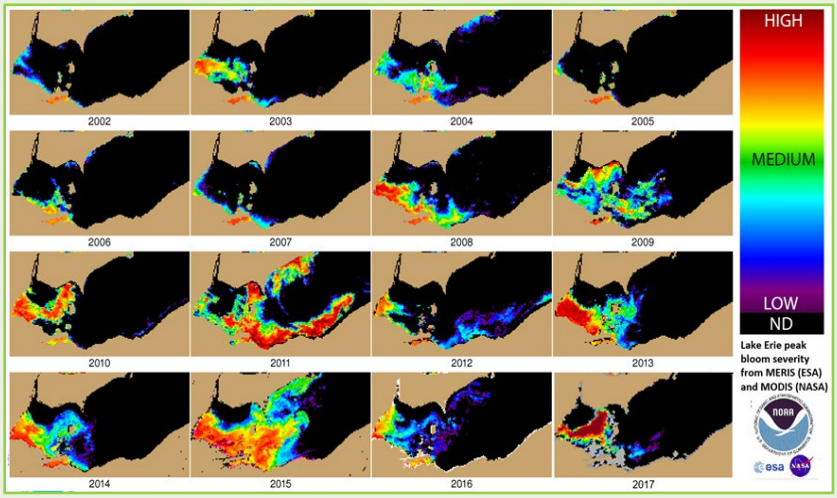
Great Lakes HABs Collaborative
NEWSLETTER
LINKING SCIENCE AND MANAGEMENT TO REDUCE HARMFUL ALGAL BLOOMS FALL 2022

What's happening with the HABs Collaborative?

Sandusky Bay Tells a Different Story than Western Lake Erie

George S. Bullerjahn, Emeritus professor and Director of the Great Lakes Center for Fresh Waters and Human Health, Bowling Green State University

Every July, the **Lake Erie Algal Bloom Forecast** is released, providing a useful prediction of the western Lake Erie cyanobacterial bloom season to come. It is now well known that the intensity of the western basin's offshore *Microcystis* bloom in mid to late summer is predicted by springtime nutrient load from the Maumee River. However, a mere one-hour drive east, toxic cyanobacterial blooms in Sandusky Bay defy such predictions. I'm pleased to share my teams' observations of differences in bloom characteristics and recent surprises in the Bay.



Lake Erie peak bloom images, 2002-2017. Note the intense bloom in Sandusky Bay (lower left of each frame) in years lacking the offshore Microcystis bloom. See 2002, 2005, 2006.

The composition of the toxic cyanobacterial bloom biomass in Sandusky Bay has been fundamentally different from that observed in open water of the western Lake Erie basin. In 2003 and 2004, Johanna Rinta-Kanto and Steve Wilhelm first observed that *Planktothrix* was the dominant microcystin-producing cyanobacterium in the Bay, with *Microcystis* virtually absent. Using Ohio-funded surveys from 2013-2019, my students have since shown that *Planktothrix* blooms appeared earlier and persisted later in the season than the offshore *Microcystis* blooms, in part due to the capability of *Planktothrix* to grow in cooler temperatures. Of particular interest was the observation that bloom intensity could not be predicted by the spring nutrient load from the Sandusky River. Most years,

independent of spring rainfall, our team observes an intense *Planktothrix* bloom from June-September, distinct from the interannual variability of the western Lake Erie *Microcystis* bloom.

Based on real-time measurements obtained by *in situ*-deployed nutrient analyzers, we have proposed that annual internal loading of phosphorus from sediment is a major driver of bloom biomass. This legacy phosphorus load entrained in sediment is independent of current inputs from the Sandusky River. Another likely factor promoting *Planktothrix* persistence is its ability to effectively scavenge nitrogen more efficiently than *Microcystis*. High rates of denitrification in the Bay result in a nitrogen-depleted system in late summer, and *Planktothrix* competes well for trace levels of nitrogen, despite the fact that it is not a nitrogen fixing genus.

