Buffalo State

Great Lakes Center

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Annual Report 2018-2019

http://greatlakescenter.buffalostate.edu

Lake Ontario Benthic Survey

September 2018

Great Lakes Long-Term Biological Monitoring Program Cooperative Science and Monitoring Initiative

CONTENTS

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 SUNY Buffalo State, as well as other institutions in North America, Europe, and South America.

- Over the last year our researchers have published **7** peer-reviewed papers, **8** papers were submitted for publication.
- We presented **34** talks, including: **22** at national/international/regional conferences, **9** invited talks, and **3** presentations in non-refereed venues.
- We submitted **9** grant proposals with a total requested amount **$4,690,422**, including **$4,371,368** for Buffalo State.
- **Fifteen** projects for research and education (including multi-year grants) are currently funded in the GLC totaling **$10,832,121** (**$7,448,628** for Buffalo State), including six newly received in 2018–2019.
- **Twelve** students were enrolled in Great Lakes Environmental Science MA and MS programs.
- **Two** issues of GLC newsletters were produced over the last year.

Great Lakes Center team at the 62nd Annual Conference of the International Association for Great Lakes Research, Brockport, June 2019. (Left to right) Sasha Karatayev, Kit Hastings, Susan Daniel, Shivakumar Shivarudrappa, Sonya Bayba, Lyuba Burlakova, Knut Mehler, and Chris Pennuto.

I. Staff

GLC Personnel

Director:	Alexander Karatayev
Research Scientists:	Lyubov Burlakova
	Mark Clapsadl (Field Station manager)
	Knut Mehler
	Christopher Pennuto
	Alicia Pérez-Fuentetaja
	Shivakumar Shivarudrappa
Research Technicians:	Susan Daniel
	Brian Haas
	Kit Hastings
	Erik Hartnett
	Brianne Tulumello
Secretary:	Susan Dickinson
WNY PRISM Coordinator:	Andrea Locke
Terrestrial IS Manager:	Lucy Nuessle
Slender False Brome Manager:	Brittany Hernon
Aquatic Programs Manager:	Kristin King
Education and Outreach Programs Manager:	Emily Thiel

Student Research Assistants:

- Joshua Allan, Graduate, GLES, Buffalo State
- Sonya Bayba, Graduate, GLES, Buffalo State
- Joseph Bodnarchuk, Graduate, GLES, Buffalo State
- Emily Burch, Undergraduate, Buffalo State
- Amy Cavanaugh, Graduate, Biology, Buffalo State
- Martens Dorcely, Undergraduate, Buffalo State
- Kyle Glenn, Undergraduate, Buffalo State
- Shania Jean-Pierre, Undergraduate, Buffalo State
- Megan Kocher, Graduate, Biology, Buffalo State
- Lauren Martinek, Graduate, GLES, Buffalo State
- Asif Muqtadir, Undergraduate, Buffalo State
- Christina Perry, Undergraduate, Buffalo State
- Akshay Sharma, Undergraduate, Buffalo State
- Georgia Shaw, Undergraduate, Buffalo State
- Brandon H. Surdi, Undergraduate, University at Buffalo
- Benjamin Szczygiel, Graduate, Biology, Buffalo State
- Jay Wagner, Graduate, Biology, Buffalo State

WNY PRISM seasonal employees:

- Julia Kostin, SUNY Plattsburgh
- Rebecca Mann, University at Buffalo
- Derek Claus, University at Buffalo
- Ryan Elliott, SUNY Oneonta
- Payton Hanssen, College of Brockport
- Ashley Carmichael, Michigan State University
- Morgan Leigh Beatey, SUNY ESF
- Emily Harrower, Fredonia
- Katelin Quarles, University at Buffalo
- Parker Everhart, SUNY ESF
- Grace Bichler, Cornell University
- Hunter Bogdan, SUNY Buffalo State
- Michele Carmalia, Erie Community College
- Danielle Casler, Canisius
- Skylar Claud, SUNY Oneonta
- Kelly Crabtree, Fredonia
- Alexandra DePonceau, Penn State
- Candace Engel, University at Buffalo
- Fabio Espinal, University at Buffalo
- Julia Gerard, SUNY ESF
- Bianca Gonzales, University at Buffalo
- Matthew Hahn, SUNY Buffalo State
- Kegan Hoopes, Penn State
- Jarred O'Connor, SUNY Buffalo State
- Jason Kappan, University at Buffalo
- Matthew Kongesor, Canisius
- Jason Porter, Canisius
- Tristan Williams, Alfred University
- Emily Doores, Cornell University
- Kathleen McCormick, University of Chicago
- Amanda Gabryszak, SUNY ESF
- Melissa Boglioli, Cornell University, UMass Auburn

GLC Affiliates (at SUNY Buffalo State)

- Amy McMillan, Professor, Biology Department
- Daniel L. Potts, Associate Professor, Biology Department
- Gary Pettibone, Professor, Biology Department
- Jill Singer, Professor, Earth Sciences and Science Education Department and Director of the Office of Undergraduate Research
- Kelly Frothingham, Professor, Geography and Planning Department
- Mary Perrelli, GIS Lab Supervisor, Geography and Planning Department
- Randal Snyder, Professor, Biology Department
- Robert J. Warren, Associate Professor, Biology Department
- Stephen Vermette, Professor, Geography and Planning Department
- Susan McCartney, Director, Small Business Development Center
- Yola M. Stockton, Assistant Professor, Art and Design Department

GLC Adjunct Professors

- Daniel Molloy, Scientist Emeritus, NY State Museum, Molloy & Associates, LLC
- Dimitry Gorsky, Fish Biologist, U.S. Fish and Wildlife Service
- Zy Biesinger, Fish Biologist, U.S. Fish and Wildlife Service

Collaborators

Collaborators in New York State

- Andrew Hannes, U.S. Army Corps of Engineers
- Brendon Sansom, Environmental Engineering, State University of New York at Buffalo
- Clifford Craft, Department of Natural Resources, Cornell University
- Connie Adams, NYS Department of Environmental Conservation
- David Lodge, Atkinson Center for a Sustainable Future, Cornell University
- David Strayer, Cary Institute of Ecosystem Studies, Millbrook
- Dawn Dittman, USGS, Great Lakes Science Center, Tunison Laboratory of Aquatic Science, Cortland
- Diana Aga, Chemistry Department, State University of New York at Buffalo
- Dianna Padilla, Department of Ecology and Evolution, Stony Brook University
- Donald Einhouse, NYS Department of Environmental Conservation
- Eric Bruestle, U.S. Fish and Wildlife Service
- Gregory Boyer, State University of New York, College of Environmental Science and Forestry, Syracuse
- Howard Lasker, Department of Geology, State University of New York at Buffalo
- James Watkins, Cornell Biological Field Station, Cornell University
- Jenny Landry, Region 8 Bureau of Wildlife, NYS Department of Environmental Conservation, Avon
- Joe Atkinson, Environmental Engineering, State University of New York at Buffalo
- Katherine Alben, Wadsworth Institute, Albany
- Lars Rudstam, College of Agriculture and Life Sciences, Department of Natural Resources, Cornell Biological Field Station, Cornell University
- Mary Alice Coffroth, Department of Geology, State University of New York at Buffalo
- Michael Wilkinson, NYS Department of

