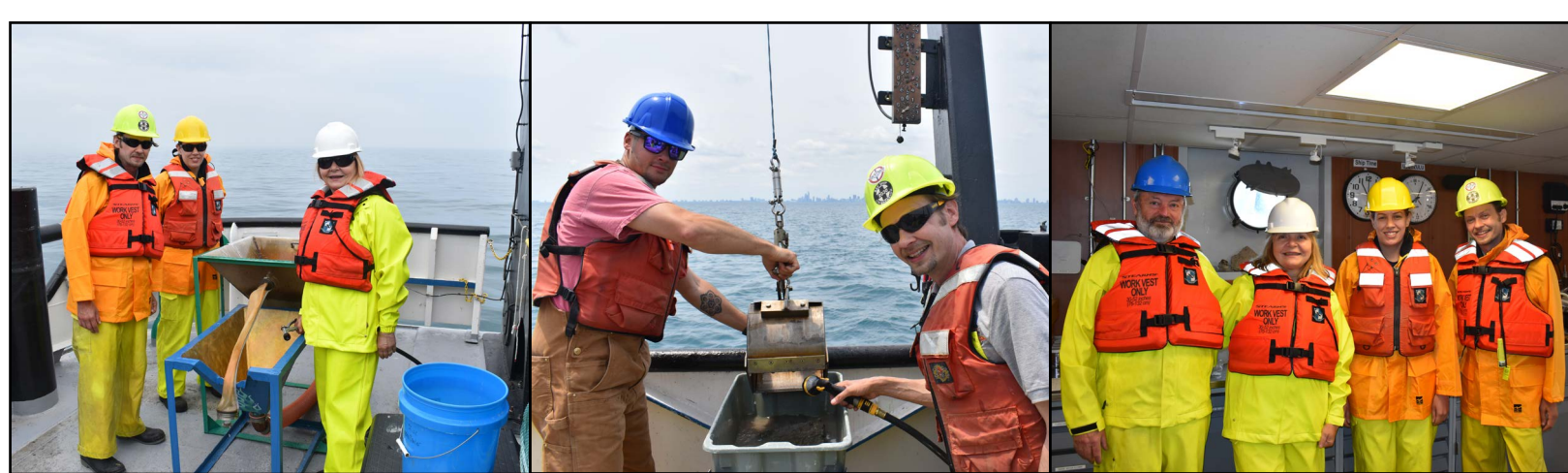




Annual Report 2021–2022

<http://greatlakescenter.buffalostate.edu>



Lake Michigan Sampling

July 2021



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MISSION

The [Great Lakes Center](#) (GLC) mission is to improve the quality of the environment by providing the best possible science to decision-makers concerned with the health and sustainability of resources, with a primary focus within the Great Lakes and their watersheds. This is accomplished through high quality [research](#), informed and current [graduate and undergraduate education](#), and dissemination of information to the public through outreach. The Center is committed to improving human-environment interactions in the Great Lakes ecosystem guided, in part, by an understanding of the evolutionary and ecological processes and patterns acting on the system. Although the main focus of the research in the GLC concentrates on the Great Lakes basin, nation-wide and international projects are also considered of high priority as they expose GLC scientists to the cutting edge of modern science, facilitate collaboration, and greatly increase visibility of the Center's activity in the scientific community.

HIGHLIGHTS

Over the last year, the Great Lakes Center saw sustained activity and productivity in research, education, and service. We continued our excellence in research conducted by GLC personnel and in collaboration with other faculty from Buffalo State College, as well as other institutions in North America, Europe, and South America.

- Over the last year our researchers have published **12 peer-reviewed papers**, and **8 papers** were submitted for publication.
- We presented **31 talks**, including: 23 at national/international/regional conferences and 8 invited talks.
- Fourteen projects for research and education, including five newly received in 2021–2022, are currently funded in the GLC totaling **\$17,694,655**, including **\$10,375,947** for Buffalo State.
- **Eleven students** were enrolled in Great Lakes Environmental Science M.A. and M.S. programs.
- **Two issues** of the GLC [newsletter](#) were produced over the last year.
- Established in 2014, the WNY PRISM office has recorded over 11,000 invasive species presence/absence data points, held and/or participated in 340 educational events, conducted 49,000 boat inspections, completed 77 Crew Assistance Program Projects, surveyed, monitored, and managed over 50 early detection sites with 3 sites reaching “presumed eradicated” after 7 years of no plants found, hired 120 seasonal employees, and worked with 193 partner organizations and agencies.



Dean Brian Cronk, Mark Clapsadl, President Katherine Conway-Turner, and Alexander Karatayev toured the Field Station and boats in August 2021.

I. Staff

GLC Personnel

Director: Alexander Karatayev

Research Scientists: Lyubov Burlakova
Mark Clapsadl (Field Station Manager)
Susan Daniel
Allison Hrycik
Christopher Pennuto
Alicia Pérez-Fuentetaja

Research Technicians: Brian Haas
Erik Hartnett
Kit Hastings
Lauren Martinek
Brianne Tulumello
Angela Tulumello

Administrative Assistant: Susan Dickinson

WNY PRISM Coordinator: Andrea Locke

Program Managers: Brittany Hernon, Terrestrial Invasive Species
Nicole Smeenck, Aquatic Invasive Species
Cecilia Pershyn, Education and Outreach
Douglas Knoph, Field Operations

Student Research Assistants: Kyle Glenn, Graduate Student, Buffalo State College
Alexander Krest, Graduate Student, Buffalo State College
Kylie Wirebach, Graduate Student, Buffalo State College
Kira Yerofeev, Graduate Student, Buffalo State College
Theo Berenson, Graduate Student, Buffalo State College
Ben Gallivan, Graduate Student, Buffalo State College
Matthew Basista, Graduate Student, Buffalo State College
Martens Dorcelly, Graduate Student, Buffalo State College
Kifaya Albayed, Undergraduate Student, Buffalo State College
Ameera Albayed, Undergraduate Student, Buffalo State College
Ruth Embada, Undergraduate Student, Buffalo State College

WNY PRISM Seasonal Employees

Invasive Species Management Assistants:
Aubrey Franks, College at Brockport (2021)
Lyndzie Vail, University at Buffalo (2021)
Melanie Donofrio, University at Buffalo (2022)
Brianna Saylor, Buffalo State College (2022)
William Walston, University of North Carolina at Asheville (2022)

Education and Outreach Assistants:

John Montgomery, Ohio University (2021–2022)

GIS Technician:

Melissa Boglioli, Cornell University, UMass Auburn (2018–2021)

Megan Kresse, Allegheny College (2022)

Survey and Monitoring Technicians:

Jason Kappan, University at Buffalo (2019–2022)

Diana Chaburka, University at Buffalo (2022)

Lead Boat Stewards:

Jesse Stevens, Buffalo State College (2021)

Vincent Manuela, University at Buffalo (2020–2022)

Tyler Harrington, University at Buffalo (2021–2022)

Boat Steward/Environmental Educators:

- Greer Barclay, Niagara University (2021)
- Nathaniel Beard, Allegheny College (2021)
- Nicholas Brown, University at Buffalo (2021)
- Noah Gerstein, University at Buffalo (2021)
- Mia Giannini, University at Buffalo (2021)
- Benjamin Halleck, St. Bonaventure University (2021)
- Jennifer Kachermeyer, Southern New Hampshire University (2021)
- Colin Kingsbury, Alfred University (2021)
- Nicholette Nowak, University of South Florida St. Petersburg (2021)
- Emily O'Bryan, Hobart and William Smith College (2021)
- Emma Ranney, SUNY Geneseo (2021)
- Heather Reimondo, Canisius College (2021)
- Ashley Daneau, Niagara County Community College (2022)
- Rachel Donner, University at Buffalo (2022)
- Oishee Ghosh, SUNY Fredonia (2022)
- Jade LaRock, Buffalo State College (2022)
- Alexis Long, University at Buffalo (2022)
- Abigail Minnekine, SUNY Geneseo (2022)
- Zachary Nyhart, SUNY Cortland (2022)
- Austin Oare, University at Buffalo (2022)
- Jenna Pecky, University at Buffalo (2022)
- Imani Stephens Ibrahim, Buffalo State College (2022)
- Luke Thompson, Jamestown Community College (2022)
- Linnie Wallen, University at Buffalo (2022)

GLC Affiliates (at Buffalo State College)

- Kelly Frothingham, Associate Dean, School of Arts and Sciences
- Susan McCartney, Director, Small Business Development Center
- Amy McMillan, Director, Honors Program
- Mary Perrelli, GIS Lab Supervisor, Geography and Planning Department
- Daniel L. Potts, Chair and Professor, Biology Department
- Jonathan Seinen, Assistant Professor, Theater Department
- Jill Singer, Distinguished Teaching Professor, Earth Sciences and Science Education Department
- Randal Snyder, Professor, Biology Department
- Yola M. Stockton, Assistant Professor, Art and Design Department
- Tao Tang, Professor, Geography and Planning Department
- Stephen Vermette, Professor, Geography and Planning Department
- Robert J. Warren II, Professor, Biology Department

Adjunct Research Scientists

- Zy Biesinger, Fish Biologist, U.S. Fish and Wildlife Service
- Dimitry Gorsky, Fish Biologist, U.S. Fish and Wildlife Service
- Vadim Karatayev, Postdoctoral Fellow at the School of Environmental Sciences, University of Guelph,

Guelph, Ontario, Canada

- Knut Mehler, Research Scientist at the Lower Saxony State Office for Water Economy, Coastal and Environmental Protection, Department of Water Management and River Basin Management, Germany
- Daniel Molloy, Scientist Emeritus, NY State Museum, Molloy & Associates, LLC

Collaborators in New York State

- Connie Adams, NYS Department of Environmental Conservation
- Diana Aga, Chemistry Department, University at Buffalo
- Katherine Alben, Wadsworth Institute, Albany
- Joe Atkinson, Environmental Engineering, University at Buffalo
- Gregory Boyer, SUNY Environmental Science and Forestry, Syracuse
- Tim DePriest, NYS Department of Environmental Conservation
- Mike Goehle, U.S. Fish and Wildlife Service
- Andrew Hannes, U.S. Army Corps of Engineers
- Clifford Kraft, Department of Natural Resources, Cornell University
- Brian Lantry, U.S. Geological Survey, Lake Ontario Biological Station, Oswego
- David Lodge, Atkinson Center for a Sustainable Future, Cornell University
- Dianna Padilla, Department of Ecology and Evolution, Stony Brook University
- Isabel Porto-Hannes, University at Buffalo
- Lars Rudstam, College of Agriculture and Life Sciences, Department of Natural Resources, Cornell Biological Field Station, Cornell University
- James Watkins, Cornell Biological Field Station, Cornell University
- Brian Weidel, U.S. Geological Survey, Lake Ontario Biological Station, Oswego

Collaborators at other U.S. Institutions

- Theodore Angradi, U.S. EPA Mid-Continent Ecological Division, Duluth, Minnesota
- Darren Bade, Kent State University, Kent, Ohio
- Richard Barbiero, Chicago, Illinois
- Dima Beletsky, Cooperative Institute for Limnology and Ecosystems Research, University of Michigan, Ann Arbor, Michigan
- Jacob Boehler, National Center for Water Quality

Research, Heidelberg University, Tiffin, Ohio

- Jonathan Bossenbroek, Department of Environmental Sciences, University of Toledo, Toledo, Ohio
- Valerie Brady, Natural Resources Research Institute, University of Minnesota Duluth, Duluth, Minnesota
- David Bunnell, U.S. Geological Survey, Great Lakes Science Center, Ann Arbor, Michigan
- Zachary Cava, Florida Game and Fish Department
- Paris Collingsworth, Illinois-Indiana Sea Grant and Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana
- Peter Esselman, U.S. Geological Survey, Great Lakes Science Center, Ann Arbor, Michigan
- Mary Ann Evans, U.S. Geological Survey, Great Lakes Science Center, Ann Arbor, Michigan
- Elizabeth Hinchey Malloy, U.S. EPA Great Lakes National Program Office, Chicago, Illinois
- Joel Hoffman, U.S. EPA, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, Duluth, Minnesota
- Donald Jerina, Laboratory of Bioorganic Chemistry NIDDK, National Institutes of Health, Bethesda, Maryland
- Leon Katona, University of Nevada Reno, Nevada
- Sergei Katsev, Large Lakes Observatory, University of Minnesota Duluth, Duluth, Minnesota
- Richard Kraus, U.S. Geological Survey, Lake Erie Biological Station, Huron, Ohio
- Bob Krebs, Department of Biological, Geological, and Environmental Sciences, Cleveland State University, Cleveland, Ohio
- Katya Kovalenko, Natural Resources Research Institute, University of Minnesota Duluth, Duluth, Minnesota
- Barry Lesht, Department of Earth and Environmental Sciences, University of Illinois at Chicago; CSRA, Chicago, Illinois
- Charles Madenjian, U.S. Geological Survey, Great Lakes Science Center, Ann Arbor, Michigan
- Christine Mayer, Department of Environmental Sciences and Lake Erie Center, University of Toledo, Toledo, Ohio
- Pawel Michalak, Bioinformatics Institute, Virginia Tech, Blacksburg, Virginia
- Thomas Nalepa, Graham Sustainability Institute, University of Michigan, Ann Arbor, Michigan
- Janet Nestlerode, U.S. EPA, National Health and Environmental Effects Research Laboratory, Gulf

