Great Lakes HABs Collaborative
NEWSLETTER
LINKING SCIENCE AND MANAGEMENT TO REDUCE HARMFUL ALGAL BLOOMS SPRING 2023

What's happening with the HABs Collaborative?

The HABs Collaborative at IAGLR 2023

The **International Association for Great Lakes Research** (IAGLR) hosted its 66th annual conference in Toronto this May. After several years of virtual meetings, the conference was again held in person and well attended with 700 registrants and over 600 presentations and posters, all under the theme of **Adapting to Climate Change.**

The Great Lakes HABs Collaborative continued its tradition of hosting a session to bring together HABs researchers and managers in the region to present and discuss their work. The session named **Updates on HABs Management and Research** was chaired by HABs Collaborative Steering Committee member **Katie Stammler,** USGS representative **Mary Anne Evans,** and Great Lakes Commission liaison **Nicole Zacharda.** In total, 17 presenters shared their research findings, and the session was well attended, with standing room only for a majority of its all-day duration.

While the wider HABs narrative can sometimes reinforce the paradigm that blooms are caused solely by excess phosphorus and increasing temperatures, the talks during this session presented the complexity that exists within the current understanding of bloom dynamics.

Several broad themes emerged from the session talks. A number of presentations focused on **factors which lead to bloom development** including river inflow dynamics, varying forms of phosphorous, and N:P stoichiometry. Presenters also spoke about the link between microbes involved in nutrient cycling and cHABs.

The Great Lakes HABs Collaborative sign welcomes IAGLR conference-goers to the session.

Attendees listen to a presentation during the Updates on HABs Management and Research session.

Additionally, attention was paid to the **toxicity of blooms** with one presentation centered on detecting cell rupture and toxin release. Other talks explored the **toxicity of microcystin** with experiments on fish embryo, *Daphnia*, and green frog tadpoles. A few presentations looked at the **role of the microbial community** in the removal of cyanotoxins.

Other talks explored the **management of HABs,** reviewing adaptive management strategies and stakeholder values in the region, or the **complexity of food web dynamics and zooplanktonic mass** within blooms. Lastly, a few surprising talks examined the nuisance algal growth conditions within the lakes and the presence of HABs in cold water.

The Great Lakes HABs Collaborative is grateful for the diversity of stimulating and thought-provoking talks and the interest in those who attended. The Collaborative is also appreciative to those who joined us for a HABBY Hour event following the talks. We hope the Great Lakes HABs community joins us in Windsor at IAGLR 2024.

Microplastics and Harmful Algal Blooms in the Great Lakes

Kishore Gopalakrishnan, Research Scientist, Wayne State University

Microplastics are a growing concern globally, and their impact on the environment and human health is still largely unknown. **Kishore Gopalakrishnan,** a bioprocess engineer at **Wayne State University,** is at the forefront of research on the impact of microplastics on harmful algal blooms in the Great Lakes.

Kishore completed his Ph.D. from the **University of Canterbury** in New Zealand and currently works in the ecotoxicology lab of professor and director of environmental sciences **Dr. Donna Kashian** at Wayne State University. Kishore's current research at Wayne State University focuses on the fate, transport, and impact of microplastics in the environment and comes from a natural extension of his background in bioprocess engineering. Bioprocess engineering involves applying engineering principles to biological systems, including microorganisms. In Kishore's

case, his research focuses on the impact of microplastics on cyanobacterial growth and the toxins they produce, as well as the effect of cyanobacteria on microplastic buoyancy.

Sample collection amidst floating ice sheets in the Detroit River at Belle Isle Park. Photo credit: Katrina Lewandowski

Part of his research is to **determine the extent to which cyanobacteria can alter the buoyancy of microplastics** by stimulating the production of extracellular polymeric substances (EPS), which can make the microplastics heavier and more hydrophilic and thereby promote their aggregation and sinking. EPS are a complex mixture of biopolymers produced by cyanobacteria as a protective barrier against environmental stresses to facilitate nutrient uptake, adhesion, and biofilm formation. These EPS can lead to the accumulation of microplastics in the water column or sediment, where they can be consumed by a variety of aquatic organisms, including zooplankton, mussels, and certain species of fish due to their small size and resemblance to food particles, to eventually enter the food chain. In addition, he investigates the effect of microplastics on the growth and proliferation of HAB forming cyanobacteria since microplastics can serve as a substrate for biofilm attachment and formation, and as a food carbon source. Biofilms can provide a protected environment for cyanobacteria to proliferate and produce toxins, thereby potentially promoting the development of HABs. Overall, his research focuses on the complex interaction between microplastics and cyanobacteria, which can have repercussions for the Great Lakes ecosystem. It is essential to develop strategies to mitigate the negative effects of microplastics and HABs and to gain a deeper understanding of the mechanisms underlying this interaction.

