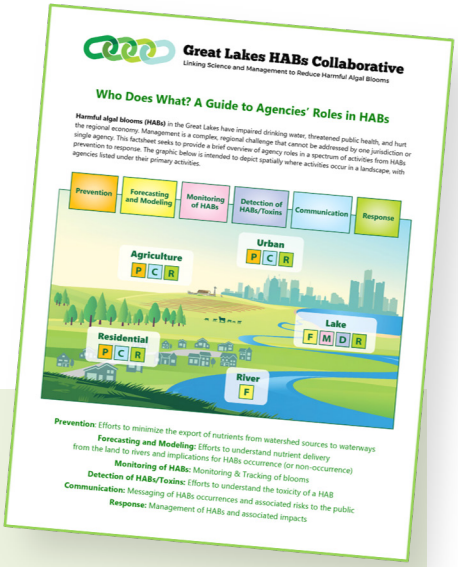
Great Lakes HABs Collaborative
NEWSLETTER
LINKING SCIENCE AND MANAGEMENT TO REDUCE HARMFUL ALGAL BLOOMS **Summer 2021**

What's happening with the HABs Collaborative?

Who Does What?
A Guide to Agencies' Roles in HABs

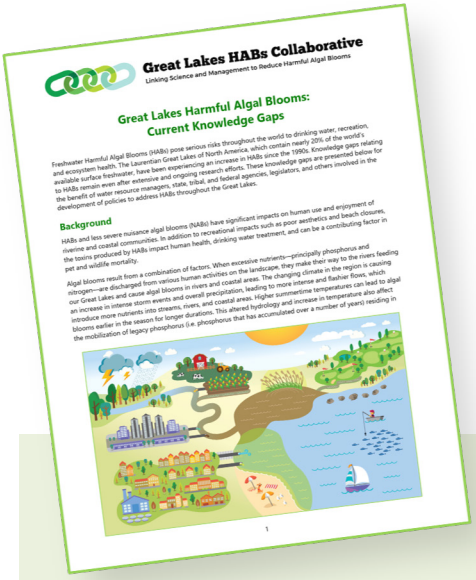


In February, a subset of Collaborative members published **a fact sheet that provides a brief overview of agency roles** from HABs prevention to response. The fact sheet is two pages long and intended to appeal to a broad audience. A copy of the fact sheet as well as previous publications from the Collaborative can be found at: www.glc.org/work/habs/publications.

Steering Committee members contributing to the fact sheet

Paul Gledhill, Cherri Baysinger, Michelle Selzer,
Katie Stammler, Nicole Zacharda, and Ken Gibbons

Great Lakes Harmful Algal Blooms: Current Knowledge Gaps



Right before the Great Lakes Commission's Semiannual Meeting, a subset of Collaborative members released **a fact sheet highlighting current knowledge gaps related to Great Lakes harmful algal blooms.** The fact sheet is intended for the benefit of water resource managers, state, provincial, tribal, First Nations and federal agencies, legislators, and others involved in the development of policies to address HABs throughout the Great Lakes. The fact sheet covers common knowledge gaps across all Great Lakes and goes into detail on specific knowledge gaps for each lake. A copy of the fact sheet as well as previous publications of the Collaborative can be found at: www.glc.org/work/habs/publications.

Steering Committee members contributing to the fact sheet

Greg Boyer, Mary Anne Evans, Timothy Maguire, Silvia Newell,
Heather Raymond, Dale Robertson, Katie Stammler,
Nicole Zacharda, and Ken Gibbons

IAGLR 2021

IAGLR's 64th annual Conference on Great Lakes Research was hosted virtually during the week of May 17, 2021. Members of the Collaborative hosted Session 32 **Great Lakes HABs: Bridging ecology, human dimensions, and management.** The session took place on May 18 and 19 and consisted of 27 talks and six posters, making it one of the largest sessions at IAGLR. The sessions were well attended, often with more than 50 participants at a time. The talks covered a wide range of topics and disciplines with presenters from a variety of institutions and agencies. Presentations spanned from the ecology of cyanobacteria, and formation and tracking of HABs, to human health effects and management options. **For those who registered, recordings of the talks are available through August 1.** For more information on the conference, visit: http://iaglr.org/iaglr2021/

Canadian Corner

There are two very exciting, agriculture focused projects underway in Ontario. **The On-Farm Applied Research and Monitoring (ONFARM)** program is a four-year, applied research initiative that supports soil health and water quality research on farms across Ontario. **Living Lab – Ontario** is the latest collaboration created under the **new Living Laboratories Initiative,** which brings together farmers, scientists, and other partners to co-develop, test and share innovative agricultural practices and technologies.

ONFARM is funded by the Canadian Agricultural Partnership, a federal-provincial-territorial initiative. ONFARM was developed by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), and is delivered by the Ontario Soil and Crop Improvement Association (OSCIA) with the support from various organizations including Agriculture and Agri-Food Canada, five Conservation Authorities and the Soil Resource Group. ONFARM is also supported by a network of farmer cooperators, who are essential to the success of this program. ONFARM builds on work completed under the Great Lakes Agricultural Stewardship Initiative's (GLASI) Priority Sub-watershed Project, supports Ontario's Soil Health and Conservation Strategy, and helps the industry meet commitments under the Great Lakes Water Quality Agreement.