Ecology Division, Gulf Breeze, Florida

- Meredith Nevers, U.S. Geological Survey, Lake Michigan Ecological Research Station, Chesterton, Indiana
- Michel Pfrender, Notre Dame Genomics and Bioinformatics Core Facility, University of Notre Dame, Notre Dame, Indiana
- Euan Reavie, Natural Resources Research Institute, University of Minnesota Duluth, Duluth, Minnesota
- Catherine Riseng, University of Michigan, Ann Arbor, Michigan
- Mark Rowe, Great Lakes Environmental Research Laboratory, NOAA, Ann Arbor, Michigan
- Ed Rutherford, Great Lakes Environmental Research Laboratory, NOAA, Ann Arbor, Michigan
- Mike Sayers, Michigan Technological Research Institute, MTU, Ann Arbor, Michigan
- Jill Scharold, U.S. EPA, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, Duluth, Minnesota
- Kurt L. Schmude, Department of Natural Sciences, Lake Superior Research Institute, University of Wisconsin-Superior, Superior, Wisconsin
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- Michael Sierszen, U.S. EPA, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, Duluth, Minnesota
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- Molly Wick, U.S. EPA, Mid-Continent Ecological Division, Duluth, Minnesota
- Daelyn Woolnough, Biology Department, Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan
- David Zanatta, Biology Department, Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan

International Collaborators

- Boris Adamovich, Research Laboratory of Aquatic Ecology, Belarusian State University, Minsk, Belarus
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- Ivan Bolotov, Laboratory of Evolutionary Ecology and Phylogenetics, Federal Center for Integrated Arctic Research, Russian Academy of Sciences, Arkhangelsk, Russia
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- Jan Ciborowski, Department of Biological Sciences, University of Windsor, Windsor, Ontario, Canada
- Renata Claudi, RNT Consulting Inc., Ontario, Canada
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- Paul Hebert, Centre for Biodiversity Genomics, University of Guelph, Guelph, Canada
- Ladd Johnson, Laval University, Quebec City, Quebec, Canada
- Rob Leuven, Radboud University, Nijmegen, The Netherlands
- Manuel Lopes-Lima, ICBAS - Abel Salazar Biomedical Sciences Institute, CIIMAR-Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Porto, Portugal
- Frances Lucy, Institute of Technology Sligo, Sligo, Ireland
- Tamara Makarevich, Department of General Ecology and Methods of Biology Teaching, Belarusian State University, Minsk, Belarus
- Olesya Makhutova, Institute of Biophysics, Siberian Branch, Russian Academy of Sciences, Krasnoyarsk, Russia
- Sergey Mastitsky, RNT Consulting Inc., Ontario, Canada

- Richard Soare, Department of Geography and Planning, Concordia University, Montreal, Canada
- Ronaldo Sousa, CIIMAR and Minho University, Braga, Portugal
- Piet Spaak, Eawag, Dübendorf, Switzerland
- Ilya Vikhrev, Federal Center for Integrated Arctic Research, Northern (Arctic) Federal University, Arkhangelsk, Russia
- Hanna Zhukava, Belarusian State University, Minsk, Belarus
- Alexandra Zieritz, University of Nottingham Malaysia Campus, Semenyih, Malaysia



GLC staff and guests at the 2021 GLC Open House.



Alexander Karatayev presents GLC achievements at the first Open House since the COVID-19 pandemic.

II. Research Activities

Current Projects

Monitoring of benthic invertebrates in Great Lakes

PIs Lyubov Burlakova, Alexander Karatayev, and Allison Hrycik. The GLC, in collaboration with Cornell University, was awarded U.S. EPA [Great Lakes Long-term Biological Monitoring](#) grants (LTM) for 2012–2017, 2017–2022, and for 2022–2028. The EPA Monitoring Program is designed to provide managers access to biological data on zooplankton and benthos to support decision-making. Within this project, we collect benthos (Buffalo State) and zooplankton data (Cornell University) across the five Great Lakes, analyze this data, and make it available to environmental and fisheries managers. Additional research projects include impact of dreissenids on the lower food web, and development of remote sensing methods. We identified benthic samples collected onboard the EPA R/V *Lake Guardian* from all the Great Lakes in 2012–2019 and submitted the data to the Great Lakes National Program Office (GLNPO). These data are the basis for individual lake reports as well as reports for the State of the Great Lakes. Thus far, the results of the study have been published in 22 papers and presented at multiple talks at regional and international meetings.

Cooperative Science and Monitoring Initiative

PIs Lyubov Burlakova and Alexander Karatayev. The Great Lakes Monitoring Program by the Great Lakes National Program Office includes both the collection of samples from 57 long-term stations sampled every year and a much more detailed survey conducted on each lake every 5 years within the [Cooperative Science and Monitoring Initiative](#) (CSMI). We participated in these surveys in 2014 (Lake Erie), 2015 (Lake Michigan), 2016 (Lake Superior), 2017 (Lake Huron), 2018 (Lake



A snail (*Valvata sincera ontarioensis*) collected from the central basin of Lake Michigan in July 2021 during CSMI.

Ontario), 2019 (Lake Erie), and 2021 (Lake Michigan).

Early detection of mollusks and annelids in the Great Lakes

PIs Alexander Karatayev and Lyubov Burlakova. In 2017, we received U.S. EPA GLRI funding to create a [DNA Barcode Reference Library](#) for Mollusca, Annelida, and minor phyla. This project is one of three funded by the EPA Great Lakes National Program Office geared toward genetic barcoding of invertebrate specimens from the Great Lakes. Two additional projects target zooplankton and rotifers (Notre Dame University, and Cornell University) and benthic arthropods (Cornell University). From 2017 to 2021, we collected multiple samples from the Great Lakes Region and successfully generated nearly 1,000 individual barcodes for many native and invasive freshwater benthic species of Annelida, Mollusca, and minor phyla (Bryozoa, Cnidaria, Nematomorpha, Nemertea, and Platyhelminthes) that, at the start of this project, had fewer than five barcodes. We generated a publicly available barcode reference library for taxa in the Great Lakes basin and updated a species checklist to be used for early detection and monitoring of invasive species.

New method for rapid assessment of dreissenid mussels populations

PIs Alexander Karatayev and Lyubov Burlakova. The Great Lakes Center, in collaboration with the U.S. Environmental Protection Agency's Great Lakes Biology Monitoring Program and Office of Research and Development-Great Lakes Toxicology and Ecology Division, has developed a new method for [rapid assessment of dreissenid mussel populations](#) in lakes. The method uses a Benthic Imaging System (BIS) to estimate population size of these invaders in near-real time. The BIS consists of Go-Pro cameras and lights mounted to a steel frame that is lowered to the lakebed from a ship. The resulting bottom images are analyzed via imaging software to estimate mussel density and percent coverage. The new method substantially reduces the time required to map distributions of dreissenid mussels across large spatial scales compared to traditional sediment collection methods. This increase in spatial resolution and reporting times of monitoring is especially important considering that the quagga mussel is now the primary regulator of phosphorus cycling in the lower four Great Lakes and their tissues and shells now contain nearly as much phosphorus as the entire water columns of the impacted Great Lakes (Li et. al., 2021). The resulting research paper "[Rapid assessment of *Dreissena* population in Lake Erie using underwater videography](#)" is published online with @SpringerNature in *Hydrobiologia*. This method for *Dreissena* rapid assessment was applied in Lake Michigan in 2021 and will be applied to other Great Lakes in the future as a valuable addition to conventional bottom grab monitoring.

Benthoscapes

PIs Lyubov Burlakova and Alexander Karatayev. Images from side-looking BIS cameras used for rapid assessment of dreissenid populations during CSMI surveys are also used to assess spatial distribution of benthos and *Mysis*. Communities of benthic macroinvertebrates are among the most useful indicators for biological assessment of environmental and anthropogenic stressors, but both sample processing and species identification are time-intensive, often requiring several years to identify all samples from a large-scale survey. Mapping benthic landscape or "[benthoscape](#)" structure and dynamics using underwater video can provide valuable and cost-effective assessment of bottom habitats on large spatial scales with minimal habitat disturbance. In 2019, during the CSMI benthic survey in Lake Erie, we used this approach to characterize benthic habitats, and then tested



The Benthic Imaging System, which has downward and sideways pointing cameras and lights, being lowered into



Three large *Mysis* shrimp viewed as the BIS landed on the lake bottom. In addition to assessing dreissenid mussel populations, we are looking into other information that can be learned about benthic macroinvertebrates from these images.

whether visual classification could serve as an indicator of hypoxia ([Burlakova et al., 2022](#)). We identified four habitat types that differed significantly in near-bottom dissolved oxygen concentration and confirmed that video analysis can provide a quick and reliable method to detect habitats affected by periodic hypoxia. Video identification of benthoscapes may be important for regional monitoring of over 20 hypoxic zones documented in the Great Lakes where the extent and magnitude of hypoxia currently represent a major knowledge gap.

Benthos of Laurentian Great Lakes: Inventory of lake-wide surveys

PIs Alexander Karatayev and Lyubov Burlakova. Over 110 lake-wide benthic surveys were conducted on the Laurentian Great Lakes since 1929. However, these studies often are not readily available, and have never been combined in one dataset to preserve historic data. According to our estimations, primary data for at least 20% of all surveys are incomplete or have already been lost. For over three years, the Great Lakes Center has been conducting an [inventory of benthic surveys](#) for all the Great Lakes to create a database with all the available information on species composition, distribution, density, and biomass of benthic invertebrates. Considering the rarity of long-term benthic studies in lake ecosystems, these data set could be useful to explore effects of different environmental factors and exotic species on community organization, for monitoring of water quality, biodiversity, exotic species introduction, fish food base assessment, and other ecosystem services provided by benthic community. Our first complete dataset on the Lake Ontario benthic community includes taxonomic data to the species level for 11 of the surveys and data to the group level for another two surveys covering the last 54 years and was published as a data paper in *Ecology* (Burlakova et al., 2021). Our second paper summarizing 90 years of benthic research in Lake Erie is currently in review in the *Journal of Great Lakes Research*.

Spatial organization of dreissenid mussels

PI Allison Hrycik. Many species self-organize into predictable patterns based on a balance of facilitation and competition. We are investigating how *Dreissena* in the Great Lakes organize spatially based on food availability, competition, and hydrodynamic forces. We are using video survey techniques (benthic sled transects) to [map distributions and self-organization patterns of *Dreissena*](#) in Lakes Michigan and Ontario. In Lake Michigan, we compared *Dreissena* patterns with current and bottom shear stress from NOAA's Great Lakes Coastal Forecast System. We are also comparing distributions to chlorophyll concentration from monitoring data as a proxy for food availability.



[Carpets of *Dreissena* with extended siphons filtering water at 85 m depth in Lake Michigan.](#)

Wet weights of Great Lakes benthic invertebrates

PI Allison Hrycik. Biomass estimates of individual species are crucial for many applications, including food web modeling, understanding trophic tracers such as stable isotopes, and estimating ecosystem services. However, data for benthic invertebrates in lakes can be difficult to find and individual weights within species may be ecosystem-specific. We are compiling [wet weights](#) and dry-to-wet weight conversion factors for common benthic invertebrates in the Great Lakes using data from eight years of LTM and CSMI surveys as well as a literature search. Furthermore, we tested for significant differences in benthic invertebrate weights between lakes, depth zones, and basins and will make recommendations of instances in which weights can be generalized across ecosystems or should be kept separate. These data will be made available to managers, modelers, and researchers for use in their own calculations.

Interactions of benthic invertebrates with the Benthic Nepheloid Layer

PI Allison Hrycik. [Benthic nepheloid layers](#) (BNLs) are areas of high turbidity and suspended solids that form near the benthos during summer stratification. BNLs can be several meters thick and are common in the Great Lakes. The suspended sediment and other material that build BNLs can come from a variety of sources, including sediment resuspension, entrainment of spring runoff in the hypolimnion, settling of particles from the epilimnion, and from density currents. We are analyzing data to examine relationships between BNL intensity/thickness and benthic invertebrate production, and to compare current BNL intensity and thickness to historical data from studies prior to the *Dreissena* invasion.

Partnership for Regional Invasive Species Management (WNY PRISM)

PI Christopher Pennuto. The [Western New York Partnership for Regional Invasive Species Management](#) (WNY PRISM) works to address invasive species priorities using a coordinated partnership for which we provide leadership, technical assistance, and opportunities for collaboration. Our goal is to improve, restore, and protect local aquatic and terrestrial resources by improving the effectiveness of invasive species management. This partnership is supported by a NYS DEC Environmental Protection Award through December 2023. For more information on Western New York PRISM Activities, see [section VI](#).

Understanding round goby migration behavior

PI Christopher Pennuto. This project is investigating the cues and pre-migratory [behavior of round gobies](#) in Lake Ontario and its connecting waters. The activity budgets of fish from Lake Ontario (migratory population) and Ellicott Creek (non-migratory population) are being assessed for movement behavior, distances moved, and seasonal activity patterns to discern the influence of habitat context.

