the Great Lakes.

6.0 Equipment and Supplies

No modifications. Note that the equipment list in the primary reference SOP is oriented toward core sampling on foot and by hand under wadable conditions, or a Van Veen grab in deeper water. In addition to the sampling gear described therein, other types of sampling equipment that are common for sampling sediment in the Great Lakes and their tributaries can be used as long as only the top 5 cm are collected and the surface area of the sample is reported.



Monitoring SOPs
available at:
bit.ly/SAB-Plastics



Risk Assessment and Management Framework

Objective outcomes

Developed recommendations for:

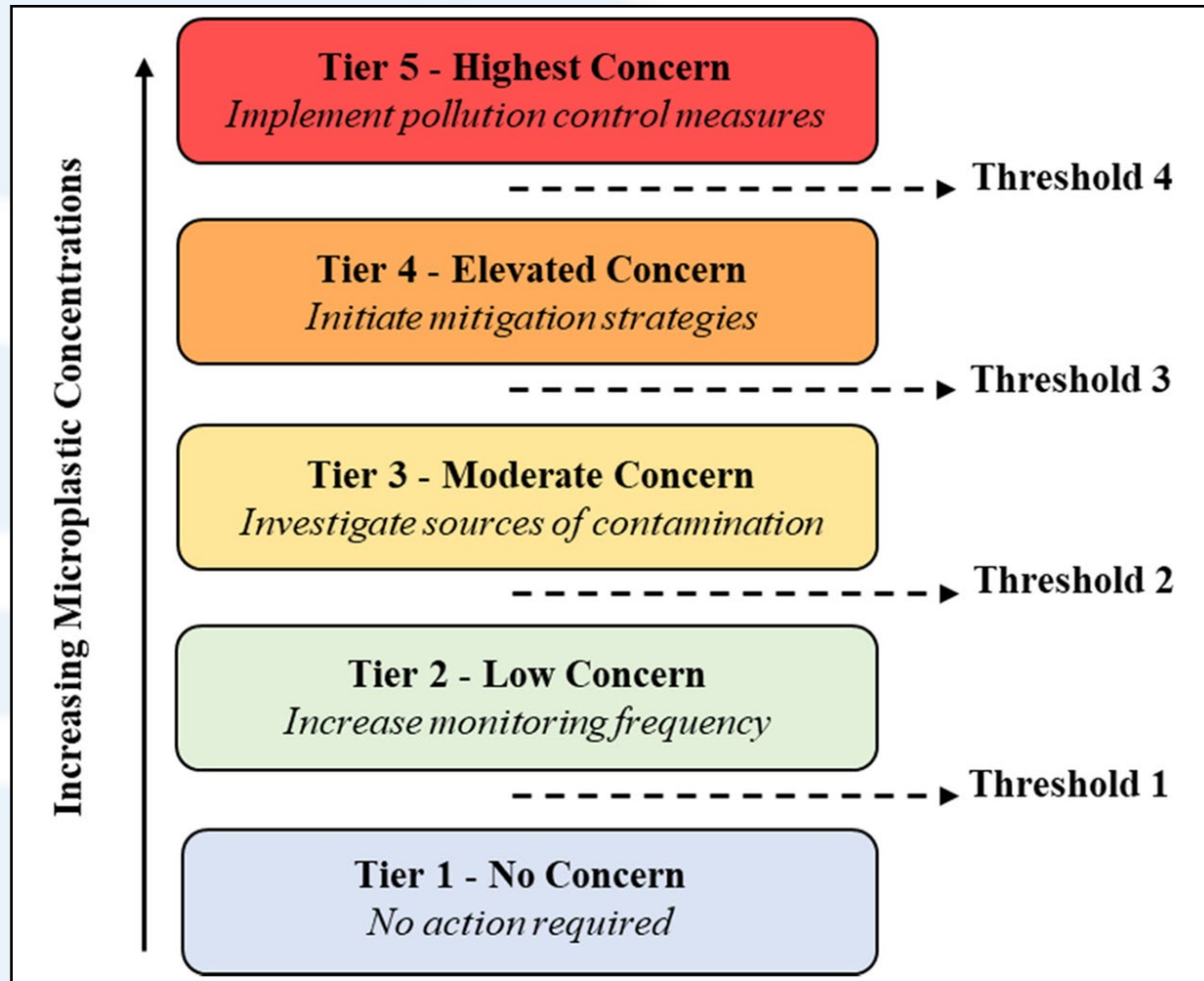
- ecological risk assessment and management framework for water and sediment,
- guidance on the use of exposure and effects data in the assessment process.