Environmental Conservation
- Mike Goehle, U.S. Fish and Wildlife Service
- Robert Baier, State University of New York at Buffalo
- Tim DePriest, NYS Department of Environmental Conservation

Collaborators at other U.S. Institutions

- Anne Scofield, Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana
- Anett Trebitz, U.S. EPA Office of Research & Development, Mid Continent Ecology Division, Duluth, Minnesota
- Arthur E. Bogan, North Carolina State Museum of Natural Sciences, Raleigh, North Carolina
- Ashley Elgin, NOAA Great Lakes Environmental Research Laboratory, Ann Arbor, Michigan
- Astrid Schwalb, Department of Biology/Aquatic Station, Texas State University, San Marcos, Texas
- Bob Krebs, Department of Biology, Geology, Environmental Science, Cleveland State University, Cleveland, Ohio
- Barry Lesht, Department of Earth and Environmental Sciences, University of Illinois at Chicago; CSRA, Chicago, Illinois
- Catherine Riseng, University of Michigan, Ann Arbor, Michigan
- Christine Mayer, Department of Environmental Sciences and Lake Erie Center, University of Toledo, Ohio
- Daelyn Woolnough, Biology Department, Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan
- Darren Bade, Kent State University, Kent, Ohio
- David Bunnell, U.S. Geological Survey, Great Lakes Science Center, Ann Arbor, Michigan
- David Campbell, Department of Natural Sciences, Gardner-Webb University, Boiling Springs, North Carolina
- David Zanatta, Biology Department, Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan
- Dima Beletsky, Cooperative Institute for Limnology and Ecosystems Research, University of Michigan, Ann Arbor, Michigan
- Donald Jerina, Laboratory of Bioorganic Chemistry NIDDK, National Institutes of Health, Bethesda, Maryland
- Ed Rutherford, Great Lakes Environmental Research Laboratory, NOAA, Ann Arbor, Michigan
- Elizabeth Hinchey Malloy, U.S. EPA Great Lakes National Program Office, Chicago, Illinois
- Euan Reavie, Natural Resources Research Institute, University of Minnesota Duluth, Minnesota
- Jacob Boehler, National Center for Water Quality Research, Heidelberg University, Tiffin, Ohio
- Jake Vander Zanden, Center for Limnology, University of Wisconsin, Madison, Wisconsin
- Janet Nestlerode, U.S. EPA, NHEERL Gulf Ecology Division, Florida
- Jill Scharold, U.S. EPA, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, Duluth, Minnesota
- Joe Conroy, Ohio Department of Natural Resources, Columbus, Ohio
- Joel Hoffman, U.S. EPA, National Health and Environmental Effects Research Laboratory, Mid-Continent Ecology Division, Duluth, Minnesota
- Jonathan Bossenbroek, Department of Environmental Sciences, University of Toledo, Toledo, Ohio
- Katya Kovalenko, NRRI, University of Minnesota, Duluth, Minnesota
- Kurt L. Schmude, Department of Natural Sciences, Lake Superior Research Institute, University of Wisconsin-Superior, Superior, Wisconsin
- Leon Katona, Wright State University, Dayton, Ohio
- Mike Sayers, Michigan Technological Research Institute, MTU, Ann Arbor, Michigan
- Mark Rowe, University of Michigan CILER, NOAA, Ann Arbor, Michigan
- Mary Ann Evans, USGS, Ann Arbor, Michigan
- Meredith Nevers, USGS, Great Lakes Science Center, Chesterton, Indiana
- Michel Pfrender, Notre Dame Genomics and Bioinformatics Core Facility, University of Notre Dame, Notre Dame, Indiana
- Michael Sierszen, National Health and Environmental Effects Research Laboratory, U.S. EPA Mid-Continent Ecology Division, Duluth, Minnesota
- Molly Wick, U.S. EPA Mid-Continent Ecological Division, Duluth, Minnesota
- Paris Collingsworth, Illinois–Indiana Sea Grant and Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana

- Pawel Michalak, Bioinformatics Institute, Virginia Tech, Blacksburg, Virginia
- Peter Esselman, USGS, Ann Arbor, Michigan
- Richard Barbiero, CSRA, Chicago, Illinois
- Richard Kraus, Lake Erie Biological Station, Great Lakes Science Center, U.S. Geological Survey, Sandusky, Ohio
- Robert Shuchman, Michigan Technological Research Institute, MTU, Ann Arbor, Michigan
- Serghei Bocaniov, Graham Sustainability Institute, University of Michigan, Ann Arbor, Michigan
- Sergei Katsev, Large Lakes Observatory, University of Minnesota Duluth, Duluth, Minnesota
- Theodore Angradi, U.S. EPA Mid-Continent Ecological Division, Duluth, Minnesota
- Thomas Miller, Lamar Bruni Vergara Environmental Science Center, Laredo Community College, Laredo, Texas
- Thomas Nalepa, The Graham Sustainability Institute, University of Michigan, Ann Arbor, Michigan
- Tom Bridgeman, University of Toledo, Toledo, Ohio
- Vadim Karatayev, Department of Environmental Science & Policy, University of California, Davis, California
- Valerie Brady, Natural Resources Research Institute, University of Minnesota, Duluth, Minnesota
- Yvonne Vadeboncoeur, Department of Biological Sciences, Wright State University, Dayton, Ohio
- Zachary Cava, Florida Game and Fish Department

International Collaborators

- Alexandra Zieritz, University of Nottingham Malaysia Campus, Malaysia
- Isabel Porto-Hannes, Fisheries and Oceans Canada, Burlington, Ontario, Canada
- Boris Adamovich, Research Laboratory of Aquatic Ecology, Belarusian State University, Minsk, Belarus
- Demetrio Boltovskoy, University of Buenos Aires, Argentina
- Elsa Froufe, CIIMAR and Porto University, Portugal
- Ivan Bolotov, Laboratory of Evolutionary Ecology and Phylogenetics, Federal Center for Integrated Arctic Research, Russian Academy of Science, Arkhangelsk, Russia
- Frances Lucy, Institute of Technology, Sligo, Ireland
- Frank Collas, Department of Environmental Science, Institute for Water and Wetland Research, Radboud University, Nijmegen, The Netherlands
- Hanna Zhukava, Department of General Ecology and Methods of Biology Teaching, Belarusian State University, Minsk, Belarus
- Ilya Vikhrev, Laboratory of Molecular Ecology and Biogeography, Federal Center for Integrated Arctic Research, Russian Academy of Science, and Northern (Arctic) Federal University, Arkhangelsk, Russia
- Jan Ciborowski, Department of Biological Sciences, University of Windsor, Windsor, Ontario, Canada
- Jürgen Geist, Fish Biology, TU München, Germany
- Krystian Obolewski, Department of Hydrobiology, Kazimierz Wielki University, Bydgoszcz, Poland
- Ladd Johnson, Department of Biology, Laval University, Quebec City, Quebec, Canada
- Maria Dittrich, Department of Physical and Environmental Sciences, University of Toronto Scarborough, Toronto, Ontario, Canada
- Michail Gladyshev, Department of Aquatic and Terrestrial Ecosystems, Siberian Federal University, Krasnoyarsk, Russia
- Manuel Lopes-Lima, ICBAS - Abel Salazar Biomedical Sciences Institute, Laboratory of Ecophysiology, CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Portugal
- Olesia Makhutova, Institute of Biophysics, Siberian Branch, Russian Academy of Sciences, Krasnoyarsk, Russia
- Paul Hebert, Centre for Biodiversity Genomics, Guelph University, Guelph, Canada
- Renata Claudi, RNT Consulting Inc., Ontario, Canada
- Richard Soare, Department of Geography and Planning, Concordia University, Montreal, Canada
- Rob Leuven, Radboud University, Nijmegen, The Netherlands
- Ron Griffiths, Aquatic Ecostudies Limited, Canada
- Ronaldo Sousa, CIIMAR and Minho University, Portugal
- Sergey Mastitsky, RNT Consulting Inc., Ontario, Canada
- Tamara Makarevich, Department of General Ecology and Methods of Biology Teaching, Belarusian State University, Minsk, Belarus
- Yulia Bespalaja, Federal Center for Integrated Arctic Research, Russian Academy of Science, Arkhangelsk, Russia