Lake Erie Lake Sturgeon: Understanding historical and current spawning habitat extent and characteristics

PI Christopher Pennuto. This project is a collaboration with the U.S. Fish and Wildlife Service which began Fall 2019. It will assess all the historical records of [sturgeon spawning habitat](#) in tributaries of Lake Erie through investigations of NYS Department of Environmental Conservation and library archives. It will revisit those same locations and document any changes in land use condition or in-stream spawning habitats. Ultimately, these activities should allow an update of tributary habitat suitability values for lake sturgeon in the Lake Erie watershed.

Invasive Starry Stonewort and macroinvertebrate communities

PI Christopher Pennuto. We are investigating the possible community-level impacts of a new invasive plant in the region by comparing macroinvertebrates collected from plant stands with varying abundances of [starry stonewort](#) ranging from no stonewort to 100% stonewort coverage. Five lakes were sampled. Although stonewort biomass differed among the sites, macroinvertebrate communities covaried with stonewort biomass. These data suggest most littoral zone invertebrates are probably mostly associated with the abundance of plant structure, and not in macrophytes as food. Thus, at least from a macroinvertebrate density perspective, native or non-native plants seem to be used equally.

Does [predator-avoidance](#) behavior play a role in detrital food webs

PI Christopher Pennuto. This project will investigate the strength of direct and indirect interactions between benthic predators and their snail prey, and the resultant influence on detrital processing rates. Round gobies (an invasive benthic fish) and native crayfish are both snail predators, and snails are important in detritus breakdown in wetland habitats. We used a mesocosm trial to assess the response of leaf litter decay following introduction of gobies. Introduction of round gobies led to complete elimination of snails in all mesocosms. However, we detected no significant differences in leaf litter decay rates among all the treatments, suggesting that snails were not significant litter consumers. A follow-up laboratory experiment on snail responses to kairomones suggested these snails were very naïve to round goby odor, exhibiting no avoidance behavior, whereas they showed avoidance responses to native predatory fish like smallmouth bass. Thus, prey behavior in response to novel predators (or lack thereof) can have important implications for stream food webs.



Mesocosms for the predator avoidance experiment set up on the lawn at the Field Station.

Invasive fish effects on stream drift and potential for aquatic terrestrial subsidy disruption

PI Christopher Pennuto. This project is investigating [stream drift](#) across an array of streams with or without round goby populations. Seasonal drift collections, benthic invertebrate abundances, and fish community structure are being investigated to assess drift response to goby presence. This project also will examine emergence patterns and riparian spider abundance. Emergence specialist spiders (Tetragnathidae) are known to

adjust their feeding locations based, in part, on emergence density. We are exploring whether this behavior is evident in stream sections dominated by round gobies.

The response of red-swamp crayfish to intensive trapping

PI Christopher Pennuto. Recently, a small pond in the region was invaded by [red-swamp crayfish](#) (*Procambarus clarkii*). This invasive crayfish has had significant food web impacts in other locations it has invaded, leading to loss of littoral macrophyte beds and changes in fish communities. We are attempting an intensive trapping campaign to assess changes in population size structure and reproductive phenology.

Bioaccumulation of flame retardants and emerging contaminants in wild birds and their eggs in the Niagara Region

PI Alicia Pérez-Fuentetaja. Halogenated compounds and pharmaceuticals are found in [eggs from piscivorous birds](#) nesting in the Niagara and St. Lawrence Rivers. We will measure bioaccumulation and potential impacts to future avian predator populations nesting in the Lower Great Lakes region. We have collected eggs of eight species of nesting piscivorous birds and we are analyzing them to map the prevalence of halogenated contaminants and food web biomagnification in the region.



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

Biological and metabolic responses of aquatic organisms to mixtures of municipal treated effluent

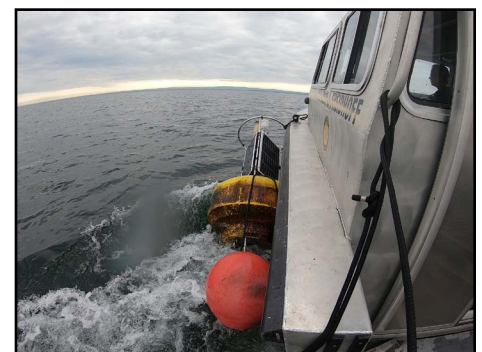
PI Alicia Pérez-Fuentetaja. We are testing egg development, hatching success, behavioral responses, and metabolomics of fathead minnows (*Pimephales promelas*) exposed to ambient Niagara River water and [urban effluent purified by advanced oxidation products](#) (H_2O_2 , peracetic acid, UV light). Fish at various developmental stages are affected by contaminants not removed by wastewater treatment plants from the effluent and also by the cleansing and purification methods proposed to further increase effluent quality before it enters the Niagara River.

Effects of calcium decline and climate change on gastropods

PI Alicia Pérez-Fuentetaja. In this project, we are looking into the effect of climate change (increased CO_2 levels) and human activities in watersheds (logging, acid rain) on calcium levels in soft water. Many lakes in Canada and around the world are soft water lakes, i.e., they have low buffering capacity. One of the problems with declining calcium levels in these lakes is that aquatic organisms that need calcium for their exoskeletons or shells are not able to obtain it from the water and this deficiency may carry up the food web. We are testing, in an experimental setting, [calcification in snails](#) that are raised in a soft water medium resembling natural calcium concentrations and exposed to different levels of atmospheric CO_2 and calcium.

Implementation of the Great Lakes Observing System

PI Mark Clapsadl. We received another year of funding to operate the eastern Lake Erie Buffalo State/Great Lakes Observing System (GLOS) [buoy](#), including funds for salary recovery. This funding comes on the heels of a successful 2021 season. Since spring of 2012, the GLC has been a participating member of GLOS, contributing by operating an observation buoy five miles offshore from Dunkirk, New York. This buoy records and transmits real time measurements of water temperature, wind speed, wave height, dissolved oxygen, and several other parameters. It is the only GLOS buoy operating in eastern Lake Erie, making it an important source of information for a variety of stakeholders. The GLOS buoy is gaining in popularity, we expect over 20,000 visits to the [GLOS website](#) by users looking to see lake conditions and our buoy data are regularly included on WIVB-TV/Channel 4 News weather reports.



Retrieving the GLOS buoy from Lake Erie in October 2021.

Grants and Funding

Ongoing grants, including five newly received in 2021–2022 (total \$17,694,655, including \$10,375,947 for Buffalo State)

1. Clapsadl, M. Buffalo State College Eastern Lake Erie Buoy. National Atmospheric and Oceanographic Administration. **\$16,970**. 2022.
2. Burlakova, L. E., and A. Y. Karatayev. DNA Barcode Reference Library: Mollusca, Annelida, and minor phyla. U.S. EPA Great Lakes Restoration Initiative. **\$400,000**. 2017–2021.
3. Burlakova, L. E., and A.Y. Karatayev. EPA-R5-GL2017-ZBC Great Lakes Long-Term Biology Monitoring Program: Zooplankton, Benthos, *Mysis*, and Chlorophyll-a Components. Additional 2022–2023 funding. **\$287,676**.
4. Clapsadl, M., B. Haas, and K. Hastings. Osprey Nesting Platform and Migrator Habitat Enhancement. Niagara River Greenway Commission. **\$94,014**. 2018–2022.
5. Drake, R., and A. Locke. Invasive Species Management to Protect Rare Habitats at Alexander and Houghton Preserve, Nature Sanctuary Society of Western New York, Inc., U.S. Forest Service Great Lakes Restoration Initiative Cooperative Weed Management Areas. **\$31,320 (\$12,118 for Buffalo State)**. 2021–2023.
6. Goodrich, Z. Mosquito Junction Swamp Restoration at Tift Nature Preserve, Buffalo Museum of Science. Niagara River Greenway Commission Greenway Ecological Standing Committee. **\$344,754 (\$25,700 for Buffalo State)**. 2019–2022.
7. Locke, A., and B. Hernon. Western New York Japanese Stiltgrass (*Microstegium vimineum*) Early Detection and Rapid Response Project, The Research Foundation for Buffalo State College, WNY PRISM. U.S. Forest Service Great Lakes Restoration Initiative Cooperative Weed Management Areas. **\$35,193**. 2021–2024.
8. Molloy, D., and L. Burlakova. The Natural Enemies of Dreissenid mussels: An update of the seminal monograph published in 1997. Hudson River Foundation. **\$65,200**. 2017–2021.
9. Pennuto, C. Administration of the Western NY PRISM: Partnership for Regional Invasive Species Management. NY DEC. **\$3,499,212**. 2019–2023.
10. Roth, B., and C. Pennuto. Assessing invasive crayfish prevalence in live animal trades within the Great Lakes Basin. U.S. EPA Great Lakes Restoration Initiative. **\$30,670**. (Subaward thru Michigan State University). 2022.
11. Pennuto, C., and B. Hernon. Rapid Response and Early Detection of Slender False Brome and Japanese Stiltgrass in Western New York. NYS Department of Environmental Conservation Terrestrial and Aquatic Invasive Species Rapid Response. **\$99,858**. 2019–2021.
12. Pennuto, C. Historic and contemporary sturgeon habitats in the Lake Erie basin. U.S. FWS. **\$70,555**. 2020–2022.
13. Rudstam, L., L. E. Burlakova, A. Y. Karatayev, and J. Watkins. Great Lakes Long-term Biological Monitoring Program. GLRI, U.S. EPA. **\$5,999,903 (\$2,700,000 for Buffalo State)**. 2017–2022.
14. Watkins, J., L. Rudstam, L. E. Burlakova, A. Y. Karatayev, and A. Hrycik. Great Lakes Biology Monitoring Program: Zooplankton, *Mysis*, and Benthic Components. GLRI, U.S. EPA. **\$6,750,000 (\$3,038,781 for Buffalo State)**. 2022–2028.

Submitted Grant proposals

1. Burlakova, L. E., and A. Y. Karatayev. EPA-R5-GL2017-ZBC Great Lakes Long-Term Biology Monitoring Program: Zooplankton, Benthos, *Mysis*, and Chlorophyll-a Components. Request to EPA for additional 2022–2023 funding. **\$287,676**. (Funded).
2. Clapsadl, M. Buffalo State College Eastern Lake Erie Buoy. National Atmospheric and Oceanographic

- Administration. 2022. **\$16,970**. (Funded).
3. Locke, A., and B. Hernon. Western New York Japanese Stiltgrass (*Microstegium vimineum*) Early Detection and Rapid Response Project, The Research Foundation for SUNY Buffalo State, WNY PRISM. U.S. Forest Service Great Lakes Restoration Initiative Cooperative Weed Management Areas. 2021–2024. **\$35,193**. (Funded).
 4. Roth, B., and C. Pennuto. Assessing invasive crayfish prevalence in live animal trades within the Great Lakes Basin. U.S. EPA Great Lakes Restoration Initiative. 2022. **\$30,670** (Subaward thru Michigan State University). (Funded).
 5. Watkins, J., L. Rudstam, L. E. Burlakova, A. Y. Karatayev, and A. Hrycik. Great Lakes Biology Monitoring Program: Zooplankton, *Mysis*, and Benthic Components. GLRI, U.S. EPA. 2022–2028. **\$6,750,000 (\$3,038,781 for Buffalo State)**. (Funded).

Publications and Presentations

Last year the researchers of the GLC were very active in publishing papers and presenting their results at international and national meetings and conferences. Twelve manuscripts were published, another 8 were submitted to peer-reviewed journals. A total of 31 presentations were made by the GLC researchers, including: 23 presentations at national, international, and regional conferences; and 8 invited talks.

