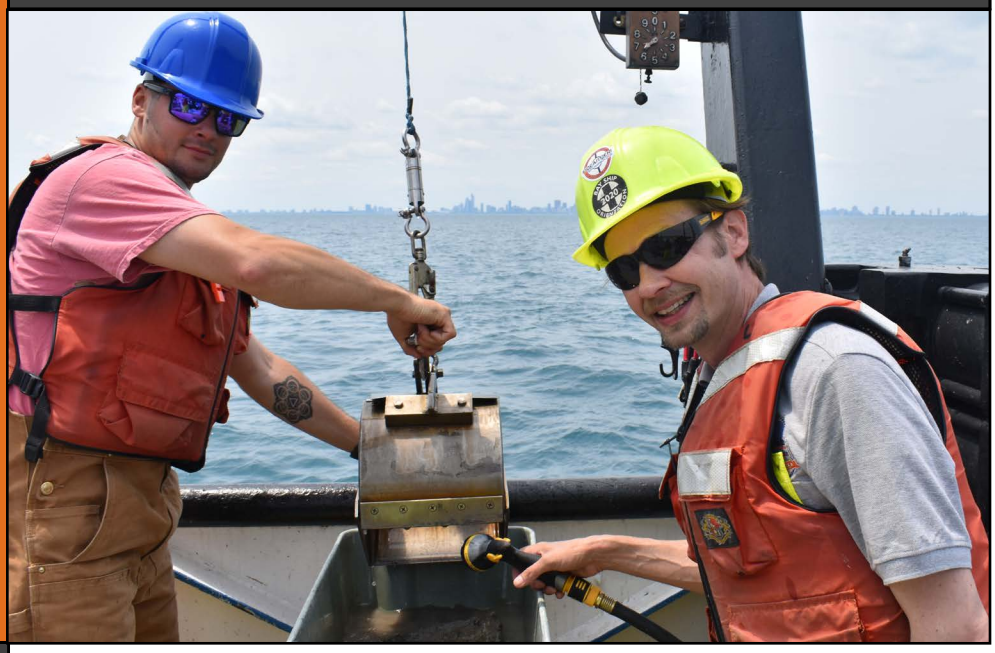
Great Lakes Center Newsletter

Spring 2022

RESEARCHING THE GREAT LAKES AND THEIR TRIBUTARIES SINCE 1966



Former GLES graduate student Josh Allen, currently *R/V Lake Guardian* marine technician, and GLC research technician Erik Hartnett washing a benthic sample.

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Buffalo State
Great Lakes Center
Since 1966

GLC continues monitoring benthos of all Great Lakes

by Lyuba Burlakova, Sasha Karatayev, Allison Hrycik, and Susan Daniel

On March 28, 2022, the Environmental Protection Agency announced awarding $6.7 million to Cornell University to monitor the lower food webs in Great Lakes. Through a collaboration with Cornell University, the Great Lakes Center (GLC) was awarded over $3 million to continue surveying benthic invertebrates for the next 5 years. Lyuba Burlakova, Sasha Karatayev, and Allison Hrycik are the principal investigators of this part of the grant.

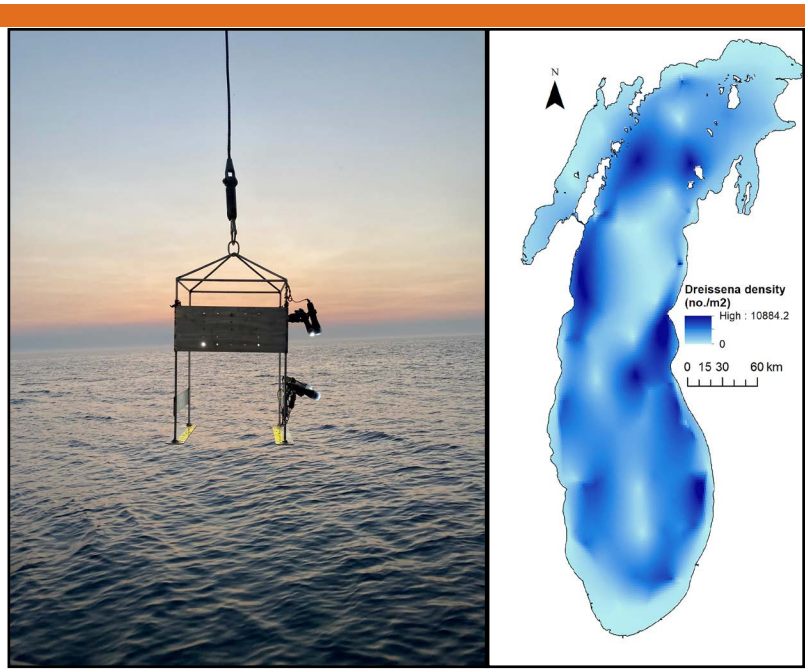
This is the third consecutive time the GLC has received this award, allowing us to collect benthic data since 2012. It takes a lot of effort and dedication from our brilliant benthic team, including research scientist, lead taxonomic expert, and lab manager Susan Daniel, and our research technicians and taxonomists Erik Hartnett, Brianne Tulumello, and Kit Hastings, together with principal investigators and graduate and undergraduate students, to sort and identify over 400 samples every year and submit the data in a timely fashion.