II. Research Activities

Current Projects

Monitoring of benthic invertebrates in Great Lakes

The GLC, in collaboration with Cornell University, was awarded a U.S. EPA Great Lakes Long-term Biological Monitoring grant for 2012-2017 and for 2017-2022. The EPA Monitoring Program is designed to provide managers access to biological data on zooplankton and benthos to support decision-making. For this project, we collect benthos (Buffalo State), zooplankton, and chlorophyll 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 already identified benthic samples collected onboard the EPA R/V *Lake Guardian* in 2012-2017 from all Great Lakes 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. Seventeen years of GLNPO Biology Monitoring Program benthic data were recently analyzed by Burlakova et al. (Burlakova et al., 2018a) to reveal temporal and spatial trends in benthic community structure across the lakes. In 2018, we published a Special Issue containing 18 papers in the *Journal of Great Lake Research* ("U.S. EPA GLNPO Long-Term Monitoring of the Laurentian Great Lakes: Approaches, achievements and lessons learned," Eds. Burlakova, L., A. Karatayev, L. Rudstam, and E. Hinchey). Together with our Cornell collaborators, we have published over 30 papers, presented >120 talks at regional and international meetings, wrote 6 reports and organized 22 special scientific sessions on Great Lakes monitoring at national and international meetings.

Cooperative Science and Monitoring Initiative

The Great Lakes Monitoring Program by Great Lakes National Program Office includes both collection of samples from a few (9–16) long-term stations sampled every year and a much more detailed survey conducted on each lake every 5 years within Cooperative Science and Monitoring Initiative (CSMI). We participated in these surveys in 2014 (Lake Erie), 2015 (Lake Michigan), and in 2016 (Lake Superior). The new 2017-2022 EPA funding allowed us to continue these surveys, including the Lake Ontario CSMI survey in 2018.

Lake Huron Benthos

In 2017, we conducted a lake-wide benthic survey at 129 stations to assess the status of the benthic macroinvertebrate community in all major basins of Lake Huron, with a primary focus on the invasive zebra mussels (*Dreissena polymorpha*) and quagga mussels (*D. rostriformis bugensis*), and to compare the current benthic community with historic data. We found that quagga mussels were most abundant in the main basin, less common in Georgian Bay and almost absent in North Channel. Comparing the 2017 findings to 2012 data, *Dreissena* density in the main basin in the shallowest (<30 m) depth zone declined by a factor of seven, remained stable at 30-90 m, and more than doubled at depths greater than 90 m. As a result, the bulk of population is now found deeper than 50 m. *Diporeia* and Sphaeriidae densities continued to decline in all basins including North

Knut Mehler and Alexander Karatayev working aboard the R/V *Lake Guardian*, September 2018.

Lyuba Burlakova stands in front of the *Lake Guardian* in Rochester, New York, September 2018.

Channel, where almost no quagga mussels were found. In contrast, in 2017 there was a substantial increase in oligochaetes in all regions compared to the 1970s and 2000s, likely due to an increase in their food resources as associated with quagga mussel feeding activities. These data were recently submitted to GLNPO; data analysis is ongoing and will be summarized in a report and a publication.

Lake Ontario Benthos

In 2018, we conducted one of the largest benthic-oriented surveys in the last decade (pictures from this study). During September 2018, we visited 52 stations lake-wide and collected 138 Ponar benthic samples and Ponar video, 52 samples for benthic algae and primary productivity (Leon Katona, Wright State University), and 17 samples for little-studied benthic copepods Harpacticoida (Joseph Connolly, Cornell University). Janet Nestlerode (U.S. EPA, NHEERL Gulf Ecology Division) applied the Sediment Profile Imaging system (SPI) at 51 stations to explore sedimentary and biogenic features and possible relationships between these measures across known stress gradients (e.g., organic enrichment, eutrophication) for development of a SPI-based Freshwater Index of Benthic Habitat Quality. Finally, for *Dreissena* monitoring, we collected video data from 56 500 m-long transects and from an additional 34 nearshore stations using a drop-down camera (collaboration with Molly Wick, U.S. EPA Mid-Continent Ecological Division). This extensive survey was documented by Yola Monakhov Stockton (Art and Design Department, Buffalo State) and displayed as a photo exhibition and a poster at the 2019 IAGLR meeting (photo collage).

Early Detection of Mollusks and Annelids in the Great Lakes

In 2017, we received GLRI, U.S. EPA 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 Lake Program Office toward genetic barcoding of aquatic invertebrate species from the Great Lakes. Two additional projects target zooplankton and rotifers (PI M. Pfrender, Notre Dame University, and Cornell University), and benthic arthropods (PI D. Lodge, Cornell University). Barcode sequences for collected specimens are generated by the Centre for Biodiversity Genomics, Guelph University, Canada. The overall goal of the three collaborative projects is to advance the current state of genetic barcode library for invertebrates in the Great Lakes, which will improve our knowledge of Great Lakes diversity and help in early detection of nonnative and potentially invasive species to this important resource. To date, we already barcoded, submitted for barcoding, or have in our possession 71% of Gastropoda, 75% of Unionida and 37% of Pisiidae. The field collection of material for barcoding and metagenetic analysis is ~80% complete, and Guelph laboratory is in the process of or has completed barcode sequencing of 6 from a projected 13 plates. The results of the project were presented by Susan Daniel at IAGLR and other regional meetings.

Partnership for Regional Invasive Species Management (PRISM)

The Western New York Partnership for Regional Invasive Species Management (WNY PRISM) continues to identify, map, and develop management plans to control aquatic and terrestrial invasive species in the eight western-most counties of New York. This award was funded for 5 more years. For more information on Western New York PRISM Activities, see section VII.

Knut Mehler and Leon Katona sampling the Genesee River in Rochester, NY, for barcoding, September 2018.

Sasha Karatayev sampling Cassadaga Creek in NY for the Barcoding project, July 2018.

Knut Mehler sampling for the Barcoding project in Michigan, October 2018.

Lyuba Burlakova sampling for the Barcoding project in New York State, July 2018.

Understanding round goby migration behavior

This project is investigating the cues and pre-migratory behavior of round gobies in Lake Ontario and 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.