Refereed Journal Publications (published/accepted)

1. Bayba, S., L. E. Burlakova, A. Y. Karatayev, and R. J. Warren II. 2022. Non-native *Dreissena* associated with increased native benthic community abundance with greater lake depth. *Journal of Great Lakes Research* 48 (3): 734-745.
2. Boltovskoy, D., R. Guisasu, L. Burlakova, A. Karatayev, M. A. Schlaepfer, and N. Correa. 2022. [Misleading estimates of economic impacts of biological invasions: Including the costs but not the benefits](#). *Ambio*.
3. Burlakova, L. E., A. Y. Karatayev, A. R. Hrycik, S. E. Daniel, K. Mehler, L. G. Rudstam, J. M. Watkins, R. Dermott, J. Scharold, A. K. Elgin, T. F. Nalepa, E. K. Hinchey, and S. J. Lozano. 2021. Density data for Lake Ontario benthic invertebrate assemblages from 1964 to 2018. *Ecology* 102(12), 2021, e03528.
4. Burlakova, L. E., A. Y. Karatayev, K. Mehler, and E. K. Hinchey. 2022. [Exploring Great Lakes benthoscapes: can we visually delineate hypoxic habitats?](#) *Hydrobiologia*.
5. Chiapella, A., H. Grigel, H. Lister, A. R. Hrycik, B. O'Malley, and J. D. Stockwell. 2021. [A day in the life of winter plankton: Under-ice community dynamics during 24 hours in a eutrophic lake](#). Submitted to: *Journal of Plankton Research* 43(6): 865-883.
6. Haines, A. D., and C. M. Pennuto. Seasonal diet and body condition changes in the Common Mudpuppy (*Necturus maculosus* Rafinesque, 1818) in Western New York. *Journal of Herpetology*. (Accepted).
7. Hrycik, A. R., P. D. F. Isles, R. Adrian, M. Albright, L. C. Bacon, S. A. Berger, R. Bhattacharya, H.-P. Grossart, J. Hejzlar, A. L. Hetherington, L. B. Knoll, A. Laas, C. P. McDonald, K. Merrell, J. C. Nejtgaard, K. Nelson, P. Nöges, A. M. Paterson, R. M. Pilla, D. M. Robertson, L. G. Rudstam, J. A. Rusak, S. Sadro, E. A. Silow, J. D. Stockwell, H. Yao, K. Yokota, and D. C. Pierson. 2021. [Earlier winter/spring runoff associated with warmer winters corresponds to lower summer chlorophyll-a in north temperate lakes](#). *Global Change Biology* 27(19): 4615-4629.
8. Hrycik, A. R., S. McFarland, A. Morales-Williams, and J. D. Stockwell. 2022. [Winter severity shapes spring plankton succession in a small, eutrophic lake](#). *Hydrobiologia* 849(9): 2127-2144.
9. Pennuto, C. M. 2022. Rapid response of the nearshore Round Goby population to temperature declines associated with upwelling events in Lake Ontario. *Journal of Great Lakes Research* 48: 843-848.
10. Porto-Hannes, I., L. E. Burlakova, and H. R. Lasker. 2022. [Genetic isolation and homogenization: Potential effects of landscape features on the population genetic structure of freshwater mussels](#). *Journal of Great Lakes Research*.
11. Spear, M. J., P. A. Wakker, T. P. Shannon, R. L. Lowe, L. E. Burlakova, A. Y. Karatayev, and M. J. Vander

- Zanden. 2022. [Early changes in the benthic community of a eutrophic lake following zebra mussel \(*Dreissena polymorpha*\) invasion](#). *Inland Waters*.
12. Watkins, J. M., L. G. Rudstam, A. Y. Karatayev, W. J. S. Currie, A. E. Scofield, and T. P. Hollenhorst. 2022. [Foreword: Stressors and successes, Lake Ontario CSMI intensive year 2018](#). *Journal of Great Lakes Research* 48: 261-263.

Refereed Journal Publications Submitted (in review)

1. Boltovskoy, D., R. C. Guiaşu, L. Burlakova, A. Karatayev, M. A. Schlaepfer, and N. Correa. 2022. Aquatic invasive species: the economic cost-benefit balance of human-made infrastructure. *Anales de la Academia Nacional de Ciencias Exactas, Físicas y Naturales Argentina* 73.
2. Brunelle, L. D., B. Szczygiel, L. S. Running, L. Su, N. Dai, A. Pérez-Fuentetaja, and D.S. Aga. Does advanced oxidation of wastewater affect aquatic life? *Daphnia's* responses in life history and lipidomics. *Env. Sci. & Tech. Water*.
3. Burlakova, L. E., A. Y. Karatayev, D. Boltovskoy, and N. M. Correa. Ecosystem services provided by the exotic bivalves *Dreissena polymorpha*, *D. rostriformis bugensis*, and *Limnoperna fortunei*. *Hydrobiologia*.
4. Hrycik, A. R., L. E. Burlakova, A. Y. Karatayev, S. E. Daniel, R. Dermott, and M. Tarbell. Individual weight estimates for Great Lakes benthic invertebrates. *Journal of Great Lakes Research*.
5. Karatayev, A. Y., L. E. Burlakova, A. R. Hrycik, S. E. Daniel, K. Mehler, E. K. Hinchey, R. Dermott, G. W. Kennedy, R. Griffiths. Long-term dynamics of Lake Erie benthos: One lake, three distinct communities. *Journal of Great Lakes Research*.
6. Karatayev, A. Y., and L. E. Burlakova. *Dreissena* in the Great Lakes: What have we learned in 30 years of invasion. *Hydrobiologia*.
7. Karatayev, A. Y., and L. E. Burlakova. What we know and don't know about the invasive zebra (*Dreissena polymorpha*) and quagga (*Dreissena rostriformis bugensis*) mussels. *Hydrobiologia*.
8. Katona, L. R., L. E. Burlakova, A. Y. Karatayev, and Y. Vadeboncoeur. Microbial N cycling may explain progressive enrichment of benthic primary producer and dreissenid 15N with depth in lakes. *Ecosystems*.

Published Reports

1. Burlakova, L. E., S. E. Daniel, I. Porto Hannes, A. Y. Karatayev, M. Pfrender, P. Simonin, K. Deiner, and B. Baloglu. 2021. DNA Barcode Reference Library: Mollusca, Annelida, and minor phyla. Final Report. USEPA 00E02254. Great Lakes Center, Buffalo State College, Buffalo, NY.
2. Karatayev, A. Y., L. E. Burlakova, A. R. Hrycik, K. Mehler, and S. E. Daniel. 2021. [Lake Erie Benthos Survey Cooperative Science and Monitoring Initiative 2019. Technical Report](#). USEPA-GLRI GL00E02254. Great Lakes Center, Buffalo State College, Buffalo, NY.

International/National/Regional Conference Presentations

1. Boynton, P. J., Watkins, L., Burlakova, A., Karatayev, T. Herne, and L. Rudstam. Incorporating benthic habitat use by mysids into traditional nighttime net-based monitoring. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
2. Burlakova, L. E., A. Y. Karatayev, K. Mehler, S. Daniel, J. Nestlerode, M. Pawlowski, E. Hinchey, and M. Wick. Exploring Great Lakes benthoscapes: can we visually delineate freshwater benthic communities? 2021 Conference, Coastal & Estuarine Research Federation. November 2021. (Virtual).
3. Burlakova, L. E., A. Y. Karatayev, K. Mehler, and E. Hinchey. Lake Erie Monitoring: Can video imagery help delineate benthic habitats? State of Lake Erie Conference. Cleveland, Ohio, March 16–18, 2022.
4. Burlakova, L. E., A. Y. Karatayev, K. Mehler, and E. Hinchey. Exotic dreissenids transform Great Lakes benthoscapes. 22nd International Conference on Aquatic Invasive Species. Oostende, Belgium, April 18–22, 2022. (Virtual).

5. Burlakova, L. E., A. Y. Karatayev, A. R. Hrycik, S. E. Daniel, K. Mehler, L. G. Rudstam, J. M. Watkins, R. Dermott, J. Scharold, A. K. Elgin, T. F. Nalepa, E. K. Hinchey, and S. J. Lozano. Six decades of Lake Ontario ecological history according to benthos. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
6. Burlakova, L. E., A. Y. Karatayev, A. R. Hrycik, S. E. Daniel, K. Mehler, L. G. Rudstam, J. M. Watkins, R. Dermott, J. Scharold, A. K. Elgin, T. F. Nalepa, E. K. Hinchey, and S. J. Lozano. Six decades of Lake Ontario ecological history according to benthos. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
7. Daniel, S. E., L. E. Burlakova, A. Y. Karatayev, I. Porto-Hannes, P. D. N. Hebert, M. E. Pfreder, D. Lodge, A. Trebitz, and S. Westergaard. Challenges to DNA barcoding: an ecologist's perspective. State of Lake Erie Conference. Cleveland, Ohio, March 16–18, 2022.
8. Daniel, S. E., L. E. Burlakova, A. Y. Karatayev, I. Porto-Hannes, I., P. D. N. Hebert, M. E. Pfreder, D. Lodge, A. Trebitz, and S. Westergaard. Challenges to DNA barcoding: an ecologist's perspective. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
9. Gernold, Z. A., A. Pérez-Fuentetaja, and D. Aga. The detection and distribution of legacy and novel per- and polyfluorinated alkyl substances in bird eggs. Poster presented at ASMS. Philadelphia, 2021.
10. Glenn, K., and C. M. Pennuto. Trophic effects of a non-native benthic fish potentially extend beyond the stream shore. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
11. Glenn, K., and C. M. Pennuto. Trophic effects of a non-native benthic fish potentially extend beyond the stream shore. NY Chapter American Fisheries Society. (Virtual).
12. Hargrave, L., A. Hrycik, L. Burlakova, and A. Scofield. Impacts of dreissenids on water chemistry and the deep chlorophyll layer in the Laurentian Great Lakes. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
13. Hrycik, A. R., A. Y. Karatayev, L. E. Burlakova, K. Mehler. Assessment of Lake Erie *Dreissena* populations with video methods. State of Lake Erie Conference. Cleveland, Ohio, March 16–18, 2022.
14. Hrycik, A. R., A. Karatayev, L. Burlakova, V. Karatayev, and M. D. Rowe. Spatial self-organization of Great Lakes *Dreissena* mussels. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
15. Karatayev, A. Y., L. E. Burlakova, A. R. Hrycik, S. E. Daniel, K. Mehler, E. K. Hinchey, R. Dermott, G. W. Kennedy, and R. Griffiths. Long-term dynamics of Lake Erie benthos: One lake, three distinct communities. State of Lake Erie Conference. Cleveland, Ohio, March 16–18, 2022.
16. Karatayev, A., L. Burlakova, K. Mehler, E. Hinchey, and A. Hrycik. Rapid assessment of exotic dreissenids in Laurentian Great Lakes using underwater videography. 22nd International Conference on Aquatic Invasive Species. Virtual. Oostende, Belgium, April 18–22, 2022. (Virtual).
17. Karatayev, A. Y., L. E. Burlakova, A. R. Hrycik, S. E. Daniel, K. Mehler, E. K. Hinchey, R. Dermott, G. W. Kennedy, and R. Griffiths. Long-term dynamics of Lake Erie benthos: One lake, three distinct communities. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
18. Krest, A. C., and C. M. Pennuto. Does macroalgae invasion alter macroinvertebrate and/or macrophyte communities in wetland habitats? Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
19. Pawlowski, M., J. Nestlerode, G. Cicchetti, E. Hinchey Malloy, L. Burlakova, and R. Kraus. “SPI-ing” on benthic conditions in Lakes Erie and Ontario using Sediment Profile Imagery. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
20. Pennuto, C. M., J. Wagner, K. Glenn, G. Shaw, and J. Allen. Rapid response of the nearshore round goby population to temperature declines associated with upwelling events in Lake Ontario. NY Chapter American Fisheries Society. 2021. (Virtual).
21. Pérez-Fuentetaja, A. and S. Witte. Effects of the anthropogenic decalcifications of lakes on aquatic snail shell formation. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.
22. Wirebach, K., and C. M. Pennuto. Habitat suitability analysis for the reintroduction of lake sturgeon

(*Acipenser fulvescens*) in Lake Erie tributaries. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.

23. Yerofeev, K., and C. M. Pennuto. Prey naiveté to a non-native predator and behavioral responses to native predators both lead to trophic cascades in a mesocosm experiment. Joint Aquatic Sciences Meeting. Grand Rapids, Michigan, May 14–20, 2022.

Invited Talks

1. Burlakova, L. E., A. Y. Karatayev, K. Mehler, and E. Hinchey. Potential of video imagery to detect hypoxic benthic habitats. Status and Approaches to Assess Lake Erie Central Basin Hypoxia Workshop, September 30, October 7, October 14, October 26, 2021. (Virtual).
2. Burlakova, L. E., and A. Y. Karatayev. *Dreissena* in the Great Lakes. Invited talk presented at SeeWandel Thematic Working Group “Neozoa & Climate Change.” Switzerland. April 25, 2022. (Virtual).
3. Burlakova, L. E. *Dreissena* in the Great Lakes. Invited talk presented at upper-level undergraduate course “Ecology of Invasive Species.” University at Buffalo, April 27, 2022.
4. Hrycik, A. R., L. Z. Almeida, and T. O. Höök. “Hypoxia has sub-lethal effects on biota.” Hypoxia Summit. October 2021. (Virtual).
5. Hrycik, A. R., P. D. F. Isles, D. C. Pierson, and J. D. Stockwell. “Winter/Spring Runoff is Earlier, More Protracted, and Increasing in Volume in the Laurentian Great Lakes Basin.” American Geophysical Union. December 2021. (Virtual).
6. Karatayev, A., L. Burlakova, and V. Karatayev. Lake morphometry determines *Dreissena* invasion dynamics. Invited talk presented at SeeWandel Thematic Working Group “Neozoa & Climate Change.” Switzerland. April 25, 2022. (Virtual).
7. Perez-Fuentetaja, A. [Virtual Emerald Shiner Workshop](#). U.S. Army Corps of Engineers. October 15, 2021.
8. Pérez-Fuentetaja, A., M. Clapsadl, R. Snyder. The Emerald Shiner in the Niagara River is a stabilizing force supporting ecosystem resilience. Ecological Standing Committee, Niagara Greenway. 2021.



Undergraduate student Ameera Albayed processing a sample collected from Lake Michigan in July 2021.

III. Education

The GLC fulfills its educational mission directly through the classes its researchers teach, through its Master of Arts and Master of Science graduate programs in [Great Lakes Environmental Science](#), through the support we offer to faculty teaching classes pertaining to environmental sciences, through the seminar speakers we sponsor, and through our educational activities in the community.