Within this project, we will combine the annual sampling at 57 long-term monitoring stations on all the lakes with one lake-wide survey of each lake per year. Sampling of all the Great Lakes aboard the EPA research vessel *Lake Guardian* is a remarkable experience.

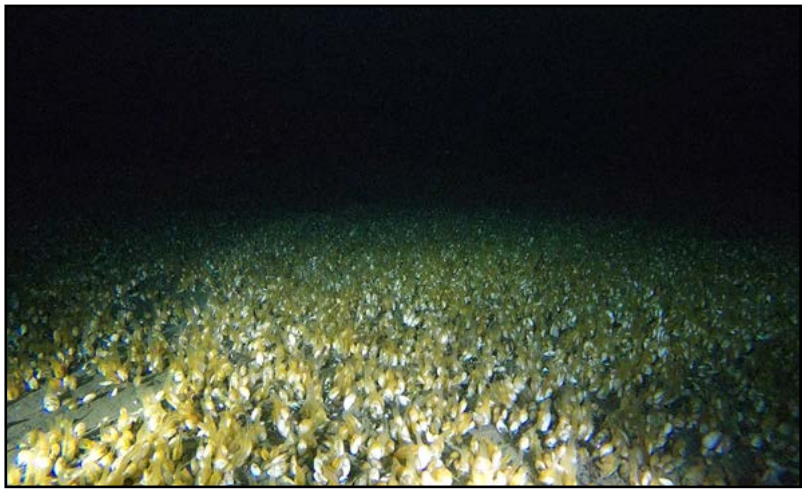
A key advantage of this grant is the broad research opportunities it presents, and our ability to modify and improve the monitoring. Thus,

we added video methods to our surveys, first to understand dreissenid distribution in lakes, then to provide rapid assessment of dreissenid populations in Great Lakes in almost real-time, and finally to improve our understanding of benthic landscapes.

Large-scale benthic surveys within the Cooperative Science and Monitoring Initiative (CSMI) allowed us not only to access the current status of each lake but were an opportunity to follow long-term changes in benthic communities. Therefore, we started to collect, analyze, and make publicly available all historical benthic data from Great Lakes. This process has now been completed for Lakes Michigan (Mehler et al., 2021), Ontario (Burlakova et al., 2022) and Erie (Karatayev et al., in review).



Left: Drop-down camera frame being deployed from the *R/V Lake Guardian*. There are both down-looking and side-looking lights and cameras. Right: A map of *Dreissena* density interpolated from benthic videos taken during the CSMI 2021 Lake Michigan survey.



Carpets of *Dreissena* with extended siphons filtering water at 85 m depth in Lake Michigan.

Major findings from these historical comparisons showed us that the benthic community underwent dramatic changes in the last six decades prompted by introduction of dreissenids, zebra and then quagga mussels, that increased the densities and biomass of benthic invertebrates over ten-fold. Moreover, the enormous changes in the benthic communities induced drastic changes in all other aquatic communities and in the Great Lakes environment. According to recent estimates, the quagga mussel is now the primary regulator of phosphorus cycling in the lower four Great Lakes: the tissues and shells of quagga mussels now contain nearly as much phosphorus as the entire water column, representing a dramatic example of large-scale reorganization of Great Lakes geochemical cycles by a single invader. Therefore, while monitoring of external phosphorus loads remains important in the Great Lakes, the monitoring of benthic, especially dreissenid populations, is now more important than ever.