Nearshore-offshore migration in an invasive fish

Researchers at the GLC are documenting the seasonal population density, size distribution, and nutrient content of round gobies in the nearshore of western Lake Ontario, as well as the lower Niagara River, to understand cues related to their offshore and return inshore annual migration. The benthic invader departs the nearshore in later fall, moving off to deeper waters in excess of 100 m over a period of a few weeks, and returns in the spring over a longer period. The project is addressing the contribution of this offshore migration to the offshore nutrient budget by comparing the population density, size distribution, and nutrient mass in the migrating and returning goby population.

Lake Erie lake sturgeon: understanding historical and current spawning habitat extent and characteristics

This project is a new collaboration with USFWS set to begin Fall 2019. It will assess all historical records of sturgeon spawning habitat in tributaries to Lake Erie through investigations of DEC 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.

Bioaccumulation of flame retardants and emerging contaminants in birds in the Niagara River

We are collecting and analyzing samples of aquatic birds and their eggs to determine the prevalence of contaminants in the Niagara River's wildlife, in particular those that contain halogenated compounds with a tendency to bioaccumulate. We are focusing on pharmaceuticals that enter the river routinely and may accumulate or alter physiological processes. In particular, we are analyzing for one of the most commonly prescribed antidepressants, selective serotonin reuptake inhibitors (SSRIs), which may cause impairments in fish and wildlife.

Experimental examination of alternatives to improve water quality after it has been treated by the Municipal Wastewater Treatment Plant and before it enters the Niagara River

In this project we are testing different approaches to improving the removal of pharmaceuticals and antibiotics from treated wastewater, using toxicological testing of the organisms exposed to the alternative water treatments using metabolomics. The testing includes LC50 and LC10 trials in crustaceans (*Daphnia*) and in adult fish (fathead minnow) and their developmental stages (eggs, larvae). The changes in metabolic products in these organisms after exposure to the alternative treatments, compared to the changes that occur in current treated effluent, will determine if these technologies are a worthwhile alternative for implementation.

Long-term monitoring on Lake Erie

The GLC has been an active member of the Forage Task Group of the Great Lakes Fishery Commission, with Mark Clapsadl as the Buffalo State representative starting in 2018. As part of the Forage Task Group, we have participated in a long-term monitoring study in eastern Lake Erie. Since our participation began in 2008, Kit Hastings has taken a leading role in the implementation of this project by conducting most of the monitoring work at the two eastern Lake Erie sites. From May through October of 2018, we collected physical limnology data, water samples, and plankton samples biweekly, and benthos monthly. Because of human resource limitations, 2018 was our last field season for the Long-term monitoring of Lake Erie.

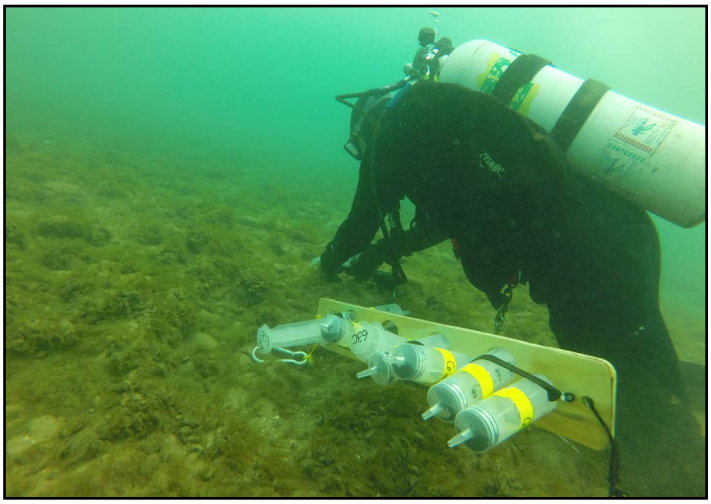
Implementation of the Great Lakes Observing System

We completed another year participating in the Great Lakes Observing System (GLOS) and have re-installed the buoy for the 2019 season. Since spring of 2012, the GLC has been a participating member of the GLOS. GLOS consists of a varied membership of universities and government agencies that operate a system of observation stations throughout the five Great Lakes. Our contribution to the GLOS has been made by operating an observation buoy five miles offshore of Dunkirk, New York. This buoy records and transmits real time measurements of water temperature, wind speed, wave height, dissolved oxygen, and several other parameters. This buoy is the only GLOS buoy operating in eastern Lake Erie, making it an important source of information for a variety of stakeholders.

Graduate students Adam Sullivan, Benjamin Szczygiel, and Amy Cavanaugh, worked on the final season of the Emerald Shiner Project during Summer 2018.

Ben Szczygiel maintaining a tank of algae to feed Daphnia for effluent trials.

Graduate student Jay Wagner and Dr. Chris Pennuto gear up before dive operations to collect algae and mussels.



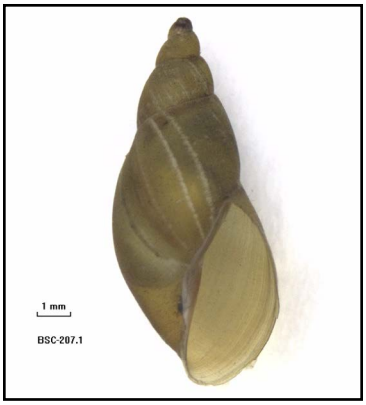
Dr. Pennuto collecting benthic water samples from within *Cladophora* beds in Lake Ontario, June 2019.

Grants and Funding

Ongoing grants, including six newly received in 2018–2019 (total $10,832,121, including $7,448,628 for Buffalo State)

Ongoing grants

1. Aga, D. S., N. Dai, A. Pérez-Fuentetaja, J. L. Fiegl, and H. M. Domske. Assessing Innovative Advanced Wastewater Treatments in Removing Antidepressant Drugs Based on Chemical Analysis and Fish Physiological Responses. Great Lakes Research Consortium. **$25,000** (**$7,000** for Buffalo State). 2018–2019.
2. Burlakova, L. E., A. Y. Karatayev. DNA Barcode Reference Library: Mollusca, Annelida, and minor phyla. GLRI, U.S. EPA. **$400,000**. 2017–2019.
3. Clapsadl, M., B. Haas and K. Hastings. Osprey Nesting Platform and Migrator Habitat Enhancement. Niagara River Greenway Commission. **$94,014**. 2018–2019.
4. Karatayev, A. Y., and M. Clapsadl. National Atmospheric and Oceanographic Administration. Implementation of a Regionally Distributed Observing Network to Support Critical Stakeholder Needs for the 2016–2020 GLOS-RA. Cooperative Agreement, SUNY ESF. **$100,000**. 2016–2020.
5. Locke, A., and C. M. Pennuto. Slender false brome working group. GLRI, U.S. EPA. **$299,900**. 2017–2019.
6. Locke, A. Priority Lands Invasive Species Removal and Volunteer Monitoring Program, The Research Foundation for SUNY Buffalo State, WNY PRISM. U.S. Forest Service Great Lakes Restoration Initiative Cooperative Weed Management Areas. **$39,999**. 2018–2020.



Flat-whorled pondsnail, one of the specimens from the Barcoding grant. Photo: Susan Daniel

7. Molloy, D., L. Burlakova. The Natural Enemies of Dreissenid mussels: An update of the seminal monograph published in 1997. Hudson River Foundation. **$65,200**. 2017–2019.
8. Rudstam, L., L. E. Burlakova, A. Y. Karatayev, J. Watkins. Great Lakes Long-term Biological Monitoring Program. GLRI, U.S. EPA. **$5,999,903** (**$2,700,000** for Buffalo State). 2017–2022.
9. Spiering, D. Vernal Pool Enhancement at Tifft Nature Preserve, Buffalo Museum of Science. Niagara River Greenway Commission Greenway Ecological Standing Committee. **$77,500.00** (**$11,909.94** for Buffalo State). 2017–2018.