The three pillars of ONFARM are:

1. Continuation of water quality and quantity monitoring and modelling established in the Priority Subwatersheds at the watershed and field scale
2. Establishment of on-farm paired trials in-field to identify soil health indicators and test the effectiveness of best management practices in cooperation with farmers
3. Enhanced engagement opportunities with stakeholders and farmers to foster a network of demonstration farms.

Living Lab – Ontario, funded by Agriculture and Agri-Food Canada, is the fourth Living Lab in Canada, following similar collaborations in the Atlantic, Eastern Prairies, and Quebec regions. Living Lab – Ontario is located in the Lake Erie and Lake St. Clair basins in southwestern Ontario, where, because of its warm climate and fertile soil, about 75% of the land is used for agriculture. **Main priorities for the Living Lab - Ontario include soil health, water quality and watershed management, as well as biodiversity and climate change.**

Led by the Ontario Soil & Crop Improvement Association (OSCIA), collaborators include farmers, three Conservation Authorities (Essex Region, Lower Thames Valley, and Upper Thames River CAs), Ecological Farmers Association of Ontario (EFAO), Innovative Farmers Association of Ontario (IFAO), the Ontario Soil Network (OSN), and scientists from Agriculture and Agri-Food Canada and Environment and Climate Change Canada. Research will focus on reducing soil and nutrient runoff from agricultural land into Lake Erie, improving water quality, conserving soil health, and increasing biodiversity on agricultural lands in Ontario. Farmers, partners and scientists will share their expertise with farmers across Canada to help accelerate the adoption of sustainable practices and technologies.

Both ONFARM and Living Lab - Ontario benefit from strong partnerships between multiple organizations with farmer innovators as key participants and advisors. By fostering these relationships and investing in demonstration, research, education and outreach, these programs will serve to provide Ontario farmers with local solutions that work to increase environmental sustainability through decreased nutrient loss and increased carbon sequestration while balancing the need for economic sustainability for our farms.

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 Nicole Zacharda at **nzacharda@glc.org.**

For the Member Spotlight in this newsletter, we requested submissions from early career professionals/scientists and students.

Brenna Friday

Brenna Friday

Brenna is a second year Ph.D. student in the Kashian Ecotoxicology Lab in the Department of Biological Sciences at Wayne State University. Brenna graduated from the University of Maryland in 2019 with a bachelor's of science in Ecology and Evolution and a determination to help conserve vulnerable amphibian populations across the U.S. Since then,

she has woven her interests in herpetology, toxicology, and genomics into her dissertation designed to examine the toxic effects of harmful algal blooms on amphibian species in inland lakes and ponds across Michigan. Brenna hopes that her research will shed light on how HABs are contributing to the global decline of amphibian populations to help inform conservation and management plans. Her project has been strengthened immensely through collaboration with government and community science organizations like the **Michigan Office of Environment, Great Lakes, and Energy** and **Friends of the Rouge.** One day Brenna hopes to repay the favor by holding a position in government research focused broadly on the intersection of public and ecosystem health.

Dr. Jozef Nissimov

Dr. Nissimov is a new faculty member (Assistant Professor) at the University of Waterloo (Canada) and leads the Environmental Virology and Ecology Research Group (ENVERG). Although Nissimov started his new role during a pandemic, his team is steadily growing. The research themes in his group include the evolutionary analysis of phytoplankton viruses and the study of viruses that infect harmful algae.

Dr. Jozef Nissimov

Nissimov and his research team's current attention is towards elucidating the type of viruses that are associated within communities of harmful algae in Canadian lakes, through metagenomic shotgun sequencing. This approach will reveal the virus diversity within HABs, and the type of microbial host organisms that viruses may be associated with. It will also reveal the type of auxiliary metabolic genes (AMGs) within freshwater viruses; genes that viruses "steal" from their hosts and make use of during infection. An expansion to this work will be infection-dynamics experiments between cyanophages (viruses infecting cyanobacteria) and hosts such as *Microcystis aeruginosa*. These will test the effects of different physicochemical parameters related to climate change on cyanobacteria-cyanophage interactions in a controlled laboratory setting, using a state-of-the-art photobioreactor modelling system. The system will allow to investigate experimentally the isolated effects of temperature, light, pH, and nutrient availability on *M. aeruginosa*-virus dynamics.

If you are interested in learning more about Dr. Nissimov's work or collaborating with him, please contact him at **jnissimov@uwaterloo.ca.**

Dr. Nicole Olson

Nicole received her bachelor's degree in chemistry and biology from Edgewood College in 2016 and recently completed her Ph.D. in chemistry at the University of Michigan. During her research in graduate school, Nicole investigated how harmful algal bloom toxins become aerosolized, and what impact this has on public health and air quality.

