Great Lakes HABs Collaborative
NEWSLETTER
LINKING SCIENCE AND MANAGEMENT TO REDUCE HARMFUL ALGAL BLOOMS **SUMMER 2024**

What's happening with the HABs Collaborative?

The HABs Collaborative at IAGLR and ASLO 2024

The **International Association for Great Lakes Research** (IAGLR) hosted its 67th annual conference in Windsor, Ontario, this May. The conference was well attended with hundreds of presentations and posters under the theme of **Shared Lakes: One Water, One Health.**

While several presentations throughout the week addressed harmful algal blooms, the Great Lakes HABs Collaborative hosted a session focused on the science and management of HABs called **Great Lakes HABs: One Water, One Health, Many Questions**. The session was chaired by HABs Collaborative Steering Committee member **Chris Winslow,** USGS representative **Mary Anne Evans,** and Great Lakes Commission liaison **Nicole Zacharda.** In total, nine presenters shared their research findings during the session.

The presenters covered many aspects of bloom research across many research locations. They shared findings using genomic characteristics to trace bloom-forming species throughout the Laurentian Great Lakes and comparing HABs species between Lake Erie to Lake Victoria in Kenya. Other talks examined the socioeconomic consequences of HABs in Lake Victoria, compared the nutrient loading between tributaries in southern Ontario, and examined several factors of bloom formation in coastal Lake Superior.

Great Lakes HABs Collaborative materials available at the IAGLR conference.

A sign greets conference goers for the Great Lakes HABs Collaborative facilitated session at the ASLO meeting.

Other speakers presented on cyano-induced lake basification, innovative HABs mitigation techniques, and a **StoryMap** highlighting the effects of the benthic HABs *Microseira wollei* . The Great Lakes HABs Collaborative is grateful for the diversity of stimulating and thought-provoking presentations and the interest from those who attended. We hope the Great Lakes HABs community joins us in Milwaukee for IAGLR 2025.

Following IAGLR, the **Association for the Sciences of Limnology and Oceanography** (ASLO) hosted their annual meeting in Madison, Wiscosin, with the theme of **Adapting to a Changing World**. Great Lakes HABs Collaborative USGS representative **Mary Anne Evans** and two partners**, Elena Litchman** and **Rebecca Gorney,** facilitated a session called **cHABs as a Response to Ecosystem Disturbance.** Throughout the final day of the meeting, 16 presenters shared their work on the interplay between HABs and disturbances to lake ecosystems. A diversity of topics was discussed, including HABs in oligotrophic lakes, HAB response to nutrient and temperature increase, reconstructing HABs historical communities, HABs response to specific environmental factors, HABs vertical migration within lakes, and benthic algae response to surface HABs.

Attendees listen to a presentation during the cHABs as a Response to Ecosystem Disturbance session.

HABs Calendar

Cleveland Water Alliance and HABs Collaborative Joint Webinar Series

In partnership with the Great Lakes HABs Collaborative, the **Cleveland Water Alliance** is hosting a series of interactive panels exploring innovations in HABs data collection and management. Webinars will be held on the third Thursday of August, September, and October of 2024 from 12-1 p.m. ET.Registration information can be found at **this link.**

North Central Region Water Network Algal Bloom Action Team Webinar Series

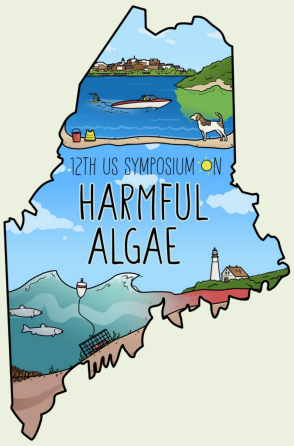
The **Algal Bloom Action Team** is hosting a webinar series as an extension of their annual virtual research symposium. Webinars will be held bimonthly, hosted by the North Central Region Water Network, and recordings can be found by visiting **this link.**

Harmful Algal Blooms, Hypoxia, and Nutrients Research Webinar Series

Hosted by U.S. EPA's Offices of Water and Research and Development, and regional offices, this free webinar series is focused on communicating the latest, cutting-edge research related to nutrients and the priority impacts of nutrient pollution: harmful algal blooms (HABs) and hypoxia. Webinars are typically held bi-monthly from 2 to 3 p.m. ET on the last Wednesday of the month. Find more information and a schedule of webinars **here**.