Experts participated in a two-day workshop to provide insights on microplastics risk assessment and management, in January 2024.



Risk Assessment and Management Framework



Tiered risk management framework for microplastic pollution developed by SCCWRP





Risk Assessment and Management Framework



Proposed tiered risk management framework for microplastic pollution in the Great Lakes, adapted to align with the US and Canadian federal governments' State of the Great Lakes reporting.

(IJC SAB, Microplastics report, 2024)

Microplastics Species Sensitivity Distribution

(ERM = Volume)

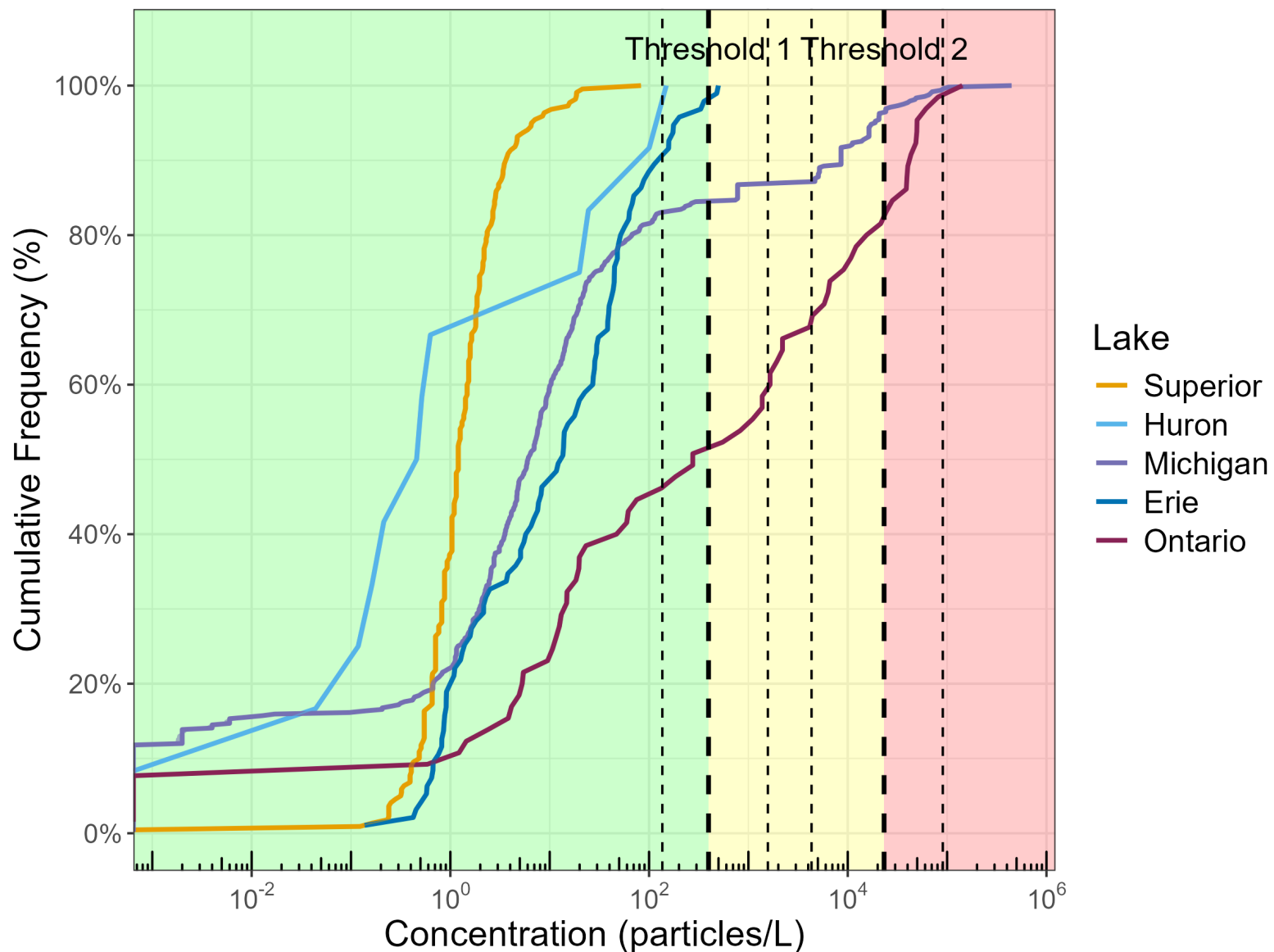


Species Specific Distribution for Microplastics in Ambient Water.