Received in 2018–2019

1. Locke, A. Niagara County Japanese Knotweed Removal Project, Niagara County Soil and Water Conservation District. **$6,998**. 2018.
2. Locke, A. Gill Creek Workshop: Invasive Plant Identification and Tracking, Buffalo Niagara Waterkeeper. **$961**. 2018.
3. Karatayev, A. Y., and K. Mehler. CSMI Lake Ontario Workshop. International Joint Commission. **$20,000**. 2019.
4. Pennuto, C. Administration of the Western NY PRISM: Partnership for Regional Invasive Species Management. NY DEC. **$3,499,212**. 2019–2023.
5. Pennuto, C. Northern Forest/Great Lakes CESU. Support for a Cladophora growth model: frequent biomass and coverage assessments married to Sentinel 3 satellite imagery in Lake Ontario. USGS. **$103,576**. 2018–2019.
6. Pennuto, C., 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.

Submitted in 2018–2019 (total $4,690,422, including $4,371,368 for Buffalo State)

1. Burlakova, L., B. Sansom, A. Karatayev, I. Hannes, C. Pershyn. Restoration of Native Freshwater Mussels in the Niagara River: Interdisciplinary Partnership with Buffalo City Public Schools. Pre-proposal submitted to Great Lakes Fish and Wildlife Restoration Act FY 2019. **$317,427** (not funded).

2. Goodrich, Z. Mosquito Junction Swamp Restoration at Tifft Nature Preserve, Buffalo Museum of Science. Niagara River Greenway Commission Greenway Ecological Standing Committee. **$344,754.00** (**$25,700** for Buffalo State). 2019–2022 (pending).
3. Locke, A. Niagara County Japanese Knotweed Removal Project, Niagara County Soil and Water Conservation District. **$6,998**. 2018.
4. Locke, A. Gill Creek Workshop: Invasive Plant Identification and Tracking, Buffalo Niagara Waterkeeper. **$961**. 2018.
5. Karatayev, A. Y., and K. Mehler. CSMI Lake Ontario Workshop. International Joint Commission. **$20,000**. 2019.
6. Pennuto, C. Administration of the Western NY PRISM: Partnership for Regional Invasive Species Management. NY DEC. **$3,499,212**. 2019–2023.
7. Pennuto, C. Northern Forest/Great Lakes CESU. Support for a Cladophora growth model: frequent biomass and coverage assessments married to Sentinel 3 satellite imagery in Lake Ontario. USGS. **$103,576**. 2018–2019.
8. Pennuto, C., 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.
9. Pérez-Fuentetaja, A., P. Collingsworth, E. Rutherford, S. Pothoven, and A. Elgin. Are Dreissena veligers a vital zooplankton prey resource for larval fish, or just empty calories? Great Lakes Fisheries Trust. **$297,636**. 2020–2022 (not funded. Planning to re-submit).

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. Seven manuscripts were published, another 8 were submitted to peer-reviewed journals. A total of 32 presentations were made by the GLC researches, including: 22 presentations at national/international/regional conferences, 9 invited talks, and 3 presentations made in non-refereed venues.

Refereed Journal Publications (published)

1. Burlakova, L. E., A. Y. Karatayev, E. Froufe, A. E. Bogan, and M. Lopes-Lima. 2018. A new freshwater bivalve species of the genus *Cyclonaias* from Texas (Unionidae: Ambleminae: Quadrulini). *Nautilus*.132: 45-50.
2. Burlakova, L. E., D. Campbell, and A. Y. Karatayev. 2019. Status of rare endemic species: molecular phylogeny, biogeography, and conservation of freshwater molluscs *Truncilla macrodon* and *Truncilla cognata* in Texas. *Malacologia* 62(2): 345–363.
3. Lang, J. V., R. J. Snyder, M. D. Clapsadl, P. Michalak, L. Kang, and A. Pérez-Fuentetaja. 2019. Morphometric differentiation and gene flow in emerald shiners (Notropis atherinoides) from the lower Great Lakes and the Niagara River. *Journal of Great Lakes Research*. DOI: 10.1016/j.jglr.2018.12.002
4. Lopes-Lima, M., L. Burlakova, A. Karatayev, A. Gomes-dos-Santos, A. Zieritz, E. Froufe, A. E. Bogan. 2019. Revisiting the North American freshwater mussel genus *Quadrula* sensu lato (Bivalvia Unionidae): Phylogeny, taxonomy and species delineation. *Zoologica Scripta*. DOI: 10.1111/zsc.12344. (First online).
5. Bruestle, E. L., C. Karboski, A. Hussey, A. T. Fisk, K. Mehler, C. Pennuto, and D. Gorsky. 2019. Novel trophic interaction between lake sturgeon (*Acipenser fulvescens*) and invasive species in an altered food web. *Canadian Journal of Fisheries and Aquatic Sciences* 76: 6-14.

Lyuba Burlakova and Art Bogan revising identification of unionids in Great Lakes Center Freshwater Mollusc Collection, May 2019.

6. Smith, S. D. P., D. B. Bunnell, G. A. Burton Jr., J. J. H. Ciborowski, A. D. Davidson, C. E. Dickinson, L. A. Eaton, P. C. Esselman, M. A. Evans, D. R. Kashian, N. F. Manning, P. B. McIntyre, T. F. Nalepa, A. Pérez-Fuentetaja, A. D. Steinman, D. G. Uzarski, J. D. Allan. 2019. Evidence for interactions among environmental stressors in the Laurentian Great Lakes. *Ecological Indicators* 101: 203-211.
7. Strayer, D. L., B. V. Adamovich, R. Adrian, D. C. Aldridge, C. Balogh, L. E. Burlakova, H. Fried-Petersen, L. G.-Tóth, A. L. Hetherington, T. S. Jones, A. Y. Karatayev, J. B. Madill, O. A. Makarevich, J. E. Marsden, A. L. Martel, D. Minchin, T. F. Nalepa, R. Noordhuis, T. J. Robinson, L. G. Rudstam, A. N. Schwalb, D. R. Smith, A. D. Steinman, and J. M. Jeschke. 2019. Long-term population dynamics of dreissenid mussels (*Dreissena polymorpha* and *D. rostriformis*): a cross-system analysis. *Ecosphere*. Published online.