Image 2: Light microscopy of bloom biomass, June 10, 2022, upper Sandusky Bay, 100X image

Through the work discussed above, I believed we were beginning to understand how blooms form in Sandusky Bay, and why they behave in such a predictable manner from one year to the next. However, in 2020 and 2021, the Bay got a bit more interesting when the *Planktothrix* bloom (and hence microcystin toxins) disappeared and was replaced largely by green algae and diatoms. Chlorophyll levels peaked around 50 μg/mL, down from 200 μg/mL in most of our previous survey seasons. Looking more closely, metagenomic surveys from 2019 showed decreases in the relative abundance of *Planktothrix*, suggesting the Bay microbial community was in transition prior to 2020.

Our next surprise occurred in June of this year. There was a cyanobacterial bloom, but this time it was composed of *Aphanizomenon* (pronounced ah-FAE-ni-zo-men-in) with a minor contribution from *Dolichospermum*. By July, the bloom largely disappeared, replaced by greens and diatoms as in 2020 and 2021. Checking our metagenomic datasets from prior years, there was a June appearance of *Aphanizomenon* in 2020 as well, but no surface scum was documented, as it was in 2022. So, we are seeing transient appearances of potential nitrogen-fixing cyanobacteria where they have not previously been known to occur.

So why did *Planktothrix* disappear? We don't believe it is due to changes in nutrient availability, as the variability on springtime nutrient loads did not influence the appearance of the *Planktothrix* bloom for the two decades prior. The high water levels of the past three years may have contributed to observed increases in water clarity and light transmission, likely due to reduced sediment resuspension. Since *Planktothrix* thrives in low-light, sediment-laden waters, perhaps that is a factor. Other ideas have been suggested, but without a clear mechanism to explain the shift in community composition. Indeed, the changes in algal and microbial communities beginning in 2019 were temporally linked to the removal of the Ballville Dam in the Sandusky River in late 2018. However, we have no idea why removing the dam would yield such drastic alterations in the Bay, so that event may be an unrelated coincidence. Addressing this question would require analysis of sediment and water quality data from the Sandusky

River prior to dam removal, and it is possible that the appropriate data and sediment samples may no longer be available.

Another puzzle is the emergence of potential nitrogen-fixing *Aphanizomenon*. What are the drivers promoting the transient June bloom of 2022? It is too early to address that question, but should we see it again in coming years, I am hopeful our surveys can identify the physical, biological and chemical factors contributing to *Aphanizomenon* success. Given that the Bay appears to be in flux these days, I ask the public to let me know if they spot a new bloom forming. We will be there as soon as we are able.

New Tool Available to Track Michigan Harmful Algal Bloom Reports

To help the public know where harmful algal blooms (HABs) have been reported in Michigan, a new **Michigan Harmful Algal Bloom Reports map** is available online at **Michigan.gov/habsmap.** The map is updated weekly from June to November and shows verified bloom reports and results of any cyanotoxin tests.

The Michigan Department of Health and Human Services (MDHHS), in collaboration with the Department of Environment, Great Lakes, and Energy (EGLE), developed the map, which was published on August 8, 2022. Any questions about the map can be directed to **MDHHS-HABsmap@michigan.gov.**

The map has different data layers that show reports and test results either from the most recent two weeks or the current season. Not all HABs in Michigan are reported to EGLE and thus may not be on the map. Also, HABs can move around, and disappear and reappear, meaning that HABs may be present in waterbodies but not be present on the map.

Any suspected HABs in Michigan can be reported to EGLE by e-mailing AlgaeBloom@Michigan.gov with pictures of the suspected HAB. More information on HABs can be found at **Michigan.gov/habs.**

HABs Calendar

North American Lake Management Society Conference

Leveraging Experience to Manage Diverse Lakes, Landscapes, and People will be hosted by the North American Lake Management Society in Minneapolis Minnesota from November 14-17, 2022. Check their **webpage** for registration information.