Microscopy examination of the effects of microplastics on the morphology of cyanobacteria.

In addition to his work with cyanobacteria, Kishore has worked with **green algae and microplastics,** and has made concerning findings that could extend beyond impacts within lake systems. His research shows that interactions between algae and microplastics could result in the movement of plastics into the aquatic food chain, which could end up in fish

and on our dining tables. Kishore's research has implications for policymakers and the public, and his work could help inform decisions on plastic waste management, pollution control, and food safety.

Kishore's expertise in bioprocess engineering has been honed through his academic and professional experiences. He completed his undergraduate and postgraduate degrees in industrial biotechnology in India before moving to New Zealand to pursue his Ph.D. in chemical and process engineering at the University of Canterbury. During his Ph.D., Kishore worked on the development of bioprocesses for the production of industrially important secondary metabolites from New Zealand alpine algae.

Regional Partners Host Sonde Calibration Events

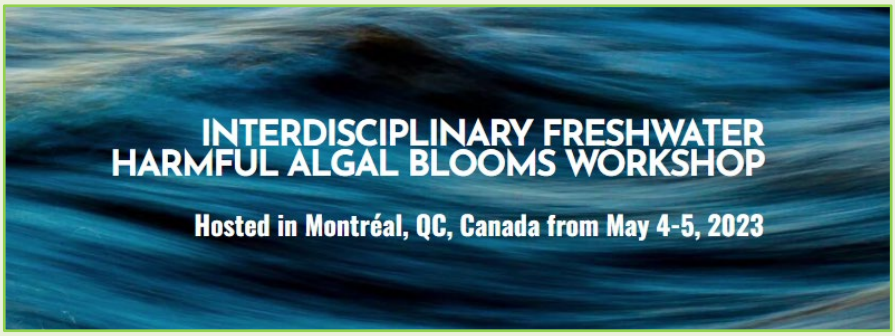
Ken Gibbons, Environmental Scientist, LimnoTech

In April, **LimnoTech, Cleveland Water Alliance, University of Toledo, and Cleveland State University** partnered to host two **sonde calibration events.** During these events, sonde users in the Lake Erie region were able to clean and calibrate their equipment prior to the summer season. Participants included water treatment plant operators, researchers, metropark staff, and non-profit organizations. Technical support was provided by LimnoTech and Yellow Springs Inc. The two events attracted nearly 50 participants and worked on nearly 50 sondes. If you're interested in learning more or participating in future events, please contact Ken Gibbons at **kgibbons@limno.com.**

HABs Calendar

Interdisciplinary Freshwater Harmful Algal Blooms Workshop

Review materials from the **Interdisciplinary Freshwater Harmful Algal Blooms Workshop** which took place on **May 4-5** in Montreal. You can find more conference details **here.**



Lake Erie HAB Season Forecast

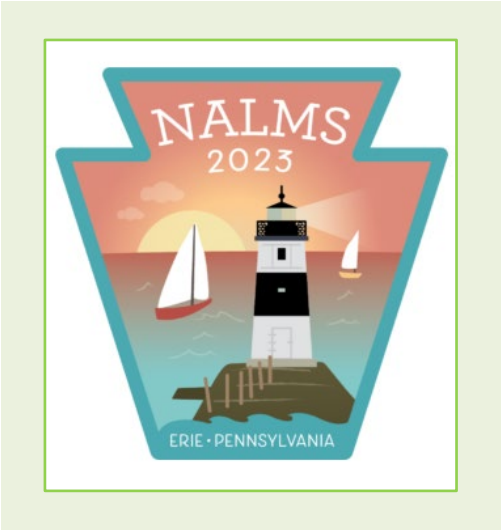
On **June 29,** NOAA will issue the official **Lake Erie HAB Seasonal Forecast** in coordination with Ohio Sea Grant. NOAA will provide information on the presence and location of any bloom throughout the summer. Click **here** to sign up for a live web event of the forecast.