This figure was developed using data on aquatic species biologically relevant to the Great Lakes from ToMEx 2.0

(IJC SAB, Microplastics report, 2024)

Great Lakes microplastics concentrations data (including tributary data) for ambient water compared to thresholds (and their 95% confidence intervals)



Comparison of microplastics concentrations against proposed thresholds from the SAB microplastics report.

Sample sizes for each lake are as follows: Lake Erie (95), Lake Huron (12), Lake Michigan (483), Lake Ontario (65), Lake Superior (220).

(IJC SAB, Microplastics report, 2024)

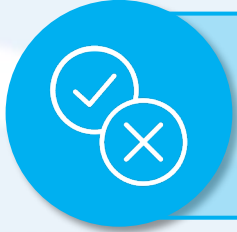
Recommendations



Develop a regionally coordinated monitoring program



Support continued research to refine monitoring and analytical capabilities, and ecological risk assessments



Under the GLWQA, adopt microplastics as a Toxic Chemicals sub-indicator and as a Chemical of Mutual Concern



Prevent the emissions of plastic and reduce plastic pollution in the Great Lakes

Microplastics under the GLWQA

Great Lakes Water Quality Agreement

Protocol Amending the Agreement Between Canada and the United States of America
on Great Lakes Water Quality, 1978, as Amended on October 16, 1983,
and on November 18, 1987

Signed September 7, 2012
Entered into force February 12, 2013



Canada

Objective 4

Be free from pollutants in quantities or concentrations that could be harmful to human health, wildlife or organisms, through direct exposure or indirect exposure through the food chain.

Objectives 4 Indicators

Indicator: Toxic chemicals for the overall Great Lakes basin.

Sub-indicators supporting the Toxic Chemicals assessment					
Sub-Indicator	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
Toxic Chemicals in Sediment	Good & Unchanging	Fair & Unchanging	Good & Unchanging	Fair & Improving	Fair & Improving
Toxic Chemicals in Water	Fair & Improving	Fair & Undetermined	Good & Unchanging	Fair & Unchanging	Fair & Unchanging
Toxic Chemicals in Whole Fish	Fair & Unchanging	Fair & Unchanging	Fair & Unchanging	Fair & Unchanging	Fair & Unchanging
Toxic Chemicals in Herring Gull Eggs	Good & Improving	Good & Improving	Good & Improving	Good & Unchanging	Good & Improving
Toxic Chemicals in the Atmosphere	Fair & Improving (No lake-by-lake assessments were determined)				

STATUS

■ Good
 ■ Fair
 ■ Poor
 ■ Undetermined

Assessment of the presences of toxic chemicals in the Great Lakes, from the government of the US and Canada's 2022 States of the Great Lakes report.

(Available at binational.net)

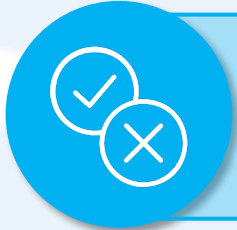
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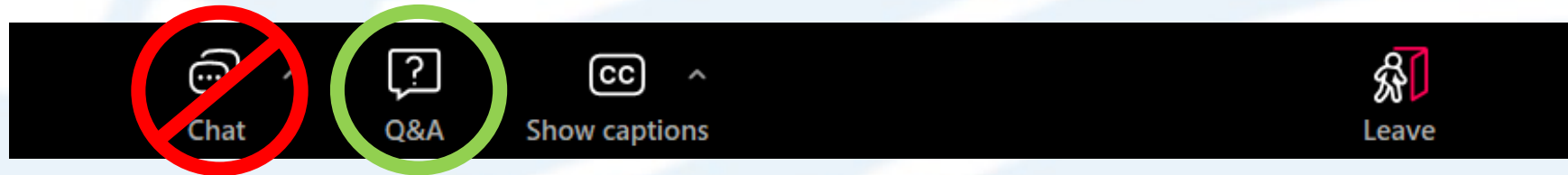
Under the GLWQA, adopt microplastics as a Toxic Chemicals sub-indicator and as a Chemical of Mutual Concern



Prevent the emissions of plastic and reduce plastic pollution in the Great Lakes

Question and Answers

On Zoom: Please use the Q and A function



Via Email: Please email questions to allison.voglesongzejnati@ijc.org

Thank You

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Chesapeake Bay Program
Science. Restoration. Partnership.



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For other questions or more information

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