11th U.S. Symposium on Harmful Algae

The **11th U.S. Symposium on Harmful Algae** will take place in Albany, New York from October 23-28, 2022. You can find more details and **register for the conference here.**

Strategies for Preventing and Managing Harmful Cyanobacteria Blooms (Two Part Series)

The **Interstate Technology and Regulatory Council** will hold two live webinar trainings review key information found in the two ITRC HCB Guidance Documents. The webinars will take place from 1:00-3:15 PM Eastern on October 13 and November 8, 2022. Registration and information are available **here.**

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 quarterly newsletter.** Please share your ideas with Connor Roessler at **croessler@glc.org.**

Spotlight: Ohio EPA's Seth Buchholz and Callie Nauman

Seth Buchholz

Seth Buchholz received his master's degree in the Department of Biological Sciences at Bowling Green State University, working under Dr. George Bullerjahn. For his NOAA-funded thesis project, Seth collaborated with LightDeck Diagnostics in developing a rapid, portable cyanotoxin detection technology and implemented this in routine monitoring programs and with local citizen science groups. He is currently employed as an Environmental Specialist II in the Division of Drinking and Ground Waters at the Ohio EPA, serving as the backup HAB coordinator and public water system inspector. Seth is grateful that he is able to apply his previous HAB research experience and passion for water quality in his career with the Ohio EPA.

Also a graduate of the Bowling Green State University Department of Biological Sciences master's program, **Callie Nauman** joined the Ohio EPA Division of Drinking and Ground Waters in 2021. Her master's research focused on harmful algal blooms and cyanotoxin detection primarily in Lake Erie and the Maumee River. Aside from her academic work, Callie has been a research technician for the Ohio State University's Stone Laboratory and Aquatic Ecology Laboratory, as well as a technician for the Wilson Lab at Auburn University. She is excited to apply her HAB knowledge and learn more from the agency as the Harmful Algal Bloom Compliance Coordinator.

Callie Nauman

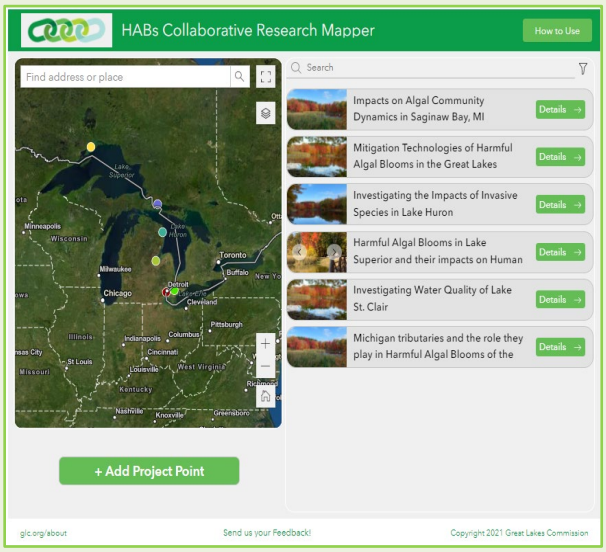
Spotlight: Jeff Pu's work on affordable water sensors

Jeff Pu and the Water Resource Sensors

Jeff Pu is a postdoctoral research fellow dedicated to understanding water resource issues. Jeff obtained his Ph.D. in water resource engineering from the State University of New York - College of Environmental Science and Forestry and MS and BS in environmental engineering from Drexel University. His work so far has focused on integrating and deploying various innovative water resource sensors to understand environmental issues (i.e., flooding, erosion, and harmful algal blooms) around Lake Erie. His current research has been jointly funded through Cleveland Water Alliance, LimnoTech, and NOAA CIGLR. For the past year, he has co-developed an Internet of Things based **affordable sensor kit** with LimnoTech. The sensor kit utilizes a state-of-art Internet of Things communication network, has battery capacity that supports 5+ years of continuous real-time monitoring, and consists of sensors that cost $40 to $200 which can measure various water quantity and quality parameters. He is currently working with a diverse group of collaborators to test and implement these kits in various environments and locations across Lake Erie region. You can find his work on various sensors around Lake Erie region on **YouTube**, **Twitter**, and **Engineering Blog**. If you are interested in learning more about the affordable sensor kits and joining a growing number of users, don't hesitate to contact Jeff at **jeff@clewa.org.**

The HABs Research Mapper is ready for beta-testing!