Understanding Algal Blooms: State of the Science Conference

On **September 6,** Ohio Sea Grant's **State of the Science Conference** will take place in Toledo, Ohio. Find more event details **here.**

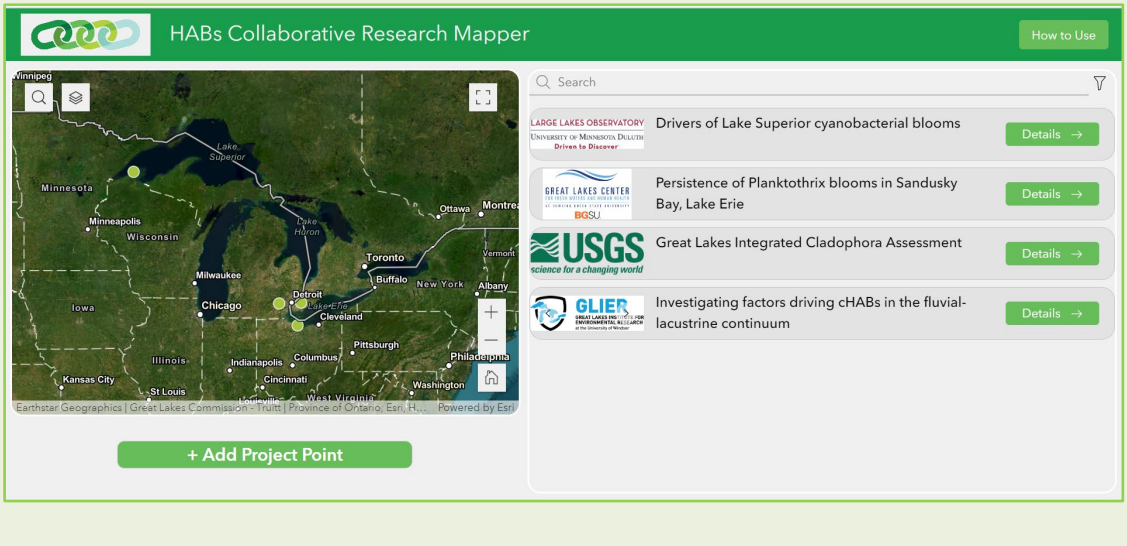
North American Lake Management Society Conference

Register for the **North American Lake Management Society Conference** to be held in Erie, Pennsylvania, from **October 22-26.** You can find more details and **register for the conference here.**



Share your research project on the HABs Research Mapper!

HABs Collaborative Steering Committee members have worked with the Great Lakes Commission to develop an app to increase collaboration among researchers and water managers working to investigate and address HABs in the Great Lakes basin. **Visit www.glc.org/work/habs to learn more.** Please reach out to Connor Roessler, croessler@glc.org if you have a research project to add to the mapper.



Member Spotlight

We know a lot of good work is happening around the Great Lakes basin thanks to many of our collaborative members. **Help us share that work by suggesting content for the "Member Spotlight" section of this periodic newsletter.** Please share your ideas with Connor Roessler at croessler@glc.org.

Spotlight: Lydia Lopez

Lydia Lopez received her bachelor's degree in environmental science at Siena Heights University under the mentorship of Dr. Heather Moody. Outside of school, Lydia holds a position as Water Stewardship Coordinator of the **River Raisin Watershed Council** (RRWC). For her senior research thesis, Lydia used both her knowledge from schooling and data collection opportunities through her position at RRWC to analyze the effects of temperature and precipitation on eutrophication parameters on Loch Erin, a local inland lake in Onsted, Michigan. Parameters tested for included levels of dissolved oxygen, nitrogen, phosphorus and *E. coli*. Lydia is excited to continue her employment at RRWC post-graduation and looks forward to continuing to work with local partners on research and remediation projects to help understand and support our Great Lakes freshwater systems.