12th U.S. Symposium on Harmful Algae

Save the date for the **12th U.S. Symposium on Harmful Algae** to be held in Portland, Maine, from October 27-November 1. Registration is open and a call for abstracts is coming soon. More event details can be found **here.**



North American Lake Management Society Conference

Save the date for the **NALMS Conference** to be held in South Lake Tahoe, California/Nevada, from November 5-8. The call for abstracts is open and more event details can be found **here.**

Member Spotlight

Spotlight: Carol Waldmann Rosenbaum

Carol Waldmann Rosenbaum

Carol Waldmann Rosenbaum is a Ph.D. candidate in the department of Integrative Biology and Ecology, Evolution, and Behavior Program at the University of Wisconsin-Madison. She is advised by Dr. Elena Litchman in the **Water Systems and Society lab**. Her research focuses on how environmental drivers and cyanobacteria ecophysiological diversity interact to shape harmful algal bloom (HAB) community structure. Carol uses multi-trait and genomic comparisons to better define cyanobacteria ecological niches in the Great Lakes contributing to the mechanistic understanding of HABs in this system.

Despite diverse environmental conditions across the Great Lakes, cyanobacterial blooms (cHAB) have been observed in all five lakes. CHABs commonly form in nutrient-rich, shallow, and warm waters such as the western basin of Lake Erie. In contrast, Lake Superior's waters are colder and oligotrophic, characteristics that are not often associated with cHABs. Bloom occurrence over a wide range of physical-chemical environments contributes to uncertainty regarding cHAB drivers. Additionally, while the dominant cyanobacterial species in each bloom vary across lakes and basins, from year to year, and can change throughout a season, the same genera are generally present in all lakes, suggesting that these cyanobacterial genera are adapted to a broad range of conditions. Although only a few genera compose most of the regional blooms, there is great inter- and intraspecific genetic and functional diversity within these genera, which may aid cyanobacterial adaptation to local conditions. Still, we know very little about whether and how different cyanobacteria are adapted to local conditions in the Great Lakes.

Carol uses trait bioassays and 16S sequencing to compare how temperature and nutrient ranges affect the growth rates of different cyanobacteria genera and how these ecophysiological traits relate to their genetic diversity. She is also empirically parametrizing and testing a resource competition model between *Microcystis*, *Aphanizomenon*, and *Dolichospermum* (most common bloom forming cyanobacteria genera in the Great Lakes). For her experiments, Carol uses cyanobacterial strains she has isolated in the past two years from several locations across the Great Lakes. Her research contributes to ongoing efforts to understand, forecast, and mitigate cHABs in the Great Lakes. Specifically, efforts aiming to better predict *Microcystis* competition with other phytoplankton, including other cyanobacteria genera, under varying environmental conditions. Developing and assessing mechanistic models to explain cyanobacterial community structure will improve existing cHAB forecasting models and aid new model development that considers community dynamics.

Spotlight: Emily Varga

Emily Varga is a Ph.D. candidate at the **Great Lakes Institute for Environmental Research at the University of Windsor**, working under the advisement of Dr. R. Michael McKay. Emily obtained her bachelor's degree in biological science at the University of Windsor and began her Ph.D. program in Environmental Science in 2020. The focus of her current research is environmental drivers of phytoplankton community dynamics and production of cyanobacterial toxins along the Thames River – Lake St. Clair continuum. Lake St. Clair is particularly important to Emily, as she resides in Belle River, Ontario, where the lake is an important source of drinking water and is used recreationally year-round by local residents. When not pursuing her studies, Emily enjoys camping and hiking with her husband, Tom, 11-year-old daughter Olivia, and their two dogs, Winnie and Fiona.