Importantly, this funding provides Buffalo State students with job and research opportunities. To date, two students received their master's degrees funded by these grants (Susan Daniel and Sonya Bayba); over 12 graduate students from GLES program went through the internship program at the GLC or found a job in the lab; over 30 undergraduate students have had jobs and became familiar with Great Lakes benthic communities and the monitoring program, and several students went aboard the *R/V Lake Guardian* to participate in sample collection, a unique and unforgettable experience. Preparation of a new cadre of scientists and citizens understanding past and current environmental problems is a very important part of our project. We invite all interested students to come to our lab to check out research and job opportunities we provide! •

Students return to work

by Susan Daniel

The Great Lakes Center has a long history of employing undergraduate and graduate students for a variety of research projects. These opportunities allow students from all backgrounds to get a hands-on view of scientific research and a chance to enhance their resumes. In 2020, due to the COVID-19 pandemic, we had to decrease the number of people working in lab spaces, forcing us to lay off many of our student workers. During the pandemic, we were only able to employ one graduate student consistently, compared with 6 pre-pandemic. Fast-forward to 2022: with lifting restrictions, we are now able to have more student workers and provide unique work experiences. Just within the last several months we have hired graduate students Kyle Glenn and Matthew Basista, and undergraduates Ameera Albayed, Kifaya Albayed, and Ruth Embaba.

Undergraduate student Ameera Albayed preparing to process a sample collected from Lake Michigan in July 2021.

Students who work in the labs are tasked with processing benthic samples (lakebed sediments that contain invertebrates) collected as a part of the Long-Term Biological Monitoring project funded by the Great Lakes National Program Office (GLNPO). These samples are collected from Lakes Superior, Michigan, Huron, Erie, and Ontario annually aboard the *R/V Lake Guardian*. Before sample processing, students learn about the environmental history of Great Lakes, the GLNPO long-term monitoring program, the role of the benthic community in aquatic ecosystems, and major benthic organisms they will encounter. Their main task, called picking, is to sift through the sediment of each sample and extract targeted organisms that will be identified later by our taxonomic experts. The process can take a considerable amount of time depending on the sediment type, ranging from 1 hour to 30 hours! Types of sediment encountered can include silt, sand, clay, detritus or decaying plant material, filamentous algae, *Dreissena* shells, or gravel, and the amount can vary greatly. Some samples have very few organisms to be extracted while others may have as many as 3,000. The most common group encountered are freshwater worms (Oligochaeta) and the invasive *Dreissena* mussels (mostly quagga, but rarely zebra mussels). Other targeted groups include the non-biting midges (Chironomidae), fingernail clams (Sphaeriidae), snails (Gastropoda), leeches (Hirudinea), mayflies (Hexagenia), scuds/sow bugs/freshwater shrimp (Crustacea), flatworms (Turbellaria), ribbon worms (Nemertea), and a few other miscellaneous groups.

Other tasks our students assist us with include sample archiving, data entry, field work, and image analysis. Sample archiving includes generating a detailed inventory of samples from previous years and checking that they contain the appropriate amount of preservative. This tedious process can take a considerable amount of time and demands attention to detail but is a very important task.

We are very happy to have students back in the lab and look forward to helping build their careers! We also have great opportunities for undergraduate and graduate research. If you are interested in working or doing research for the Great Lakes Center, please contact Susan Daniel at danielse@buffalostate.edu. •

State of Lake Erie meeting

by Allison Hrycik

Susan Daniel, Sasha Karatayev, Allison Hrycik, and Lyuba Burlakova attended SOLE.

GLC research scientists Allison Hrycik, Sasha Karatayev, Lyuba Burlakova, and Susan Daniel attended the State of Lake Erie (SOLE) meeting on March 15–17, 2022 in Cleveland, Ohio. The meeting brought together researchers, resource managers, industry professionals, and non-profit employees with an interest in Lake Erie. SOLE is part of a larger series of State of the Lake Meetings that follow intensive field years on each of the Great Lakes. The conference had a hybrid format, with about half of the attendees in person and half online. GLC members elected to attend in person, making this our first in-person conference in two years! It was great to catch up with our colleagues around Lake Erie.

Allison presented on using video methods to assess *Dreissena* mussel populations in Lake Erie, including our "rapid assessment" of mussels using a drop-down camera. Lyuba presented on video methods to distinguish different benthic communities and environmental conditions. Sasha talked about long-term changes in Lake Erie benthos using our grab sample data combined with other surveys from the past 90 years. Susan's presentation was an ecologist's perspective on genetic barcoding and described lessons learned from a project to catalog barcoding data from aquatic species in the Great Lakes. Other highlights included plenary talks by Chris Korleski (the head of EPA's Great Lakes National Program Office) who described ongoing and future research endeavors in Lake Erie and Bill Zawiski (Ohio EPA) who described the history of the Cuyahoga River, which infamously caught on fire several times, but has undergone successful restoration efforts that have improved water quality tremendously. •