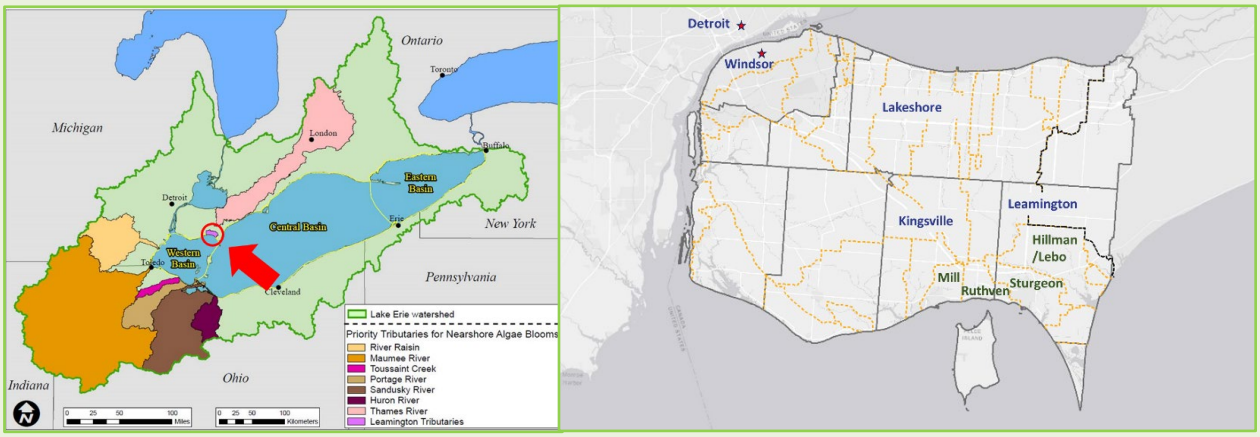
Lydia Lopez

Canadian Corner

Expanding greenhouse sector in Essex County, Ontario, contributes to downstream water quality degradation

Katie Stammler, Water Quality Scientist, Essex Region Conservation Authority

The Great Lakes Water Quality Agreement named the **Leamington Tributaries** as a priority watershed for phosphorus load reduction to mitigate HABs in Lake Erie. These are actually several relatively small, hydrologically distinct watersheds in the municipalities of Leamington and Kingsville in Essex County, Ontario, and they are heavily influenced by greenhouse agriculture. Average total phosphorus (TP) concentrations from 2017 – 2021 in watersheds dominated by traditional (i.e., non-greenhouse) agriculture in the Essex Region ranged from 0.12mg/L to 0.30mg/L, whereas average TP in the Leamington Tributaries in the same time period ranged from 2.9 to 6.0 mg/L. This is 100-200 times higher than the Provincial Water Quality Objective of 0.03mg/L for streams to prevent nuisance algal growth.



Located in the southeast corner of Essex County, Ontario, the Leamington Tributaries are actually several hydrologically distinct watersheds in the municipalities of Leamington and Kingsville. These include Lebo Creek, Sturgeon Creek, Mill Creek, and the Ruthven Area drainage, which consists of six small watersheds.

In 2012, the Essex Region Conservation Authority began monitoring these watersheds biweekly year-round and in 2016 began event sampling with ISCO autosamplers in three watersheds. Now, with a decade of data, we have explored long-term trends and comparisons in nutrient concentration and load between greenhouse and non-greenhouse influenced streams. In addition, students at the University of Windsor digitized the footprint of greenhouses from aerial photography between 2000 and 2020. In total, the greenhouse footprint has more than tripled over this 20-year period, with many more greenhouses installed after our analysis. In the study watersheds, the greenhouse footprint increased between 4% and 20%.

Year over year, nutrient concentrations continue to be significantly, and strikingly higher in greenhouse streams than non-greenhouse streams, with most individual sites showing no trend over time. In typical agricultural streams, the highest nutrient concentrations and loads are observed during rain or snowmelt events in the non-growing season, due to surface runoff over bare fields. However, in greenhouse watersheds, the highest concentrations and loads are observed during baseflow conditions in the growing season, with rain events causing a dilution effect. This tells us

Greenhouse footprint in the study watersheds in 2000 (left) vs 2021 (right)

that these streams behave as though they have point sources. Next steps include refining the nutrient load calculations for inclusion in binational reporting and continued monitoring if and when funds become available. This work is also in preparation for publication.

Further action is needed to determine how nutrients are escaping from what should be closed-loop operations. This may require compliance monitoring and/or oversight during construction to ensure that losses to the environment are prevented. Perhaps most telling is the increase in nutrient concentration in a watershed that went from 0% to >20% of the watershed in greenhouse agriculture, where all structures are newly built. With greenhouse agriculture continuing to expand in this area, and elsewhere in the Great Lakes basin, it is essential that we take heed of this canary in the coal mine.

Get involved and stay in touch!

Find us on Twitter

The Collaborative is active on Twitter! Follow us to get up-to-date information about our work and other HABs-related content. @GLHABsCollab

Join our Listserv

To join our listserv and receive announcements about the Collaborative, please email Connor Roessler at croessler@glc.org