Great Lakes Center MS and MA Graduate Programs

The GLC administers two interdisciplinary applied environmental science programs in Great Lakes Environmental Science (GLES). The GLES programs provide an opportunity for students to pursue graduate studies through a thesis-based [Master of Arts](#) (M.A.) and an internship-based [Master of Science](#) (M.S.). Both programs provide students with the opportunity to attain a broad understanding of the physical, chemical, biological, and social factors that comprise the Great Lakes ecosystems. GLES graduates are prepared to provide a leadership role as they address a broad range of problems and issues related to the management of resources within the Great Lakes and surrounding watersheds.

Students enrolled in GLES Administered by the GLC in 2021–2022:

Master of Art:

Lara Hargrave
Alexander Krest
Corinna Solomon
Amanda Jacobs
Hutong Fan
Matthew Basista

Master of Science:

Jason Kappan
Skyler Paternostro
Theo Berenson
Jade LaRock
Michael Kalinka

Advising Undergraduate and Graduate Students

- Lyubov Burlakova was the thesis co-advisor for one GLES M.A. student.
- Allison Hrycik was the thesis co-advisor for one GLES M.A. student.
- Chris Pennuto was the advisor of 5 graduate students, a committee member for four graduate students, the advisor for 8 GLES non-thesis PSM students, and Internship coordinator for 2 GLES graduate students.
- Alicia Pérez-Fuentetaja was the thesis advisor for two Biology graduate students. She served as a PhD committee member for two students in the Chemistry Department at the University at Buffalo.



Two of Chris Pennuto's graduate students, Kylie Wirebach and Kyle Glenn, collecting round gobies for research.

IV. Outreach, Service, and Professional Development

All members of the GLC have been actively involved in outreach and service to the profession, to the College, and to the community.

Lyubov Burlakova:

- Faculty Mentor/Advisor (together with Allison Hrycik), Lara Hargrave, M.A. student, Great Lakes Environmental Science (2020–present).
- Completed “Culture of Civility: Creating Harassment-Free Workspace (New York)” course (November 9, 2021).
- Initiated preparation of educational course in Great Lakes Invertebrate Monitoring for our student technicians.
- Ruth Huppuch Research and Education Award Fund Committee.
- Helped to organize 2021 GLC Open House.
- Participated in preparation of the [Great Lakes Center 2020–2021 Annual Report](#).
- Committee member for Great Lakes Center Goals 2030.
- Participated in establishment of two Graduate Scholarships per year funded by the Ruth Huppuch Foundation.
- Wrote articles for [GLC Newsletter](#) series.
- Helped in organizing Great Lakes Center Retreat to discuss recent achievements and future plans, May 2022.
- Associate Editor of the *Journal of Great Lakes Research* and *Hydrobiological Journal* (Ukraine).
- Guest Editor, Special Issue “Biology and impacts of invasive freshwater molluscs” in *Hydrobiologia*.
- Participated in multiple Lake Huron CSMI 2022 survey planning workshops.
- Participated in collaboration between Great Lakes Center and the Swiss Federal Institute of Aquatic Science and Technology (Dr. Piet Spaak), May 2022.
- Session Chair, State of Lake Erie IAGLR Meeting (March 2022).
- Session Chair, Joint Aquatic Sciences Meeting (May 2022).
- Participated in Status and Approaches to Assess Lake Erie Central Basin Hypoxia Workshop, September – October 2021.
- Participating in Lake Michigan Data Meeting, every month since October 2021.
- Member of Aquatic Life Use Metrics - Benthic Invertebrate subgroup led by Ohio Sea Grant and Ohio EPA to develop aquatic indicators for Lake Erie.
- Participated in preparation of the State of the Great Lakes 2021 Report.
- Participated in multiple phone conferences with EPA, NOAA, USGS, etc., about current research and potential future projects.
- Participated in meetings with our partners from Cornell University on the Great Lakes Long-term Biological Monitoring Program.



Meeting with Piet Spaak from Swiss Federal Institute of Aquatic Science and Technology to collaborate on quagga mussel research in US and European lakes.

- Member of the International Planning Committee for the Joint meeting of European Large Lakes Society and International Association for Great Lakes Research in Petrozavodsk in 2022.
- Member of the Freshwater Molluscs Conservation Society *ad hoc* International Committee.
- Member of the Association for the Sciences of Limnology and Oceanography.
- Member of the International Association for Great Lakes Research.
- Member of the Ecological Society of America.
- Member of Buffalo State's "The Friends of the Maud Gordon Holmes Arboretum."
- Reviewed a draft of the National Strategy for USGS Native Freshwater Mollusk Research.
- Reviewed 4 manuscripts for *Diversity*, *Hydrobiologia*, *Freshwater Science*, and *Limnologica*.
- Interviewed by Breanna Fuss from Spectrum News on the \$3 million award that Great Lakes Center received from the Environmental Protection Agency to study Great Lakes. May 31st, 2022.

Mark Clapsadl:

- Oversaw Field Station operations and provided assistance with multiple research projects (both funded and unfunded) and provided for field trip experiences for BSC classes.
- Completed a major reconfiguration of our most important research vessel, the *John J. Freidhoff*. This work added almost 3 feet of deck space to the boat, increased floatation in the stern and eliminated problems with water intruding in a following sea or while stationary and working. Most importantly this work resulted in improved safety of the vessel.
- COVID-19 restrictions limited the activities possible in terms of field station activities. However, I was able to coordinate activities with other field station personnel and continue to safely provide a presence at the field station throughout the pandemic. We were able to provide the support required for the projects listed above and to address routine field station needs.
- Installed and operated a weather buoy in eastern Lake Erie that provides a direct service to boaters in the lake by providing information on conditions on the lake (waves, wind etc.) that are not available from any other source and that can be used for making safe boating decisions. We have had over 20,000 views of the website that provides this information. In addition, these data are being used by climate modelling researchers and fishery management professionals.

Susan Daniel:

- Gave a lecture "Introduction to Great Lakes Ecology" for Upper-Level Photography (Yola Monakhov Stockton) class, September 7, 2021.
- Completed "Culture of Civility: Creating Harassment-Free Workspace (New York)" course, October 8, 2021.
- Assisted in the preparation of an educational course in Great Lakes Invertebrate Monitoring for our student technicians.
- Wrote articles for [GLC Newsletter](#) series.
- Chemical and Biological Safety officer for the Great Lakes Center (2014–present).
- Member of Aquatic Life Use Metrics - Benthic Invertebrate subgroup led by Ohio Sea Grant and Ohio EPA to develop aquatic indicators for Lake Erie.
- Participated in preparation of the State of the Great Lakes 2021 Report.
- Participated in multiple phone conferences with EPA about current research and potential future projects.
- Participated in meetings with our partners from Cornell University on the Great Lakes Long-term Biological Monitoring Program.
- Member and Regular U.S. Board Member of the International Association for Great Lakes Research.

- Chair of the Awards Committee for the International Association for Great Lakes Research.
- Member of the Justice, Equality, Diversity, and Inclusion Committee for the International Association for Great Lakes Research.
- Member of Buffalo State's "The Friends of the Maud Gordon Holmes Arboretum."
- Mentor as part of the NY Chapter Aquatic Fisheries Society Women in Fisheries Mentoring program.
- Session chair for *Contributed Topic: Urban Issues/Pollution*. Joint Aquatic Sciences Meeting. May 14–20, 2020, Grand Rapids, Michigan.

Susan Dickinson:

- Continued to keep the GLC office open and fully functioning throughout the COVID-19 pandemic.
- Execute daily operations of the GLC including purchases of supplies and equipment, travel paperwork, and maintaining multiple budgets (all with state, Research Foundation and College Foundation monies).
- Proof-read multiple research papers, reports, and flyers/brochures for GLC and WNY PRISM.
- Scheduled and organized annual Open House, staff retreat, and staff meetings.
- Maintained or disposed of departmental files in accordance with NYS and SUNY schedules for records management.
- Assist with GLES program functions: scheduling of thesis proposal/defense meetings, Banner course input, distribution and collection of annual Performance and Evaluation forms.
- Continued to digitize departmental historical files.
- Taught myself basics of Qualtrics Surveys in order to create online surveys/forms.
- Created several fillable versions of scholarship and award applications (Word, pdf, Qualtrics) to post on GLC website and/or distribute, as necessary.
- Split work time assisting as the Chemistry Department Administrative Assistant for 2 weeks until they were able to hire a temp.
- Volunteered at on-campus COVID-19 testing site.
- Began taking online accessibility courses through Deque University (thus far achieved "Customer Service for People with Disabilities Curriculum" certificate).
- CSEA Local 640 Treasurer beginning July 2021 (4-year term).
- Member of Local 640's Veterans Committee, and chair of Budget and Audit Committees.
- Completed "Civilian Response to Active Shooter Events" webinar.

Brian Haas:

- Collected benthic samples on Lake Erie and Lake Ontario for the EPA Biology Monitoring Program.
- Installed additional plantings in the migratory bird garden as part of the Osprey Nesting Platform and Migrator Habitat Enhancement Project.
- Aided in the launching and retrieval of the GLOS buoy in Lake Erie.
- Provided general assistance to WNY PRISM at the Field Station.
- Helped graduate and undergraduate students from Buffalo State College with research projects that were conducted in the Field Station labs.
- Supported local agencies including the NYSDEC and USFWS through general assistance and the use of the Field Station grounds and boat launch.
- Made strategic purchases and installations that enhanced the Field Station's operational and research capacity.

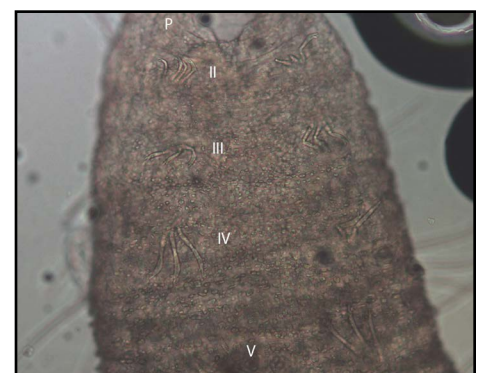
- Worked with Buffalo State Property Control and the SUNY Research Foundation to manage both state-owned and grant-awarded assets.
- Ensured boats, vehicles, and equipment were properly stored and cared for.
- Continued to make sure that the field station is compliant with all health and safety COVID-19 protocols.
- Participated in mock interviews for the Career Development Center.
- Collaborated with professors outside the GLC to develop applicable content and field trips related to their courses.
- Helped various departments on campus when our resources were requested.
- Worked with Field Station neighbors, including the West Side Rowing Club and the Navy Operational Support Center, and provided assistance when possible.
- Performed duties outside of my professional obligations to ensure that the Great Lakes Center Field Station remains functional and in good order.
- Continued to build my knowledge of GoPro camera equipment as it applies to educational support and research projects.
- Participated in NYSDEC webinars that pertain to my field of study.
- Continued to keep up to date regarding current research on the Great Lakes along with recent trends.

Erik Hartnett:

- Was actively involved in several research projects: Monitoring of benthic invertebrates in Great Lakes; DNA Barcode Reference Library: Mollusca, Annelida, and minor phyla; Archival, salvage and documentation of historic samples.
- Completed training to prevent harassment in the workplace, February 2022.
- President of Virginia, Edward, Trinity, Tupper, Elmwood (V.E.T.T.E.) Block Club.

Kit Hastings:

- Played a key role in producing two issues of [GLC Newsletter](#) (editor).
- Wrote multiple articles for GLC Newsletter series.
- Assisted in preparation of the [GLC Annual Report](#) publication.
- Managed the [GLC website](#).
- Improved the accessibility of the GLC website, Annual Report, and Newsletters, in compliance with Buffalo State Guidelines for Accessibility.
- Assisted in lab work associated with the Great Lakes Long-term Biological Monitoring Program and Lake Erie CSMI projects (sorted samples and identified oligochaetes).
- Created the [GLNPO Benthic Invertebrate Reference Guide](#) for the [Great Lakes Benthos Monitoring Project](#).
- Participated in webinars that pertain to my field of study, including “The role of dreissenid mussels in nutrient cycling” and “ArcGIS Online Training.”
- Completed web accessibility class “Images, SVG, and Canvas” from Deque University.
- Attended 13th Annual CUNY Accessibility Conference.



A microscope picture from the *Spirosperma ferox* entry in the GLNPO Benthic Invertebrate Reference Guide.

- Participated in United Way of WNY's 21-Day Racial Equity Challenge 2021 and attended diversity webinars.
- Member of the Buffalo State Institutional Animal Care and Use Committee.
- Member of WNY GIS User Group and NYS GIS Association.
- Member of oSTEM.
- Bengal Allies member.

Brittany Hernon:

- Attended the NYS Invasive Species Summit, Albany, New York, November 2021.
- Completed the Buffalo State Stop the Bleed Training, Buffalo, New York, November 2021.
- Passed the NYS Pesticide Applicator exams and obtained a NYS Commercial Pesticide Applicator License in Category 3A, Depew, New York, February 2022.
- Co-hosted a virtual Hemlock Woolly Adelgid (HWA) classroom training and in-person HWA field training for volunteers so they could survey for and report the species, January 2022.
- Facilitated one remote Great Lakes Slender False Brome Working Group meeting to increase communication and collaboration among partners and interested parties, April 2022.