Modifications to the *R/V John J. Freidhoff*

by Mark Clapsadl and Brian Haas

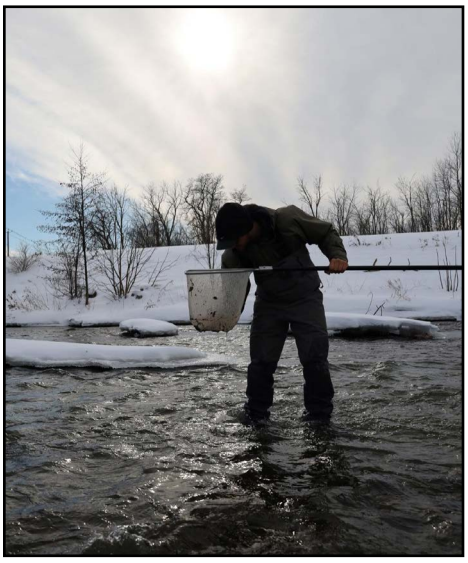
The GLC's main research vessel, the *John J. Freidhoff,* is undergoing some major modifications to improve its working capacity. Using marine architects and fabricators from Workskiff Inc. and Willard Marine, we carried out a plan to optimize deck space, improve deck drainage, and enhance the handling of the boat. This project involved removing the twin engines from the back deck and mounting them to a newly fabricated, custom-designed engine bracket. By moving the engines back onto the new bracket, as well as making other structural changes to the boat, additional deck space was created. The additional space permits us to deploy and retrieve equipment in a safer and easier manner. These modifications also rebalance the vessel, making it less likely to take on water in rough conditions. The final work is being completed in April and we should have the *John J.* back at the Field Station and ready for work by the beginning of May. •

The *R/V John J. Freidhoff* undergoing modifications this spring. The back end has been completely remodeled. Photo credit: Willard Marine.

Freezin' for a reason: Both gobies and researchers endure winter in local streams

by Kyle Glenn, graduate student

The onset of winter generally concludes the field season for many studies. However, graduate student and GLC center research assistant Kyle Glenn is ready to sample the freezing streams in search of the round goby. Discovering winter presence or absence is only one facet of Kyle's year-round sampling effort but it may help bridge data gaps regarding goby migratory and feeding behavior. Kyle and his advisor, Dr. Chris Pennuto, are compiling years of data on winter presence/absence and diet composition of round gobies across streams of Western New York, including Kyle's Undergraduate Summer Research Fellowship project research.



Kyle Glenn sampling Lake Erie tributaries for round gobies in March.

One method used to indicate the value of a particular prey item is to compare how many captured fish have eaten that prey with the total number of that prey eaten among all the fish collected. In general, prey that are eaten by most of the fish in a population and prey that are eaten in large numbers are deemed valuable to the population. It is then possible to compare multiple locations or different times of year to determine if the same prey items are important across the range of conditions experienced by round gobies. Preliminary results suggest chironomid midges are a valuable winter prey item across all locations where fish have been captured in winter. This differs slightly from past investigations of summer diets, where more prey types, in addition to midges, provide significant food resources.

Goby being measured from Allen's Creek in March 2022, proof that gobies can be found in Lake Ontario tributaries year round.

Next up for Kyle is an investigation on whether round goby foraging behavior has any impact on stream drift. Stream drift is increased invertebrate activity that occurs at night when they enter the water column to either evade predators or search for more resources. Kyle plans to answer the question "do non-native, benthic-feeding fishes impact stream drift?" Gobies are thought to impact invertebrate communities through the consumption of prey, but some of Kyle's preliminary results point to gobies altering drifting invertebrate behavior. Seeing how these alterations to drift extend beyond the stream shoreline and potentially impacts riparian spiders is a gap in research that remains to be answered.

Kyle recently presented his preliminary findings on drift differences among streams with and without round gobies at the NY Chapter of the American Fisheries Society meeting. He showed that certain taxa were more common in the drift when gobies were present, suggesting that those taxa were avoiding round gobies. He also showed that riparian spiders were less abundant at locations harboring round gobies, suggesting that these non-native fish may facilitate a reduction in the emergence of adult insects. These early results will require further assessment and make up the bulk of Kyle's thesis work. His ability to collect the data needed for his thesis has been made possible by funds from the Graduate Student Association, a Stevenson Award from the Great Lakes Center, and the use of a field vehicle from the GLC. •

Swallow-wort Biocontrol Research and Outreach Group

by Andrea Locke, WNY PRISM Coordinator

Pale swallow-wort (*C. rossicum*).