Emily Varga

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 that increases 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.

Michigan HABs Group Hosts HABs 101 Webinar

Erica Clites, Michigan Sea Grant

Michigan Sea Grant and partners around Michigan hosted a **HABs 101 webinar** on March 6. Over 140 individuals attended live and over 300 have since watched the recording. Viewers learned what harmful algal blooms look like, the role of algae in the ecosystem, how to respond if a potential HAB is observed, and how to prevent and reduce the likelihood of a HAB occurrence. Presenters also busted some myths, and shared tips for keeping families and pets safe and taking action to support healthy water quality on your property and in your community.

Many participants reported that they would feel more confident explaining harmful algal blooms to a neighbor after watching the webinar. 45% of those who attended the webinar were connected with lake associations. We encourage you to share the recording and list of resources with audiences who may find it helpful. If you have suggestions of resources to add, send them to Erica Clites, clitese1@msu.edu.

This webinar was an outgrowth of a group of over 40 Michigan professionals involved in HABs outreach and engagement who have been meeting every other month since July 2023. The group consists of representatives from state agencies including the Michigan Department of Health and Human Services, Michigan Department of Environment, Great Lakes, and Energy, and Michigan Department of Agriculture and Rural Development. It also includes representatives from Michigan State University, MSU Extension, the University of Michigan, and the Cooperative Center for Great Lakes Research (CIGLR), as well as other nonprofits and local health departments.

The group has been identifying gaps in available HABs information and brainstorming how to fill those gaps. The webinar provided a way to address misconceptions, provide a broader view of the role of algae in the ecosystem as well as connecting people to the organizations involved in HABs work and providing tips on HABs prevention. Later in 2024, this group will be releasing a social media toolkit for partners to use as well as hosting another Algae 101 webinar. If you want to find out more about this group, or if you work in Michigan and want to attend our meetings, contact Erica Clites.

Canadian Corner

Environmental drivers of phytoplankton community dynamics in the Thames River in southwestern Ontario

Emily Varga, Great Lakes Institute for Environmental Research, University of Windsor

Toxin producing **cyanobacterial harmful algal blooms (cHABs)** in freshwater bodies are enhanced by over-enrichment of phosphorus (P) and nitrogen (N) due to anthropogenic activities. However, interactions among multiple factors including light availability, water mixing, and bioavailability of N and P are increasingly being considered to manage the proliferation of cHABs. Phytoplankton communities in tributaries differ from those in their receiving waters. For example, in western Lake Erie and Lake St. Clair, cyanobacterial blooms tend to be dominated by colonial species, such as *Microcystis*, whereas cyanobacterial assemblages in the tributaries are often dominated by various filamentous taxa, such as *Aphanizomenon flos-aquae* and *Planktothrix agardhii* (McKay et al, 2020). This is likely due to sediment resuspension and resulting light attenuation in rivers as opposed to nutrient limitation under more optimal light conditions in lakes. Agriculturally influenced rivers are often characterized by high turbidity and low light levels due to high sediment loads, and much of the spatial and temporal variation in phytoplankton community composition can be attributed to variation in light availability (Davis et al., 2014). Surveys along the fluvial-lacustrine continuum from the Thames River to Lake St. Clair confirm this difference in taxonomic composition, reinforcing the idea that rivers do not primarily seed phytoplankton communities in lakes (Crevecoeur et al., 2023).