Lake spray aerosol (LSA) is produced by freshwater wave breaking and bubble bursting in a size range important for inhalation exposure, with diameters < 2.5 µm making it possible to inhale these particles. Nicole collected freshwater samples from Mona Lake in Michigan during a severe HAB. Freshwater samples were analyzed for the presence of blue-green algae and microcystin toxins, after which LSA was generated in the laboratory using a custom made LSA generator. Eight types of microcystins were detected in the freshwater samples and seven toxins were detected in LSA particles, demonstrating that toxins are emitted through the aerosolization process in freshwater environments. Our results suggest microcystins partition to the air-water interface of bubbles passing through the HAB and are then transferred to the aerosol phase after bubble bursting. As HABs increase with a warming climate, understanding and quantifying the emissions of toxins into the atmosphere is crucial for evaluating the health consequences of HABs globally.

Dr. Nicole Olson
Dr. Nicole Olson and Dr. Andrew Ault (University of Michigan) collecting aerosol samples next to a freshwater HAB.

Nicole will be starting a postdoc position with the Environmental Protection Agency later this summer. If you are interested in learning more about Nicole's work, please contact her at **niolson@umich.edu.**

Dr. Sara R. Rivera

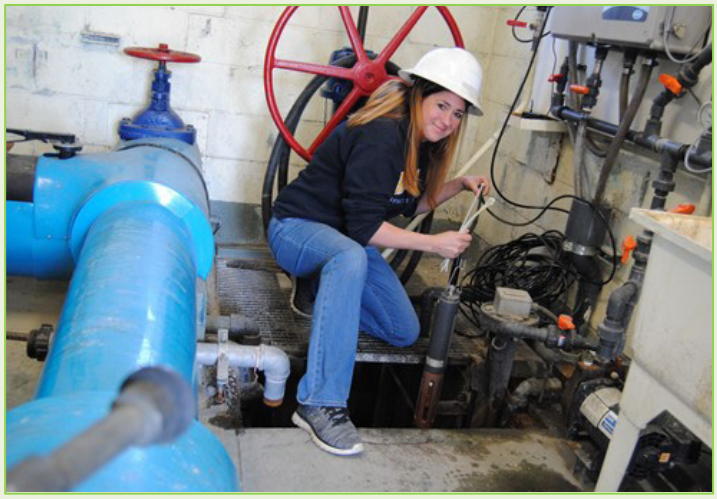
Dr. Sara R. Rivera is a Postdoctoral Research Fellow working with Dr. Gregory Dick (University of Michigan) and Dr. Reagan Errera (NOAA-GLERL). Her research is focused on "conversations" between the *Microcystis* and colony-associated heterotrophic bacteria. Dr. Rivera firmly believes that to better understand bloom dynamics, we must understand these "conversations" taking place at the molecular level because small changes can have large impacts if the message is passed along throughout the Western Lake Erie basin. Her work includes identifying the microbial

partners of both toxin producing *Microcystis* and non-toxin producing *Microcystis* to isolate and understand these partnerships from both environmental samples and laboratory based cultures. Ultimately, this research may help us to better understand why some blooms are bigger or more toxic than others. Dr. Rivera previously received her B.S. in geological sciences and biochemistry at the University of Michigan before completing both her M.S. and Ph.D. degrees in oceanography at the Scripps Institution of Oceanography at the University of California San Diego.

Dr. Sara R. Rivera

Emily Varga

Emily Varga is a Ph.D. student at the Great Lakes Institute for Environmental Research at the University of Windsor working with Dr. Mike McKay. Emily is researching the source of seed populations of cyanobacteria to Lake St. Clair, where there are annual HAB occurrences on the south shore. Reports of bloom events in agriculturally influenced tributaries are more recent, and surveys confirm that the taxonomic composition of cyanobacteria differ from that of the blooms in their receiving waters, suggesting that rivers do not directly seed lake blooms. However, rivers do contribute to the cyanoHABs in lakes by delivering nutrients to promote the blooms. The goals of our study are to gain an understanding of the factors that contribute to the formation of distinct cyanoHABs in rivers compared to the lakes into which they flow, specifically focusing on the Thames River and the receiving waters of Lake St. Clair, part of the Huron-Erie corridor. This research will address which environmental factors promote the proliferation of algal blooms (e.g. nutrient concentrations, temperature, and light). It will also address the dominant algal taxa found within these riverine systems and their downstream receiving waters as well as the prevalence of toxin production. Seasonal comparisons will be conducted to examine how the taxonomic composition of the blooms vary over time and between the rivers and lakes. Our project will include use of remote data collection using water quality sondes to monitor in real-time changes in physico-chemical parameters and algal community dynamics. As a pilot, we have deployed a sonde to detect algal pigments in the intake well of the Stoney Point Water Treatment Plant (Lake St. Clair) which logs and reports data to a LoRaWan gateway and dashboard at 10-min intervals.



Emily Varga