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Figure 1. At left, a vertical profiler deployed by The Jefferson Project is seen opposite a water-sampling device deployed by Cole Beale of SUNY Oneonta on Chautauqua Lake. Photo provided by Cole Beale.

RESEARCH ROUNDUP

Conferences Highlight Efforts on Chautauqua Lake

A goal of Alliance staff is to seek out current information from scientists, engineers, and others working in lake and watershed management in an effort to apply it to our work and share it with stakeholders. While the COVID-19 pandemic presented a new set of challenges on this front, shifting the majority of conferences and seminars online, the last 12 months have still provided valuable opportunities for us to stay up-to-date. In October, staff attended the Harmful Algal Bloom Symposium, an event sponsored by the New York State Department of Environmental Conservation, Hobart and William Smith Colleges, State University of New York at Fredonia, and Corning Incorporated. This was followed by the Northeast Aquatic Plant Management Society's 2022 conference, which was also hosted digitally in January. These events outlined a range of important developments in different fields, and included several presentations from scientists and engineers who work directly on Chautauqua Lake. Their efforts to better understand this complex natural ecosystem and its impairments lay a necessary foundation upon which decision-makers can set management priorities.

Harmful algal blooms (HABs) are a growing concern for waterbodies across the country, and October's symposium laid out some of the ongoing efforts to help understand and address this important water quality issue. Algae come in many forms and are a vital component of aquatic ecosystems, but under certain conditions some species can undergo rapid, excessive growth, form blooms, and produce toxins that may be harmful to humans and animals. Over the last several decades researchers are often seeing these levels of harmful growth more and more frequently. The Environmental Protection Agency cites increasing temperatures and storm water runoff of nutrients as two key factors contributing to the increased frequency of HABs. Two types of HAB programs were discussed during the October symposium—research and action. That is to say that work is being done to better understand HABs, alongside work on how we might be able to better manage them. These complementary objectives were outlined by James Tierney, Deputy Commissioner for Water Resources at the New York State Department of Environmental Conservation, who set the table for the discussion by presenting an overview of HAB initiatives and planning at the state level. These recent efforts stretch back to 2018, when state officials set funding aside for HAB programs at 12 priority lakes, including Chautauqua. Since then, research and action (including both prevention and mitigation) have been informed and aided by state guidance documents such as the 2018 Chautauqua Lake HAB Action Plan and the 2021 HABs Research Guide. Dr. Lewis McCaffrey, a research scientist with NYSDEC, followed Tierney's comments with a discussion of several different pilot programs pursued by the state to assess engineering solutions for HABs. McCaffrey's discussion outlined some of the different engineering approaches that could be useful, such as ultrasonic technology, chemical treatments, or aeration to disrupt algae growth or manage nutrients.

An example of these mitigation programs that you may be familiar with was covered by another symposium presenter, Dan Levy of the engineering firm AECOM. In 2020, the Harmful Algal Bloom Interception, Treatment, and Transformation System (HABITATS) program was conducted by the US Army Corps of Engineers' Engineer Research and Development Center and AECOM, in coordination with NYSDEC, on the lake at Chautauqua Lake Association headquarters in Lakewood and at Long Point State Park in Ellery. The research project that was tested here is designed to collect floating masses of algae, treat it, and transform it into potentially useful products like biofuel or biomaterial. In his discussion, Levy offered an overview of the pilot program and the feasibility of deploying this unique technology to battle HABs in the future.

This presentation was followed by another update on work being done right here at home. Dr. Courtney Wigdahl-Perry of the State University of New York at Fredonia, active on the lake since 2014, is working in collaboration with partners at Hobart and William Smith Colleges, the Finger Lakes Institute, the Cary Institute of Ecosystem Studies, SUNY Oneonta, Corning, and Binghamton University. In an effort to advance HAB monitoring techniques and data collection, this team of researchers deploys specialized cameras on flying drones to get a birds-eye view of algal blooms. Unlike your smartphone, these cameras designed by Corning are able to detect very specific wavelengths of light that can provide important visual information on the biological variables at work in and around HABs. This work is intended to provide researchers with new spectral clues about the origination, development, and movement of blooms on a larger spatial scale than you might get with individual water samples. Wigdahl-Perry and the research team are also performing imaging research on Seneca, Keuka, and Otsego lakes.

An important theme underlying these talks by HAB researchers and engineers is that there is still much to learn. The specific toxins produced by HABs are a great example of this. We understand that certain species of algae can produce harmful toxins, but something else is less clear. What blooms cause what toxins and when are these toxins a concern for humans? This question is one that Cole Beale hopes to shed some light on as he pursues his master's degree at SUNY Oneonta and continues his work on the lake that began in 2021 (both Beale and Wigdahl-Perry presented at last year's Chautauqua Lake Water Quality Research Panel, which is available on the Alliance website at: http://www.chautauquaalliance.org/news/2021-chautauqua-lake-water-quality-research-panel/). Beale's sampling approach attempts to mimic how humans may be exposed to HAB toxins during recreation. Using a novel collection device towed behind a boat, water samples are gathered as spray and droplets might collect on a person's skin during an inner tube ride. These water samples are then analyzed to detect toxins associated with HABs and potential health concerns.

While HABs are a more recent point of emphasis for researchers, excessive aquatic plant growth still remains an important area of study for the lake. Rounding out the presentations by scientists working directly on the lake was a NEAPMS lecture by Kara Foley, a graduate researcher at North Carolina State University. Foley and collaborating researchers have collected plant data on the lake since the fall of 2020 in order to gather information on native and invasive plant conditions. Foley and NC State have worked in cooperation with the Chautauqua Lake Partnership and SOLitude Lake Management to help inform management actions and assess the status of the lake's plant communities.

A takeaway from these presentations is that the lake has become a forward-looking example for other waterbodies through this expansion of research and development. In addition to the work of the scientists and engineers mentioned here, there are also ongoing research and monitoring programs by The Jefferson Project, Bowling Green State University, Racine-Johnson Aquatic Ecologists, the Citizens Statewide Lake Assessment Program (CSLAP) which stretches back decades, and the Alliance's more recent Chautauqua Lake Aquatic Data (CLAD) mapping program. There is an understandable desire for these research and monitoring programs to quickly lead to specific solutions to specific problems, like HABs, nuisance-level plant growth, or invasive species. However, complexity often increases as we travel down the path from research to informed, data-driven decisions. The path is rarely a straight line, and it is often necessary to circle back during the process. Answers to initial, fundamental questions often yield more questions, and highlight relationships between key variables. Actions taken to improve one set of conditions can trigger unintended changes in another. Ultimately the effectiveness of our solutions will depend on the strength of our datasets and how well we understand the system we wish to improve. The efforts of these researchers set our lake up for success in this process, and continue to grow our collective body of knowledge. Their work can help to identify new gaps in our understanding, and provide us with new lines of evidence to arrive at the best available solutions. For more information on HABs, please visit http://www.chautauquaalliance.org/harmful-algal-blooms-habs/. Other resources related to topics discussed here are available elsewhere on the Alliance website.