The Thames River is a large agricultural watershed in southwestern Ontario which empties into the southeast end of **Lake St. Clair**. For several years, the southern end of Lake St. Clair has experienced nearshore cHABs with high toxicity and in recent years cHABs have been observed in the Thames River itself. The in-river blooms raised concerns locally and led to the need to better understand the differences and/or similarities in environmental factors driving cHABs and phytoplankton community composition along the tributary to lake continuum. We used microcosm experiments to determine how multiple environmental factors promote or constrain phytoplankton community dynamics in the Thames River (Varga et al., 2024). Microcosms were deployed in early, mid and late summer of 2021 to determine the effects of light attenuation, in conjunction with nutrient availability, on the proliferation of the phytoplankton community over the typical growing season.

In late summer, there was a depletion of bioavailable P compared to mid-growing season, which correlated with a phytoplankton community shift from diatom to cyanobacterial dominance. In microcosms where light availability was lowest, filamentous taxa were the most dominant, whereas in microcosms with higher light availability, colonial, buoyant taxa were dominant. Chlorophyll *a*, measured as a proxy for biomass, and total phytoplankton abundance, measured as cells/mL were positively correlated to light availability. Overall species diversity was lowest in the containers with least light availability. During the late summer trial, DIN:SRP (ratio of dissolved inorganic nitrogen to soluble reactive phosphorus) at the start of the experiment was lower than the mid-summer trial and the cyanobacterial communities showed a shift from non N–fixing *Merismopedia* to N–fixing *Planktothrix*. Despite the

presence of potential toxin producing taxa, total microcystin concentrations ranged from 0.03 µg/L – 0.14 µg/L across treatments and did not exceed the maximum acceptable level of 10 µg/L for recreational exposure in Canada.

In summary, this study found lower abundances of colonial genera and higher abundances of filamentous forms, coincident with reduced light, contributing to the overall cyanobacterial dominance. These results suggest that light availability, in conjunction with nutrient stoichiometry, shape the dynamics of phytoplankton community composition. However, results were not consistent across the growing season, suggesting that seasonality, and likely temperature, play an important role in temporal phytoplankton community dominance. These findings lead to a subsequent three-year study along the Thames River-Lake St. Clair continuum in which differences between phytoplankton communities and nutrient concentrations are being investigated across seasons, and river vs. lake sites.

References

Crevecoeur, S., Edge, T. A., Watson, L. C., Watson, S. B., Greer, C. W., Ciborowski, J. J. H., Diep, N., Dove, A., Drouillard, K. G., Frenken, T., McKay, R. M., Zastepa, A., & Comte, J. (2023). Spatio-temporal connectivity of the aquatic microbiome associated with cyanobacterial blooms along a Great Lake riverine-lacustrine continuum. *Frontiers in Microbiology*, *14*. https://doi.org/10.3389/FMICB.2023.1073753

Davis, T. W., Watson, S. B., Rozmarynowycz, M. J., Ciborowski, J. J. H., Mckay, R. M., & Bullerjahn, G. S. (2014). Phylogenies of microcystin-Producing cyanobacteria in the lower laurentian great lakes suggest extensive genetic connectivity. *PLoS ONE*, *9*(9). **https://doi.org/10.1371/journal.pone.0106093**

McKay, R. M., Frenken, T., Diep, N., Cody, W. R., Crevecoeur, S., Dove, A., Drouillard, K. G., Ortiz, X., Wintermute, J., & Zastepa, A. (2020). Bloom announcement: An early autumn cyanobacterial bloom co-dominated by *Aphanizomenon flos-aquae* and *Planktothrix agardhii* in an agriculturally-influenced Great Lakes tributary (Thames River, Ontario, Canada). *Data in Brief*, *30*, 105585. **https://doi.org/10.1016/j.dib.2020.105585**

Varga, E., Weidman, R. P., Song, Z. & McKay, R. M. (2024). Environmental drivers of phytoplankton community dynamics in an agriculturally – influenced tributary in the lower Great Lakes. *Science of the Total Environment, 939*. **https://doi.org/10.1016/j.scitotenv.2024.173411**

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