The Western New York Partnership for Regional Invasive Species Management (WNY PRISM) provides the WNY region with best management practices for addressing invasive species management priorities. Most often this involves information regarding tools, methods, and strategies for the removal of individual species, but also includes assistance through education and outreach, management planning, spread prevention, and habitat restoration. We are fortunate in that for most invasive species we have effective means of management, however there are several species for which existing management options are not effective. This may be due to unique characteristics of the species or the habitat it is most often found, or it could simply be due to how widespread the species is. It is at this point when invasive species managers and researchers turn to the development of biological controls, or biocontrols, as a potential management tool.

Pale and black swallow-wort (*Cynanchum rossicum*, *C. louiseae*) are herbaceous, perennial, twining vines that outcompete native species and natural communities, decreasing biodiversity and structural diversity, inhibiting forest regeneration, and impeding recreation. Swallow-wort provides poor habitat and forage for native wildlife, including monarch butterflies. It's unknown how often monarchs lay their eggs on swallow-wort, where they can't survive, but it is expected to be higher in areas lacking the native common milkweed. Swallow-wort has also been shown to be allelopathic, inhibiting root growth in native species, including a 40% reduction in root development of butterfly weed.

Traditional management methods have shown to be ineffective against all but the earliest infestations of swallow-wort. Swallow-wort is able to self-pollinate (sexual reproduction is more common), high-density stands can produce 32,000 seeds per square meter and some seeds are polyembryonic. Plants can regenerate from root fragments and vegetative growth has both a waxy cuticle and contains a white-milky sap, similar to milkweeds. These characteristics hinder the effectiveness of mechanical, manual, and chemical treatments. When combined using an integrated pest management strategy, these methods can be successful, but there is a significant investment of time and money that most are unable to sustain.

Biocontrols are a component of an integrated pest management strategy that is defined as the reduction of pest populations by natural enemies and typically involves an active human role. When used in combination with other methods, it can lead to far greater sustained success with controlling certain invasive species. While biocontrols offer a powerful tool in the management of invasive species, we do remain cautious. The modern biocontrol approval process involves multiple rounds of testing and regulation to ensure the highest level of safety and target specificity.

Researchers have identified the moth *Hypena opulenta* as a biocontrol agent for pale and black swallow-wort. *H. opulenta* originates in Ukraine, from the same area as pale swallow-wort. Its larvae feed exclusively on the leaves of pale and black swallow-wort, defoliating the plants. *H. opulenta* produces more than two generations

per year, with adults emerging in June and females laying eggs on the underside of swallow-wort leaves 2–5 days after emergence. The larvae create distinctive leaf "windows" as they begin feeding on the underside of the leaf, before eating the rest. The multiple, overlapping generations continue to stress and defoliate swallow-wort. *H. opulenta* was approved for release in the United States in August 2017 (previously approved for release in Canada) and efforts to establish and monitor test plots have been underway since.

H. opulenta larvae on a swallow-wort leaf at Clarence Oak Openings, NY.

Project partners viewing progress at Clarence Oak Openings.

The New York State Swallow-wort Research and Outreach Group was created to advance a two-tiered program related to the release of *H. opulenta*. The research objectives include development of mass rearing techniques, the study of *H. opulenta* establishment in the field, and to understand the impact of biocontrol on swallow-wort and native plant populations. The outreach objectives include informing land managers about swallow-wort and swallow-wort biocontrol, development of standardized monitoring protocol, and the establishment of demonstration sites across NYS.

WNY PRISM assisted with identifying release sites for *H. opulenta* and connecting researchers with appropriate land managers and organizations to gain permission and assistance with the demonstration projects. Two sites were selected in western New York: Clarence Oak Openings and Holley Falls Canal Park. WNY PRISM also assisted outreach efforts with the development of materials and installation of a boot brush station at Holley Falls Canal Park.

Results have been favorable with near 100% defoliation occurring in several demonstration sites over the 2020 and 2021 seasons. However, we have yet to see populations successfully overwinter in NYS, although this has occurred in Canada. Establishing self-sustaining populations will be essential to ensuring the success of this biocontrol. Continued site monitoring will take place at established demonstration sites in 2022 with additional releases planned at several of these sites.

If you would like to learn more about *Hypena opulenta* research in New York State, come to the WNY PRISM Spring Partner Meeting on April 21st at the Buffalo State Alumni Center, where Dr. Dylan Parry, Principal Investigator, will discuss the state of the science. •

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