Refereed Journal Publications Submitted (in review)

1. Bunnell, D. B, S. A. Pothoven, P. M. Armenio, L. Eaton, D. M. Warner, A. K. Elgin, L. E. Burlakova, and A. Y. Karatayev. 2019. Spatiotemporal variability in energetic condition of alewife and round goby in Lake Michigan. *Canadian Journal of Fisheries and Aquatic Sciences*. Accepted.
2. Hannes, I. P., H. R. Lasker, and L. E. Burlakova. Genetic isolation and homogenization: potential effects of waterfalls and man-made canals on the population genetic structure of freshwater mussels. Submitted to: *Conservation Genetics*.
3. Johnson, R. J., A. Pérez-Fuentetaja, G. W. Pettibone, R. J. Snyder, and M. D. Clapsadl. The emerald shiner (*Notropis atherinoides*) as a bioindicator of urban water pollution in the Niagara River. Submitted to: *Journal of Great Lakes Research*.
4. Karatayev, V. A., L. E. Burlakova, A. Y. Karatayev, L. Yang, and T. Miller. Advection and habitat loss interactively reduce persistence: maintaining threatened riverine populations while restoring natural flow regimes. Submitted to: *Oecologia*.
5. Krebs, R. A., L. E. Burlakova, and D. T. Zanatta. Patterns of dispersal of *Pyganodon grandis* (Bivalvia: Unionidae) into the lower Great Lakes Watershed. Submitted to: *The Nautilus*.
6. Mitchell, Z., L. Burlakova, A. Karatayev, and A. N. Schwalb. Post-drought survival of freshwater mussels depends on pre-drought abundances and changes in hydrological and thermal conditions: A comparative study assessing the effects of a severe drought in four tributaries of a sub-tropical river. Submitted to: *Hydrobiologia*.
7. Qiao, J., J. F. Atkinson, S. J. Bennett, B. A. Hinterberger, A. R. Hannes, A. Pérez-Fuentetaja, and S. K. Delavan. Unconfined fishway design and hydraulic condition assessment for the emrald shiner (*Notropis atherinoides*) in the upper Niagara River. Submitted to: *River Research and Applications*.
8. Porto-Hannes, I., L. E. Burlakova, A. Y. Karatayev, and H. R. Lasker. Molecular phylogeny, biogeography, and conservation status of the Texas-endemic freshwater mussel *Lampsilis bracteata* (Bivalvia, Unionidae). Submitted to: *Zootaxa*.

International/National/Regional Conference Presentations

1. Barbiero, R., B. Lesht, L. Burlakova, L. Rudstam, J. Watkins, A. Karatayev, E. Reavie, and E. Hinchey. Thirty-five years of EPA monitoring of the lower food web in the Laurentian Great Lakes: an overview of system-wide changes. Association for the Sciences of Limnology and Oceanography 2019 Aquatic Sciences Meeting. February 25–March 1, 2019. San Juan, Puerto Rico.
2. Bayba, S., L. Burlakova, A. Karatayev, R. Warren, E. Hinchey Malloy, and K. Bockwold. *Dreissena* and benthos: exploring mechanisms of facilitation and competition. 62nd Annual Conference on Great Lakes Research. June 10–14, 2019. Brockport, New York.

Lyuba Burlakova and graduate student Sonya Bayba presenting poster at the 62nd Annual Conference of IAGLR, June 2019.

3. Burlakova, L. E., R. P. Barbiero, A. Y. Karatayev, S. E. Daniel, and E. K. Hinchey. Long-term biological monitoring of the Laurentian Great Lakes: spatial and temporal patterns in benthic communities. International Conference "Big Lakes, Small World," European Large Lakes Symposium and International Association for Great Lakes Research (ELLS-IAGLR-2018). September 23–28, 2018. Evian, France.
4. Burlakova, L., A. Karatayev, S. Daniel, R. Barbiero, K. Mehler, E. Hinchey, and V. Karatayev. Decadal trends in benthic community of the Laurentian Great Lakes revealed by long-term monitoring. Association for the Sciences of Limnology and Oceanography 2019 Aquatic Sciences Meeting. February 25–March 1, 2019. San Juan, Puerto Rico.
5. Burlakova L., A. Karatayev, S. Bayba, S. Daniel, K. Mehler, A. Scofield, and E. Hinchey Malloy. Facilitative and competitive effects of *Dreissena* on benthos of Laurentian Great Lakes. 62nd Annual Conference on Great Lakes Research. June 10–14, 2019. Brockport, New York.
6. Clapsadl, M. D. J. Cochran, A. Pérez-Fuentetaja, and R. Snyder. An examination of diversity and growth of larval prey fishes in differing habitat types within the upper Niagara River. Fifth European Large Lakes Symposium (ELLS) and International Association of Great Lakes Research (IAGLR). September 23–28, 2018. Evian, France.
7. Daniel, S., L. Burlakova, A. Karatayev, K. Mehler, P. Hebert, M. Pfrender, D. Lodge, and A. Trebitz. Great Lakes DNA barcode reference library: Mollusca, Annelida, and minor phyla. 62nd Annual Conference on Great Lakes Research. June 10–14, 2019. Brockport, New York.
8. Karatayev, A., L. Burlakova, A. Karatayev, K. Mehler, A. Elgin, and T. Nalepa. Population dynamics of *Dreissena polymorpha* and *D. rostriformis bugensis* in the Laurentian Great Lakes. International Conference "Big Lakes, Small World," European Large Lakes Symposium and International Association for Great Lakes Research (ELLS-IAGLR-2018), September 23–28, 2018. Evian, France.
9. Karatayev, A., S. Daniel., L. Burlakova, K. Mehler, P. Hebert, M. E. Pfender, D. Lodge, and A. Trebitz. Great Lakes DNA Barcode Reference Library: Mollusca, Annelida, and Minor Phyla. State of Lake Superior Conference. October 11, 2018. Houghton, Michigan.
10. Karatayev, A. Y., L. E. Burlakova, V. Karatayev, M. Rowe, T. Nalepa, and A. Elgin. Lake morphometry determines *Dreissena* invasion dynamics. ASLO Aquatic Sciences Meeting. February 23–March 2, 2019. San Juan, Puerto Rico.
11. Karatayev, A., L. Burlakova, K. Mehler, A. Elgin, and T. Nalepa. Long-term population dynamics of dreissenids in lakes Michigan and Huron. 62nd Annual Conference on Great Lakes Research. June 10–14, 2019. Brockport, New York.
12. Katona, L., K. Mehler, L. Burlakova, A. Karatayev, and I. Vadeboncoeur. Variability in sediment and mussel-associated algal biomass along a depth gradient in Lake Ontario. 62nd Annual Conference on Great Lakes Research. June 10–14, 2019. Brockport, New York.
13. Mehler, K., L. Burlakova, A. Karatayev, and J. Scharold. Trends in Lake Superior benthos with particular emphasis on the amphipod *Diporeia* spp. State of Lake Superior Conference. October 9–12, 2018. Houghton, Michigan.
14. Mehler, K., L. Burlakova, and A. Karatayev. Using underwater imagery to improve invasive species monitoring in the Great Lakes. 62nd Annual Conference on Great Lakes Research. June 10–14, 2019. Brockport, New York.
15. Monakhov Stockton, Y., L. Burlakova, A. Karatayev, and K. Mehler. 2018 CSMI Lake Ontario benthic survey through a photographer's lens. 62nd Annual Conference on Great Lakes Research. June 10-14, 2019. Brockport, New York.
16. Pennuto, C., K. Mehler, and E. Bruestle. There and back: changes in the size structure of seasonally migrating round goby in Lake Ontario. 62nd Annual Conference on Great Lakes Research. June 10–14, 2019. Brockport, New York.
17. Pérez-Fuentetaja, A., M. D. Clapsadl, and R. J. Snyder. The connecting energy link: How migratory prey fish couple the food webs of Lake Erie and the Niagara River (Great Lakes). Fifth European Large Lakes Symposium (ELLS) and International Association of Great Lakes Research (IAGLR). September 25, 2018. Evian, France.
18. Rudstam, L., L. Burlakova, B. Adamovich, A. Karatayev, H. Zhukava, K. Holeck, A. Hetherington, R. Jackson, T. Zhukova, and T. Mikheyeva. Ecosystem responses to dreissenid mussels in polymictic lakes 25 years post-invasion. 34th Congress of International Society for Limnology. August 19–24, 2018. Nanjing, China.
19. Travis, S., D. S. Aga, and A. Pérez-Fuentetaja. Poster Presentation. Analysis of legacy and novel flame retardants in

two avian species from the Niagara migration flyway using gas chromatography tandem mass spectrometry. 256th American Chemical Society (ACS) National Meeting. September 19, 2018. Boston, Massachusetts.