Allison Hrycik:

- Became an Adjunct Assistant Professor through the Biology Department (September 2021).
- Organized and presented at Lake Huron CSMI 2022 Planning Meeting (April 20, 2022, Virtual Meeting).
- Participated in preparation and editing of the State of the Great Lakes 2022 Report.
- Participated in multiple phone conferences with EPA, NOAA, USGS, etc., about current research and potential future projects.
- Completed Buffalo State's van driver safety course (October 15, 2021).
- Completed SUNY RF's Conflict of Interest training (March 11, 2022).
- Participated in GLC Open House (August 26, 2021).
- Participated in the Benthic Invertebrate Subgroup panel of experts of the Lake Erie Aquatic Life Use Metrics project led by Ohio EPA to advise the state on the development of aquatic life use metrics for Lake Erie.
- Member of the Association for the Sciences of Limnology and Oceanography.
- Member of the International Association of the Great Lakes Research.
- Member of American Geophysical Union.
- Attended multiple webinars on topics including science communication, peer review, and hydrodynamics.
- Reviewed manuscripts for *Ecological Applications*, *Freshwater Biology*, *Inland Waters*, *Limnologica*, and *Limnology & Oceanography*.

Alexander Karatayev:

- Organized Great Lakes Center Open House, August 2022.
- Was interviewed by the Buffalo State President Dr. Conway-Turner for the 10th installment of "[Faculty Engaged](#)," August 24, 2021.
- Published [Great Lakes Center 2020–2021 Annual Report](#).
- Committee member for Great Lakes Center Goals 2030.
- Initiated creation of two Graduate Scholarships per year funded by the Ruth Huppuch Foundation.
- Wrote articles for [GLC Newsletter](#) series.

- Organized Great Lakes Center Retreat to discuss recent achievements and future plans, May 2022.
- Completed SUNY Sexual Harassment Prevention Training (September 29, 2021).
- Campus Representative for the Great Lakes Research Consortium.
- Associate Editor of *Hydrobiological Journal* (Ukraine).
- Guest Editor of the Special Issue of the *Journal of Great Lakes Research* dedicated to Lake Ontario.
- Participated in multiple Lake Huron CSMI 2022 survey planning workshops.
- Invited Dr. Piet Spaak, from Switzerland to discuss collaboration between Great Lakes Center and the Swiss Federal Institute of Aquatic Science and Technology, May 2022.
- Participated in multiple phone conferences with EPA, NOAA, USGS, Sea Grant, etc., about current research and potential future projects.
- Participated in meetings with our partners from Cornell University on the Great Lakes Long-term Biological Monitoring Program.
- Interviewed by Breanna Fuss from Spectrum News on the \$3 million award that Great Lakes Center received from the Environmental Protection Agency to study Great Lakes, May 31st, 2022.
- Member of Aquatic Life Use Metrics - Benthic Invertebrate subgroup led by Ohio Sea Grant and Ohio EPA to develop aquatic indicators for Lake Erie.
- Member of Freshwater Mollusk Conservation Society.
- Member of the Association for the Sciences of Limnology and Oceanography.
- Member of the International Association for Great Lakes Research.
- Reviewed manuscript for *Biological Invasions*.

Douglas Knoph:

- Attended Webinar - Spotted Lanternfly in The Catskills: Virtual Panel, May 24, 2022. Highlighted outreach strategies for agricultural communities.
- Attended Webinar - Why Nature Is Important: Learning to Love our Planet, April 27, 2022. Highlighted restoration of natural habitat for birds in WNY.
- Attended Slender False Brome Working Group meeting, April 29, 2022.

Andrea Locke:

- Attended the NYS Invasive Species Summit, Albany, New York. November 2021.
- Attended the NYS Invasive Species In-Service, Virtual. November 2021.
- Participated in Tonawanda Creek/Erie Canal Hydrilla Demonstration Project Collaborative as part of Advisory Committee and as part of the New York State Hydrilla Task Force.
- Coordinated with the Department of Agriculture and Markets to direct WNY response to Spotted Lanternfly.
- Participated in Great Lakes Action Agenda Working Group Meetings.
- Held position on Great Lakes *Phragmites* Collaborative Advisory Committee and Funding Sub-Committee.
- Member of the GLES PSM Advisory Board.
- Held Resume Building Workshop for WNY PRISM seasonal employees, including Buffalo State College students.
- Provided information, updates, and feedback to the New York Invasive Species Advisory Committee (ISAC) and Invasive Species Council (ISC).
- Coordinated Rails to Trails Volunteer Monitoring and Removal Program in partnership with the Town of Tonawanda.

- Served as regional representative for New York State statewide Forest Pest Task Force and Hemlock Initiative.
- Coordinated Mile-a-Minute Working Group meetings to address emergence of the species in Genesee County.
- Held multiple, open WNY PRISM Partnership and Working Group Meetings to allow for public involvement in regional invasive species issues.
- Assisted partners with invasive species management planning for public lands restoration efforts.
- Worked with Niagara River Greenway to develop Volunteer Management System.

Christopher Pennuto:

- Coordinator, GLES masters programs.
- Co-chair, Task Force on Teaching Load Equity in SAS.
- Member, BSC Sustainability Committee.
- Student awards judge, JASM conference, May 2022.
- Reviewed manuscripts for *Journal of Great Lakes Research*, *Biological Invasions*, *Ecology of Freshwater Fish*, and *Hydrobiologia*.

Alicia Pérez-Fuentetaja:

- My research has resulted in a local wildlife habitat improvement as the “Emerald Shiner Demonstration Project” at Broderick Park, which includes a noble design for fish passage from the Niagara River into Lake Erie. This project involves repair to a portion of the existing seawall and installation of baffles for fish passage.
- Member Niagara Watershed Advisory Committee 12/16/21 Webex meeting.
- Member Association of Great Lakes Research.
- Member Association for the Sciences of Limnology and Oceanography.

Cecilia Pershyn:

- Attended the NYS Invasive Species Summit, Albany, New York. November 2021.
- Coordinated and recruited volunteers for 4 Japanese Stiltgrass (JSG) Volunteer Workdays to pull JSG from sites along Cazenovia Creek. July through September 2021.
- Co-hosted a virtual Hemlock Woolly Adelgid (HWA) classroom training and in-person HWA field training for volunteers so they could survey for and report the species. January 2022.
- Hosted Rails to Trails Community Science Project classroom training and field training for community scientists so they could survey for and report invasive species along the Town of Tonawanda Rails to Trails pathway. April and June 2022.
- Facilitated one remote WNY PRISM Invasive Species Symposium Advisory Group meeting to increase communication and collaboration among partners and interested parties. May 2022.
- Coordinated 9 Invasive Species Walk and Talks. July 2021 through June 2022.

Nicole Smeenk:

- Attended the NYS Invasive Species Summit, Albany, New York. November 2021.
- Attended the iMap Mobile Advance Data Review Workshop, virtual. May 2022.
- Completed Commercial Pesticide Apprentice training and qualifications. May 2022.
- Participated in the Aquatic Invasive Species Lakes and Ponds Vulnerability Prioritization Advisory Group.
- Provided updates at New York State Aquatic Invasive Species Staff quarterly meetings.
- Participated in statewide Watercraft Inspection Steward Program Coordinators meetings.

- Assisted in revisions for the statewide Watercraft Inspection Steward Program Manual.
- Coordinated WNY PRISM Southern Tier Water Chestnut Working Group.
- Coordinated training for the WNY PRISM Watercraft Inspection Stewardship Program.

Brianne Tulumello:

- Was actively involved in several research projects: Monitoring of benthic invertebrates in Great Lakes; DNA Barcode Reference Library: Mollusca, Annelida, and minor phyla; Archival, salvage and documentation of historic samples.
- Completed “Civilian Response to Active Shooter” presented by CERT, June 9, 2022.
- Completed ArcGIS Online training, May 3, 2022.
- Completed “Stop the Bleed” First aid and tourniquet training, March 14, 2022.
- Completed training to prevent harassment in the workplace, January 3, 2022.
- Completed RF learning and development training Art of Delegation, July 22, 2021.
- Completed RF learning and development training Creating a Culture of Recognition and Appreciation, July 21, 2021.



Susan Daniel, Alexander Karatayev, Allison Hrycik, and Lyubov Burlakova at the State of Lake Erie Conference in Cleveland, Ohio in March 2022.



Lara Hargrave, Allison Hrycik, Lyubov Burlakova, Alexander Karatayev, Susan Daniel, Kyle Glenn, and Kira Yerofeev at the Joint Aquatic Sciences Meeting in Grand Rapids, Michigan in May 2022.



Allison Hrycik and Sarah Lawhun collecting video and Ponar samples from Saginaw Bay, Michigan in June 2022.



Sarah Lawhun, Allison Hrycik, and Justin Meyer (Purdue University) sampling benthos in Saginaw Bay, Michigan in June 2022.

V. Field Station Activities

R/V John J. Modifications

One of the big changes in 2021–2022 has been the completion of a project to modify the [Research Vessel John J. Friedhoff](#). This boat was purchased in 2009 and, although it has served us well over the years, it suffered from a couple of problems. The back deck was too small, and the boat was stern heavy, which often resulted in water on the deck while working. More importantly, it meant that the deck drained more slowly than is ideal when it took on water from waves. In 2021 and 2022, we worked with marine architects and marine fabricators to create a plan and then modify the boat to fix these problems. The modifications included adding an engine bracket and moving both the twin outboards and the transom aft. The bracket provides additional displacement and length to the hull as well as a space to mount the engines. By moving the engines back, we were also able to move the transom further aft, thus gaining almost 3 feet of deck space. The boat now has more deck space, is better balanced so the deck stays dry and drains more quickly (safer), and because the hull is longer, the boat gets on step at a lower speed and should be more fuel efficient as well.



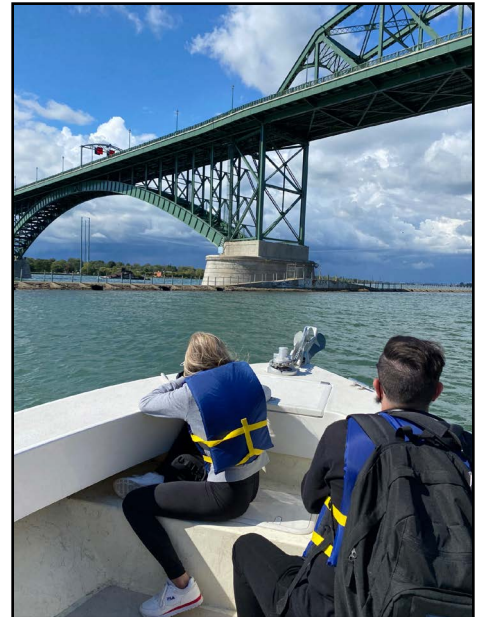
The R/V John J. Friedhoff undergoing modifications this spring. The back end has been completely remodeled. Photo credit: Willard Marine.

Educational Support

With the softening of COVID-19 related restrictions we have been able once again to hold field trips, getting students back out on the water for multiple trips including some new and very well received trips for students in Photography classes. In addition to the actual field trips, Brian Haas has worked hard to provide the students with virtual field trips. It can sometimes be difficult to get groups of students out onto the water because of weather conditions and other factors, so, during the COVID-19 lockdown period we began to develop virtual field trip videos. The videos introduce students to fish sampling techniques that are commonly used in fisheries management and showed these techniques being performed by Field Station staff in our local waterways. The final product was streamed to the class through Blackboard and will also be used to support upcoming education and outreach objectives.

Shoreline and boat ramp stabilization

We have been working for many years to make changes to our shoreline that will act to reduce the damage caused by wind-driven flooding events. The last phase of that process in our plan is to increase the size of the concrete “apron” at the top of our boat ramp. This apron would reduce or eliminate the amount of rock and gravel that get washed into the boat ramp when flooding and waves reach the parking lot. Unfortunately, storms that drive these kind of flooding events are now an annual occurrence. At present we are working on the bid process, and although this is a very simple project, it is anyone’s guess when actual construction may start.



Two photography students sit in the front of the Privateer, taking pictures of the Niagara River, Black Rock Canal, and the Peace Bridge.



Purple martin fledglings at the Field Station in August 2021.

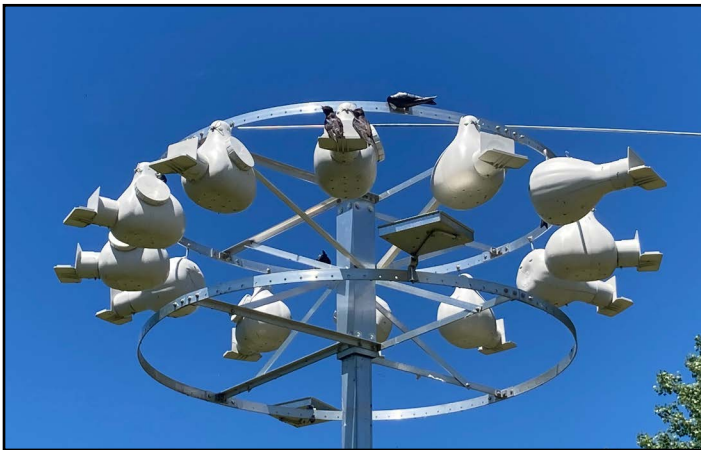
Osprey Nesting Platform and Habitat Enhancement Project

In 2021–2022, we continued to work on the Osprey Nesting Platform and Habitat Enhancement Project funded through the Niagara River Greenway Commission (no cost extension 2022) (\$94,104, PI's Clapsadl, Haas, and Hastings). The work during this time has focused on placing additional perennials and woody plants in the plantings that were created as part of this project. All plants used are native plants that were selected for their potential to provide food, cover, and nesting sites for migrating and local birds.