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. Please consider adding your research project to the Mapper and tell us your thoughts if you see opportunities to improve this app! **Visit www.glc.org/work/habs to learn more.**



News from our HABs Collaborative Co-chairs

Gina LaLiberte

Welcome to new co-chair, Gina LaLiberte of Wisconsin DNR

Gina LaLiberte joined the HABs Collaborative Core Team as co-chair in May 2022. She serves as the Statewide Harmful Algal Bloom Coordinator for the Wisconsin Department of Natural Resources in the Environmental Management Division's Bureau of Water Quality in Madison, Wisconsin. She has led the DNR's response and communication on harmful algal bloom issues since 2011. Her previous work for the DNR focused on paleolimnological reconstructions and stream bioassessment using diatoms. A lifelong resident of the Great Lakes region, she grew up in southwestern Michigan, earned a BS in biology and a MS in resource ecology management from the University of Michigan, and embarked on a career in freshwater algae as a biology Ph.D. candidate at Bowling Green State University.

An update from co-chair Dr. Ruth Briland

Ruth Briland was recently promoted within the Ohio Environmental Protection Agency to serve as the Environmental Supervisor of the Total Maximum Daily Load (TMDL) and Integrated Report Programs. She now works directly with efforts to address impairments and restore Ohio's waters to meet beneficial uses. The Maumee Watershed Nutrient TMDL works to address harmful algal blooms in western Lake Erie; learn **more here.** Ruth will continue as co-chair of the HABs Collaborative.

Dr. Ruth Briland attending an outreach event

Connor Roessler

Connor Roessler joins the GLC team

Connor Roessler joined the Great Lakes Commission in April 2022. He works as a program specialist within the water quality program, including work for the HABs Collaborative. He joins the GLC with experience as a watershed educator in West Virginia and with an MS in environmental communications and education from the University of Michigan and a BS in environmental science from the University of Virginia.

Canadian Corner

HABs Collaborative Co-Chair Emeritus Dr. Katie Stammler of the Essex Region Conservation Authority shares updates on events hosted by Living Lab – Ontario.

With a return to in-person events, this summer has been packed with field tours and meetings, letting us connect and share great ideas. Through the **Living Lab – Ontario** project, there was a series of seven events held throughout Ontario to highlight the work being done by farmers, partners, and Agriculture and Agri-food Canada researchers to achieve goals of nutrient reduction and improved soil health through the use of many different best management practices. These events were an opportunity to come together on-farm, to share data, and knowledge, and to strategize on next steps for their innovations.

In the Essex Region, Henry and Jeremy Denotter hosted an event on September 9 at their farm in Kingsville. Henry shared his experience with integrating conservation practices into his farming operation beginning decades ago with a switch to no-till farming. Today, the Denotters build their program around precise 20" row spacing, using a full crop rotation that includes corn, soy, winter wheat and buckwheat as a cover crop or potentially harvestable fourth crop following wheat. Henry's motto "it's all about the water" has led him to adopt fertilizer application methods that ensure the nutrients get in the ground where the plants need it rather than broadcast across the surface which can increase losses in runoff to ditches and streams. To learn more about Living Lab – Ontario visit: **https://www.osciaresearch.org/living-lab/**or check out Henry's farm on the Ontario Soil Roadtrip by downloading the app at **ontariosoil.net/soilroadtrip**. Henry is also a collaborator with the provincial ONFARM program.

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