20. Travis, S., D.S. Aga, and A. Pérez-Fuentetaja. Assessing bioaccumulation of emerging and legacy flame retardants in common tern from the Niagara Migration Flyway using gas chromatography tandem mass spectrometry. Pittcon Conference and Expo 2019. March 17, 2019. Philadelphia, Pennsylvania.
21. Travis, S. C., A. Pérez-Fuentetaja, and D. S. Aga. Assessing bioaccumulation of legacy persistent organic pollutants in common terns from the Niagara River. 9th International Symposium on Flame Retardants. May 15, 2019. Toronto, Canada.
22. Wardell, J., P. Esselman, and K. Mehler. Using a deep convolutional neural network to identify Dreissenid mussels. 62nd Annual Conference on Great Lakes Research. June 10–14, 2019. Brockport, New York.

Invited Talks

1. Burlakova, L. E. *Dreissena* in Great Lakes and underwater imagery for *Dreissena* monitoring. Lecture, GLC 535 Great Lakes Ecosystems course. February 13, 2019.
2. Burlakova, L., A. Karatayev, S. Daniel, R. Barbiero, K. Mehler, and E. Hinchey. Decadal trends in benthic community of the Laurentian Great Lakes. Invited Seminar, University Laval, Quebec, Canada. May 2, 2019.
3. Burlakova, L. E., A. Karatayev, and K. Mehler. *Dreissena* in Great Lakes & underwater imagery for *Dreissena* monitoring. NY Sea Grant Teachers Workshop, Great Lakes Center Field Station. August 1, 2018.
4. Karatayev, A., L. Burlakova, D. Padilla. Can introduced species replace lost biodiversity? A test with freshwater molluscs. Invited talk at the Cornell University Biological Field Station, Bridgeport, New York. July 3, 2018.
5. Karatayev, A. Application of drop-down camera to monitor invasive species in the Great Lakes. Invited talk presented at EPA Great Lakes National Program Office, Chicago. May 8, 2019.
6. Karatayev, A. Y., L. E. Burlakova, V. Karatayev, M. Rowe, K. Mehler, A. Elgin, T. Nalepa. Lake morphometry determines Dreissena invasion dynamics. Invited talk presented at Department of Biology Laval University seminar, Quebec, Canada. May 2, 2019.
7. Karatayev, A. Benthic food webs. Invited talk presented at Lake Ontario CSMI Data Synthesis and Reporting for Management and Policy Making Workshop, Buffalo, New York. June 19–20, 2019.

Sasha Karatayev presenting data at the Lake Ontario CSMI Data Synthesis and Reporting for Management and Policy Making Workshop. Buffalo State, June 19–20, 2019.

8. Pérez-Fuentetaja, A. *Daphnia*'s challenge: strategies to survive and reproduce under limiting environmental conditions. SUNY Buffalo State, Biology Seminar Series, Buffalo, New York. December 3, 2018.
9. Pérez-Fuentetaja. A., M. D. Clapsadl, and R. J. Snyder. Oral Presentation. Migratory prey fish support ecosystem resilience in the long term: The emerald shiner in the Niagara River. Department of Environmental Conservation, Buffalo, New York. July 19, 2018.

Presentations at local Conferences and workshops (non-refereed)

1. Burlakova, L. E., A. Y. Karatayev, E. Froufe, A. E. Bogan, and M. Lopes-Lima. A new quadruline species from Texas (Unionidae, Ambleminae, Quadrulini). 19th Annual Faculty/Staff Research and Creativity Fall Forum, SUNY Buffalo State. October 25, 2018.
2. Daniel, S., L. E. Burlakova, A. Y. Karatayev, K. Mehler. Creating Great Lakes DNA Barcode Reference Library. 19th Annual Faculty/Staff Research and Creativity Fall Forum, SUNY Buffalo State. October 25, 2018.
3. Karatayev, A., L. E. Burlakova, and T. Miller, M. Perrelli. *Popenaias popeii* - the first endangered freshwater mussel in Texas. 19th Annual Faculty/Staff Research and Creativity Fall Forum, SUNY Buffalo State. October 25, 2018.

III. Education

The GLC fulfills its educational mission directly through the classes its researchers teach, through its Master of Art 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 (MA) and an internship-based Master of Science (MS). 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 2018-2019:

Master of Art:	**Master of Science:**
Sonya Bayba	Zachary Adams
Corinna Solomon	Joshua Allan
	Joseph Bodnarchuk
	Stephanie Hanson
	Alyssa Hessler
	Lauren Martinek
	Zachary Neudeck
	Cecilia Pershyn
	Sean Ryan
	Benjamin Wrazen

Advising Undergraduate and Graduate Students

- Lyubov Burlakova was a committee member for Brandon Sansom (2015–2018), PhD student, State University of New York at Buffalo, and faculty Mentor/Advisor for Sonya Bayba, M.A. student, Great Lakes Environmental Science (2018–present).
- Alexander Karatayev was a committee member for two graduate students.
- Knut Mehler was an instructor of GLC 590 Integrating Remote Sensing and Spatial Statistics in Invasive Species Ecology, Spring 2019, for Joseph Bodnarchuk, M.A. student, Great Lakes Environmental Science Graduate Program.
- Chris Pennuto was the advisor of two graduate students and a committee member for four graduate students.
- Alicia Pérez-Fuentetaja served as a PhD committee member for student Steven Travis

Summer student interns for the Lake Ontario *Cladophora* project: Georgia Shaw (Biology undergrad), Joshua Allan (GLES graduate student), and Kyle Glenn (Biology undergrad).

in the (Environmental) Chemistry Department at University at Buffalo, and the advisor for two Biology M.A. graduate students, Benjamin Szczygiel and Amy Cavanaugh.

International Students Exchange

- This year we are hosting two international visiting scholars, PhD students Martyna Bakowska and Natalia Mrozinska from Kazimierz Wielki University in Bydgoszcz, Poland (June 15–September 15, 2019). These students will work under the supervision of Lyubov Burlakova and Alexander Karatayev on different aspects of Great Lake benthic ecology, including learning EPA Long-term Monitoring protocol, collecting benthic samples and video images onboard EPA R/V *Lake Guardian*, sample processing, data analysis, and report and publication writing.

Sasha Karatayev and Polish PhD students Natalia Mrozinska and Martyna Bakowska, June 2019.

- We are working on establishing a formal collaboration for joint research and student exchange (Agreement of Cooperation) between Buffalo State and Kazimierz Wielki University in Bydgoszcz, Poland.
- Our GLES student, Joseph Bodnarchuk, is doing an internship abroad hosted by our collaborator Dr. Frances Lucy at the Institute of Technology (Sligo, Ireland). Joseph received the Stevenson Environmental Education Award to participate in environmental projects within the Center for Environmental Research Innovation and Sustainability.