Other projects

We provided field and laboratory support for multiple faculty and student research projects, including, but not limited to providing support for the deployment of a new GLOS (Great Lakes Observing System) buoy in Lake Erie off Dunkirk, as well as several Masters' level research projects.

We have continued to maintain a rigorous regular maintenance program for our research boats. This program, coupled with the ability to store the boats in the boat shed out of sun, rain, and snow, has enabled us to keep the boats in good working order.



A pair of purple martins perching outside the nesting gourds at the Field Station.



Setting up the predator avoidance mesocosms at the Field Station.



Brian Haas and Mark Clapsadl collecting benthic samples on Lake Erie for the Great Lakes Long-term Biological Monitoring Project.



Mark Clapsadl and Brian Haas collecting dreissenid mussels at the Field Station for Dr. Evan Ward (University of Connecticut) for a project looking at the uptake of various synthetic particles by dreissenid mussels.

VI. Western New York PRISM Activities

[Western New York Partnership for Regional Invasive Species Management](#) (WNY PRISM) is a sponsored program of the Research Foundation for Buffalo State College and is hosted by the Great Lakes Center. Funding for WNY PRISM is provided by the Environmental Protection Fund through a contract with the NYS Department of Environmental Conservation. Funding for WNY PRISM, through the current contract, supports continued operations through December 31, 2023.

The Western New York Partnership for Regional Invasive Species Management (WNY PRISM) works to address invasive species priorities using a coordinated partnership network for which the program provides leadership, technical assistance, and opportunities for collaboration. The goal of this program is to improve, restore and protect local aquatic and terrestrial resources by improving the effectiveness of invasive species management efforts, engaging the public in management actions, and increasing awareness of invasive species issues throughout the eight-county, Western New York region.

To achieve established goals, WNY PRISM coordinates several high-profile priority programs. WNY PRISM runs a robust Early Detection and Response Program, several Community Science Programs, a Crew Assistance Program that sees WNY PRISM work with dozens of partners across the region, and a Watercraft Inspection Stewardship Program with up to 20 Boat Stewards. This is in addition to expansive education and outreach, data collection, and information management efforts.

For more information WNY PRISM activities and results, see the [WNY PRISM Annual Report](#).

Program Highlights and Accomplishments

Western New York Partnership for Regional Invasive Species Management (WNY PRISM) continues to address invasive species priorities through our many programs and essential partnerships with regional stakeholders.

During the 2021 summer season, WNY PRISM surveyed 2,800 acres in addition to the 24 sites surveyed for early detection species, which itself accounted for 700 hours of effort and 95 miles of trail surveyed. A total of 819 records were submitted to iMapInvasives, representing 41 unique species. Early detection priority species removal efforts resulted in 31 sites managed with over 30 bags of plant material removed.

The Watercraft Inspection Stewardship Program resulted in 12,886 boat inspections and 684 interceptions, the most common being Eurasian watermilfoil (390) and curly leaf pondweed (137). Spread prevention measures prior to talking with a Boat Steward were taken by 65% of survey participants and 78% agreed to take the “Clean. Drain. Dry.” Pledge to Protect.

Education and Outreach effort resulted in WNY PRISM hosting and/or attending 65 public events with 2,676 Direct Contacts and over 18,000 Attendees. WNY PRISM has produced 115 Facebook posts that have reached 54,557 users and maintains over 1,000 followers. WNY PRISM has 745 page followers on Instagram where 104 posts and 58 stories have reached 4,000 users. WNY PRISM’s YouTube channel, which features presentations and training videos, has recorded 488 views, with 53 hours watched, and 1,100 impressions this year. Over 200 people have signed our Pledge to Protect Banners, indicating a commitment to taking small steps to stop the spread and manage invasive species.

WNY PRISM also maintains an Approaching Region and Early Detection Priority Species Lists, which provide guidance for the selection of priorities within the Tier 1 (Prevention) and Tier 2 (Early Detection/Eradication) categories. WNY PRISM prioritizes the survey, monitoring, and management of these species, as well as education and outreach related to increasing regional awareness.

The Data Gap Species Priority List is adjusted annually. In 2021, four species were selected as priority data gap species: tree of heaven, wild chervil, callery pear, and swallow-wort. In 2022, five were selected: hemlock woolly

adelgid, tree of heaven, leafy spurge, Japanese honeysuckle, and callery pear. WNY PRISM field staff were trained to identify these species and instructed to keep a lookout for them. We also highlighted them in outreach and social media, seeking help from community scientists to add observations to iMap.

WNY PRISM addresses invasive species issues as identified within the WNY PRISM [5-year Strategic Plan \(2019–2023\)](#), which was developed in accordance with established Core Functions, through a year-long collaborative process involving regional partners. Six goals associated with WNY PRISM's established core functions (Partnership Coordination, Information Management, Education and Outreach, Prevention, Early Detection/ Rapid Response, and Habitat Management and Restoration) are broken down into objectives and strategies for implementation. The strategic plan is supported by annual work plans that identify specific tasks WNY PRISM staff will focus on in any given year. The WNY PRISM 2021 and 2022 Annual [Work Plans](#) provided the framework for FY2022.

Partner/Network Coordination

- Held 2 Full Partner Meetings and Quarterly Steering Committee Meetings.
- Participated in PRISM Leader's Quarterly Meetings and Monthly webinar series.
- Released 2021 Annual Report.
- Released 2022 Annual Work Plan.
- Participated in NYS Invasive Species Program Coordinating Groups: Terrestrial Coordinators, Aquatic Coordinators, Education and Outreach Committee, Aquatic Invasive Species Lakes & Ponds Vulnerability Prioritization Advisory Group, New York Invasive Species Research Institute Metrics Committee, and iMapInvasives Working Groups.
- Participated in Great Lakes Action Agenda Meetings.
- Participated in *Hydrilla* Collaborative and NYS *Hydrilla* Meetings.
- Coordinated Western New York Water Chestnut Working Group and facilitated meetings and communication.
- Facilitated Mile-a-Minute Working Group meetings and communication.
- Participated in WNY Forest Pest Task Force.
- Hired new Field Operations Manager.
- Posted, interviewed, and hired 2022 Seasonal Positions (1 E&O, 3 ISMA, 15 Boat Stewards, 2 Lead Stewards, 1 GIS Technician, 2 Survey and Monitoring Technicians).
- Held Resume Building Workshop for seasonal staff including Boat Stewards and Invasive Species Management Assistants.
- Served on the Great Lakes *Phragmites* Collaborative Advisory Committee and Funding Sub-Committee.

Information Management

- Submitted 819 records to iMapInvasives including 41 unique species.
- Identified geographic data gaps within iMap and completed surveys at 4 sites, covering 55.9 acres. Species specific data gap surveys focused on tree of heaven, callery pear, wild chervil, and swallow-wort.

- Surveyed 4 sites for water chestnut (94.1 acres) and removed 266 plants. Partners surveyed and removed 171 plants from 3 sites and 2 new sites were confirmed.
- Maintained WNY PRISM priority species lists.
- Compiled information on potential knotweed biocontrol release sites for Dr. Amatangelo from SUNY Brockport.
- Worked with partners to select and monitor research sites for newly approved biocontrol agent targeting swallow-wort species, *Hypena opulenta*. Developed *Hypena opulenta* outreach material to promote biocontrol.
- Assisted with The Nature Conservancy's Great Lakes Aquatic Nuisance Species Early Detection and Rapid Response surveillance efforts. New infestation of starry stonewort was discovered in the Buffalo Small Boat Harbor.
- Identified 83 WNY region public boat launches, and surveyed 76, for presence of invasive species outreach, disposal stations, and potential for launch staffing.
 - 37 launches (49%) had invasive species and/or spread prevention signs.
 - 15 launches (20%) had invasive species disposal stations.
- Developed AIS survey rake toss protocol.
- Worked with Lake Erie Watershed Protection Alliance to update the Stream Visualization Assessment Program data collection protocol. Developed and provided species identification resources for LEWPA Technicians.
- Finalized 2022 internal data quality assurance protocols for field season data collection and review.
- Participated in Post Treatment Data Work Group Meeting and reviewed data collection survey and provided feedback to iMap.
- Maintained WNY PRISM Listserv serving 334 members.
- Released bi-monthly eNews featuring News, Funding Opportunities, and Events in WNY.
- Maintained online resources including documents identifying contractors, private lands programs, grants, and native plant suppliers.



Project partners viewing progress of swallow-wort biocontrol with *Hypena opulenta* at Clarence Oak Openings.

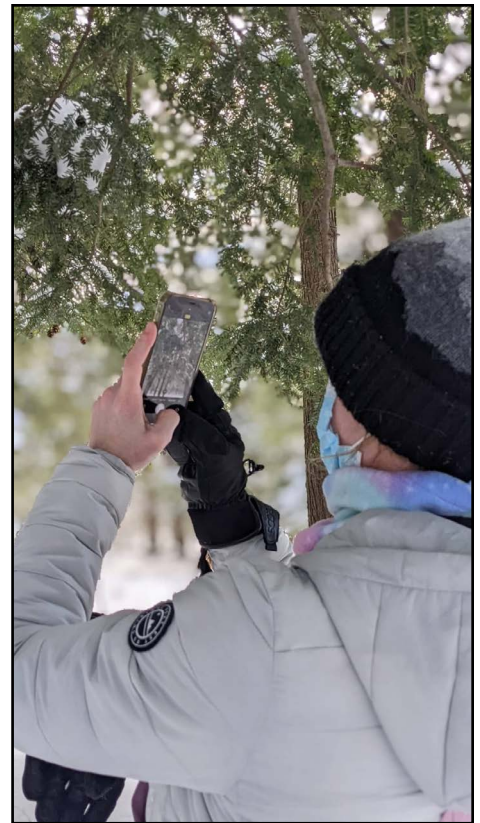
Education and Outreach

- Released Spring and Fall [eNewsletters](#).
- Coordinated NYISAW Events for the WNY PRISM Region.
- Held and/or attended 65 public events with 2,676 Direct Contacts and over 18,000 Attendees.
- Implemented Community Science Trail Survey Pilot Project with the Town of Tonawanda, for the Rails to Trails.
- Implemented HWA Hunters Community Science Program:

- Held two-part volunteer training and 3 Walk and Talks.
- 17 HWA Hunters were trained with 6 active reporters surveying 20 and submitting 35 reports to iMap.
- Developed new, bi-weekly community science bulletin.
- Responded to 55 public inquiries including species reports, identification and management questions, and requests for assistance.
- Social Media:
 - Facebook – 846 page likes and 1,003 followers, 115 published posts reached 54,557 users, generated 1,570 clicks and led to 1,763 engagement actions.
 - Instagram – 745 followers, 104 published posts with 1,876 likes and reached 16,039 people.

Prevention

- Watercraft Inspection Steward Program (WISP):
 - Conducted 12,886 inspections working at 15 launches.
 - Data showed a 92% inspection acceptance rate with 684 Aquatic Invasive Species interceptions.
 - Spread prevention measures were taken by 65% of survey participants prior to talking with a Boat Steward and 78% agreed to take the “Clean. Drain. Dry” Pledge to Protect.
 - Produced weekly and monthly reports on Boat Steward data collection and interactions.
 - Updated launch profiles for end-of-season reports to partners.
 - Revised launch fact sheets for 2022 launches.
 - Reviewed and prioritized launches ahead of 2022 season – received approval from DEC for launch selection.
 - Conducted two-day, training for Boat Steward/Environmental Educators.
 - Boat Stewards staffed 15 public boat launches in summer 2021 and we have identified 18 public boat launches for 2022.
- Completed installation of 6 new Boot Brush Stations and developed signs for 2 additional stations awaiting installation by our partners.
- Developed new “Clean. Drain. Dry.” posters to display as part of Boat Steward tables, printed, and laminated.
- Participated in the Watercraft Inspection Stewardship Program Manual Revision Review working group meeting and provided



A volunteer takes a picture of hemlock branches at the HWA Field Training at Chestnut Ridge Park on January 29, 2022.



A boat steward inspects a boat at West Canal Park Launch in June 2021.

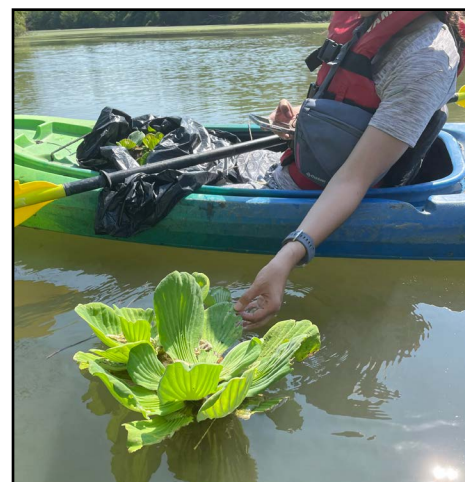


Installing a boot brush station at Cazenovia Creek Fish and Wildlife Management Area in May 2022.

revisions for the assigned “Communications” section. The Manual was released in May.

Early Detection and Rapid Response

- Facilitated WNY Mile-a-Minute Working Group meetings and communication and assisted partners with removal and outreach efforts.
- Worked with Tonawanda Creek/Erie Canal *Hydrilla* Demonstration Project Partners to continue surveys, management, and outreach.
- Held semi-annual Great Lakes Slender False Brome Working Group meetings.
- Followed up with community scientist who reported porcelain berry in 2020, confirmed he treated recurring plant in 2021.
- Treated Japanese angelica tree at Lake Erie State Park.
- Slender false brome survey and management efforts completed for 2021:
 - 2 sites surveyed.
 - 8.25 bags removed from Genesee County Park and Forest and the West Shore Trail.
 - 5 acres treated at Letchworth State Park, Inspiration Point.
- Completed 2021 early detection site monitoring and updated the list for 2022.
- Continued Japanese stiltgrass surveys, monitoring, and management. Completed Japanese stiltgrass treatments at Hunters Creek County Park (2 acres), Mossy Point (0.03 acres, 0.33 miles), American Legion Post 362 (0.18 acres), Chestnut Ridge County Park (1.4 acres), and Franklin Gulf (0.22 acres).
- Identified 2022 Japanese stiltgrass survey sites.
- Identified Japanese stiltgrass volunteer workday needs and began reaching out to project partners to confirm dates.
- Completed habitat suitability model for mile-a-minute.
- Surveyed Scajaquada Creek for Hydrilla, based on iMapInvasives Report, no plants found.
- Water Lettuce:
 - New site confirmed in Tonawanda Creek/Erie Canal – 38 total plants removed.
 - Plants were found and removed from Ellicott Creek – approximately 148 plants removed.
 - No plants found at Hyde Park Lake.
- Water Hyacinth:
 - 7 early detection sites were monitored.
 - 38 total plants removed from Tonawanda Creek/Erie Canal.
 - 3 water hyacinth sites declared “presumed eliminated” after plants have not been found for 5 years.
- Updated/selected priority grid squares for iMap tree-of-heaven



Removing water lettuce from Ellicott Creek in August 2021.

and spotted lanternfly community science early detection program, 2022.

Management and Habitat Restoration

- Crew Assistance Program:
 - Completed 2021 Crew Assistance Program Projects.
 - Completed selected projects (9) and provided project reports to all partners.
 - Published new Crew Assistance Program page on website.
 - Released 2022 Crew Assistance Program request for proposals - received 13 proposals including at least one from each county.
 - Reviewed, scored, and prioritized projects, held pre-selection meetings with partners.
 - Developed work plans and MOUs for selected projects (10), received signed MOUs.
- Visited potential HWA biocontrol release sites with NY Hemlock Initiative and collected samples for mortality analysis.
- Submitted 2022 Scope of Work to Erie County and received approval for all proposed projects.
- Completed a site visit at Sinking Ponds Wildlife Sanctuary in East Aurora alongside volunteers seeking to develop a management plan.
- Met with Bergen Swamp Preservation Society Members to discuss development of an updated site-weed management plan.
- Implemented removal efforts at several sites including Seneca Bluffs Natural Habitat Park, the Riverwalk Trail, Reinstein Woods, Houghton Preserve, The Owen's Falls and Rattlesnake Hill WMA. Target species included invasive shrubs, knotweed, *Phragmites*, Canada thistle, wild parsnip, oriental bittersweet, mugwort, reed canarygrass, crown vetch, and autumn olive.
- Planted native species as part of Tifft Nature Preserve and Reinstein Woods projects.
- Completed draft Crew Assistance Reports for survey and management projects.
- Held WNY Southern Tier Water Chestnut Working Group Meeting.
- Participated in iMapInvasives Water Chestnut Action Site Meetings and submitted data.
- Provided information to DEC as part of European Frog-bit Collaborative Meeting.
- Finalized Crew Assistance Program Reports and provided to partners.
- Discussed preserve management with Nature Sanctuary Society of Western New York.
- Met with representatives from Bergen Swamp Preservation Society to begin process of drafting a new invasive species management plan.



WNY PRISM crew at Bergen Swamp, June 10, 2022.

Additional Projects

Priority Lands Invasive Species Removal and Volunteer Monitoring Program

The goal of this project is invasive species removal and monitoring efforts on high conservation value lands located within Erie and Niagara Counties of New York, owned by the Land Conservancy and Buffalo Audubon Society. WNY PRISM is continuing work to remove invasive shrubs from identified sites: Owens Falls Sanctuary, Niagara Escarpment Preserve, and Stella Niagara Preserve. Target species include Japanese barberry, common buckthorn, bush honeysuckle, multi-flora rose, and knotweed species. This project will result in a sustainable level of ongoing management needs and will allow for the natural regeneration of native plant communities present within the project sites.

Rapid response and early detection of slender false brome and Japanese stiltgrass in Western New York

Early detection of priority invasive species requires rapid response to control current infestations and move toward the end goal of eradication in a region. Two early detection species of concern are slender false brome (*Brachypodium sylvaticum*) and Japanese stiltgrass (*Microstegium vimineum*). Both grasses can displace native species and form dense monocultures. To achieve the goal of eradication, this project will perform a slender false brome removal in conjunction with surveys for these two early detection species in areas near known infestations to document the extent of their presence and distribution.

Restoration for enhanced resiliency against invasive species re-establishment in managed sites

Invasive species pose a serious threat to the environment, including significant negative impacts to the native plant communities necessary for providing ecosystem services such as nutrient filtration, air and water quality, pollinator habitat, runoff capture and erosion control. WNY PRISM developed native seed mixes of species with demonstrated characteristics that will allow for increased competitiveness against invasive species. This project provides for the purchase of native seed mix for the restoration of ten acres within the Lake Erie Watershed.

Mosquito Junction Swamp Restoration at Tift Nature Preserve

Extensive invasive species removal and habitat restoration has taken place at the Buffalo Museum of Science Tift Nature Preserve, mostly focused on the remnant marsh areas. This project will focus on the important transitional areas between the marsh and additional wetlands and upland areas that continue to be threatened by invasive species. Through a collaboration with Tift Nature Preserve and the Lyceum at Silo City, WNY PRISM will work to enhance and restore the 14 acres that make up the Mosquito Junction area of Tift Nature Preserve. Efforts will include invasive species removal and native plant restoration.

Western New York Japanese Stiltgrass (*Microstegium vimineum*) Early Detection and Rapid Response Project

WNY PRISM will implement an invasive species removal project focused on Japanese stiltgrass (*Microstegium vimineum*), an early detection priority species. WNY PRISM will lead survey and removal efforts across sites along Cazenovia Creek, Buffalo River, Hunter's Creek, and Eighteenmile Creek. Removal will involve the use of volunteers for hand removal and the WNY PRISM Crew for herbicide treatments. Boot brush stations will be placed at trailheads to reduce the spread and reintroduction of invasive species along trails.

Invasive species management to protect rare habitats at Alexander and Houghton Preserves

The Nature Sanctuary Society of WNY partners with WNY PRISM to eradicate invasive shrubs from 16 acres of the NSSWNY's Houghton



Japanese stiltgrass removal at Mill Road Park on July 31, 2021.



Hand pulling invasive species at Houghton Bog on May 31, 2022.

Preserve. Removal efforts will focus on glossy buckthorn, multi-flora rose, and bush honeysuckle, and will protect the integrity of the preserve's sphagnum bog habitat that is home to rare species such as spotted turtle and podgrass. The project will also include detection, eradication, and control of goutweed and garlic mustard on the 118-acre Alexander Preserve, where these invasives threaten old growth forest understory habitat hosting rare and listed species such as Virginia Bluebell.

Collaboration

WNY PRISM works to provide the region with support and resources necessary to implement invasive species management projects while also working with statewide and greater regional partners. Working with partners outside of the region allows WNY PRISM to provide support for shared priorities and ensure priorities of the WNY PRISM region are incorporated into broader programs. WNY PRISM staff participate in, and/or facilitate, several local, statewide, and regional working groups, task forces, and collaboratives to better support the region we serve. Within each of these collaboratives, members work together to develop and implement a wide range of projects aimed at improving management efficacy. To date, WNY PRISM has worked with 193 partners including 21 new partners in 2021.

WNY PRISM Steering Committee Members

- Mark Bogdan, New York State Department of Transportation
- Bob Smith, New York State Certified Nursery and Landscape Association
- Megan Kocher, New York Sea Grant
- Jonathan Townsend, Chautauqua County; Royal Fern Nursery
- Jennifer Dunn, New York State Department of Environmental Conservation
- Robert Coady, Buffalo Niagara Waterkeeper
- Kathleen Buckler, U.S. Army Corps of Engineers – Buffalo District
- Aaron Heminway, New York State Office of Parks, Recreation, and Historic Preservation
- Paul Fuhrmann, Ecology & Environment, Inc.
- Colleen Keefer, U.S. Fish and Wildlife Service – Lower Great Lakes Fish and Wildlife Conservation Office
- Mike Shaw, U.S. Department of Agriculture – Natural Resources Conservation Service
- Sharon Bachman, Cornell Cooperative Extension of Erie County

Presentations, Workshops, and Trainings

1. Locke, A. Japanese Stiltgrass Management. M&T Bank Think Green Resource Group, Virtual. July 8, 2021.
2. Locke, A. Invasive Species Management in Western New York. Finger Lakes Regional Watershed Alliance Quarterly Meeting, Lakeville, NY. July 19, 2021.
3. Locke, A. Unity Island Walk and Talk. Friends of Unity Island, Buffalo, NY. August 4, 2021.
4. Locke, A. Terrestrial Invasive Species Management Workshop. WNY PRISM, Buffalo, NY. August 7, 2021.
5. Pershyn, C. Invasive Species Resources for Educators. Science Ken Ton Opening Day, Kenmore, NY. August 30, 2021.
6. Smeenk, N., and A. Krest. WNY PRISM Aquatic Invasive Species Workshop. Great Lakes Center Field Station. September 25, 2021.
7. Locke, A. Emerging Invasive Species in the Southern Tier. Audubon Community Nature Center, First Friday Talk Series, Jamestown, NY. October 1, 2021.
8. Locke, A., B. Hernon, C. Pershyn, and N. Smeenk. Fall Partner Meeting. WNY PRISM, Buffalo, NY. October 21, 2021.
9. Locke, A., and C. Pershyn. Uninvited Virtual Viewing Party Panelist. NYS PRISM Network, Virtual. November 13, 2021.

10. Pershyn, C. *Hypena opulenta* Case Study: An Overview. NYS Invasive Species Summit, Albany, NY. November 15, 2021.
11. Hernon, B., and C. Pershyn. It Takes A Village – A Collaborative Approach to Addressing Hemlock Woolly Adelgid. Rural Landowners Workshop, Yorkshire, NY. March 5, 2022.
12. Locke, A. Swallow-wort Biocontrol Project. Rural Landowners Workshop, Yorkshire, NY. March 5, 2022.
13. Smeenk, N. Aquatic Invasive Species Management for your Backyard Pond. Rural Landowners Workshop, Yorkshire, NY. March 5, 2022.
14. Pershyn, C. Invasive Species in Your Garden. Plantasia Garden and Landscape Show, Hamburg, NY. March 18, 2022.
15. Locke, A. Swallow-wort Biocontrol Research Group. New York State Water Quality Symposium, Virtual. March 18, 2022.
16. Pershyn, C. New Master Gardener Volunteer Training. Erie County Master Gardener Volunteer Training. April 2, 2022.
17. Locke, A. Invasive Species Management from Theory to Practice. University at Buffalo Ecology Class, Buffalo, NY. April 8, 2022.
18. Locke, A. College Lodge Walk and Talk. WNY PRISM, Brocton, NY. April 10, 2022.
19. Hernon, B. Common Backyard Invasives and Management Options. Strykersville Senior Citizens, Strykersville, NY. April 18, 2022.
20. Locke, A. Spring Partner Meeting. WNY PRISM, Buffalo, NY. April 21, 2022.
21. Smeenk, N. Introduction to Invasive Species. SUNY Brockport. April 27, 2022.
22. Smeenk, N. Aquatic Plants and Invasive Species. Federated Garden Clubs of New York State, Virtual. April 29, 2022.
23. Smeenk, N. Uninvited Documentary Viewing and Panel Discussion. Jamestown Audubon Community Nater Center. June 3, 2022.
24. Pershyn, C., and M. Pistolese. Native Alternatives to Common Invasive Garden Plants. NYISAW Statewide Webinar. June 7, 2022.
25. Hernon, B. Invasive Species Identification and Management. Friends of Letchworth State Park, 5th Annual Stewardship Day, Castile, NY. June 11, 2022.
26. Smeenk, N. Launch and Learn with WNY PRISM Boat Stewards. New York Invasive Species Awareness Week, Multiple Locations. June 12, 2022.



Craneridge Walk and Talk on July 25, 2021.



Visiting the West Seneca Farmers' Market on July 15, 2021.