Seminars

In order to facilitate collaboration between the GLC personnel and leading experts in aquatic ecology and related sciences, and to increase visibility of the Center in 2018-2019, we invited 5 speakers to present talks at our seminar series, including:

1. Annie Scofield, Purdue University. "Long-term change in the Great Lakes lower food web: the importance of deep chlorophyll." November 5, 2018.
2. Chuck Madenjian, USGS. "Sex and contaminants in fish: "hot spots," big testes, and high-activity males." November 26, 2018.
3. Arthur Bogan, Curator of Mollusks at North Carolina State Museum of Natural Sciences. "Freshwater Bivalves: distribution, food and conservation." May 16, 2019.
4. Shivakumar Shivarudrappa, Louisiana Universities Marine Consortium. "Varied response of macrobenthos to recurring and abated environmental stressors." April 18, 2019.
5. Sergei Katsev, Large Lakes Observatory, University of Minnesota Duluth. "Sediment geochemistry and nutrient dynamics in the Upper Great Lakes." April 23, 2019.

New research scientist Shivakumar Shivarudrappa was hired in May 2019. Shiva will be replacing Knut Mehler, who is returning to Germany in August 2019.

IV. Outreach and Service Activities

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

Lyubov Burlakova:

- Helped to organize Great Lakes Center Open House (September 2018).
- Helped to published Great Lakes Center 2017–2018 Annual Report (September 2018).
- Wrote articles for GLC Newsletter series.
- Committee Member, Brandon Sansom (2015–2018), PhD student, State University of New York at Buffalo.
- Chair of the search committee for Research Scientist position at GLC, Spring 2019.
- Faculty Mentor/Advisor, Sonya Bayba, M.A. student, Great Lakes Ecosystem Science (2018–present).
- External Examiner, PhD Thesis by Nathan Haag, "Displacement of the invasive zebra mussel by the similarly invasive quagga mussel: patterns and biological factors." Laval University, Quebec, Canada, May 2019.
- Supervised internship of two international visiting scholars, PhD students Martyna M. Bakowska and Natalia Mrozinska from Kazimierz Wielki University in Bydgoszcz, Poland, in Great Lakes Center, June 15–September 15, 2019.
- Working on establishing a formal collaboration for joint research and student exchange (Agreement of Cooperation) between Buffalo State and Kazimierz Wielki University in Bydgoszcz, Poland.
- Hosted Jacey Falcone (junior, Hamburg High School and Health Science Academy) for STEM Shadowing Program, February 21–22, 2019.
- Interview with Alex Dahl (Lawrence University in Appleton, Wisconsin) for his podcast discussing our paper "Modeling habitat of freshwater mussels in the lower Great Lakes 25 years after the Dreissena invasion," February 21, 2019.
- Participated in preparation of the State of the Great Lakes 2017 and 2019 Reports.
- Invited attendee of "Ecological Risk Assessment of Black Carp (*Mylopharyngodon piceus*) for the Great Lakes Basin" Peer Review Meeting, December 4–6, 2018, Milwaukee, Wisconsin.
- Coordinator of the Great Lakes Center and Biology Department Seminar Series (2018); in 2019, helped to invite 3 more speakers to present their research.
- Participated in organizing Lake Erie CSMI 2019 Planning Meeting, March 14–15, 2019, Buffalo, New York.
- Participated in organizing CSMI Lake Ontario Data Synthesis Workshop, June 19–20, 2019, Buffalo, New York.
- Reviewer for 2018 IAGLR Scholarships.
- Attended meeting with GLNPO in Chicago (May 2019) to present current progress on the ongoing projects and discuss future research and grant opportunities.
- 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.
- Participated in writing a letter from Great Lakes

Planning Meeting for Cooperative Science and Monitoring Initiative 2019 Lake Erie Benthic Survey, Buffalo State, March 2019.

Center to Russian Ministry of Natural Resources and Ecology to express concern over proposed changes to discharge permissions into Lake Baikal, April 2019.

- Member of the International Planning Committee for the joint meeting of European Large Lakes Society and International Association for Great Lakes Research in Petrovadosk in 2021.
- Co-chair of the session,"Coupling long-term monitoring, remote sensing and modelling for the assessment of lake ecological status," at the International Conference "Big Lakes, Small World," European Large Lakes Symposium and International Association for Great Lakes Research (ELLS-IAGLR-2018), September 23–28, 2018, Evian, France.
- Co-chair of a special session, "2016 CSMI Lake Superior extensive field year: status of benthic community," at the State of Lake Superior Conference, October 9–12, 2018, Houghton, Michigan.
- Co-chair of the session, "Large Lakes of the World: Detecting changes using long-term monitoring," ASLO Aquatic Sciences Meeting, February 23–March 2, 2019, San Juan, Puerto Rico.
- Co-chair of the session, "Mud, Macrofauna, and Microbes: Benthic organisms-abiotic interactions at varying scales," at the 62nd Annual Conference on Great Lakes Research, June 10–14, 2019, Brockport, New York.
- Member of Freshwater Mollusk 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 Freshwater Mollusk Conservation Society.
- Reviewed 10 manuscripts for *Hydrobiologia, Aquatic Conservation, Journal of the Great Lakes Research, Ecology, Ecology and Evolution, Freshwater Mollusk Biology and Conservation, Limnology, Freshwater Science, Freshwater Biology, Limnology & Oceanography*.
- Member of the Buffalo State's "The Friends of the Maud Gordon Holmes Arboretum."
- Member profile interview for IAGLR "Lakes Letter" spring 2019 issue.

Mark Clapsadl:

- My efforts to improve the functionality and appearance of the GLC Field Station are beginning to pay off. The combination of the boat launch and dock improvements, along with the new native habitat plantings, as well as a remodel of the Field Station conference room and various painting projects have resulted in a more professional and up-to-date overall appearance of the Field Station and grounds.
- Helped provide opportunities for Buffalo Public School students to experience and learn about local natural resources through field trips on Lake Erie, as well as through projects funded through an external grant.
- The Great Lakes Observing System buoy that I operate in Eastern Lake Erie has become a valuable tool for numerous individuals and agencies. Recreational and commercial charter operators use the real-time lake condition data to make decisions about safety (wave height), agencies such as NYS DEC use lake temperature profile data to guide research activities, and climate scientists are using these data in climate models.

Susan Daniel:

- Wrote multiple articles for GLC Newsletter series.
- Participated in meetings with our partners from Cornell University on the Great Lakes Long-term Biological Monitoring Program.
- Acting Safety Officer for the Great Lakes Center on the Chemical and Biological Hygiene Committee, SUNY Buffalo State (2014–present).
- Awards Committee Co-Chair, International Association for Great Lakes Research.
- Participated in State Union Trash Pickup on SUNY Buffalo State campus.

- Participated in search committee for Research Scientist position at GLC, Spring 2019.
- Hosted Jacey Falcone (junior, Hamburg High School and Health Science Academy) for STEM Shadowing Program, February 21–22, 2019.
- Participated in several seminars offered on campus, including a Microaggression seminar and LGBTQ+ Cultural Competency workshop.

Susan Daniel received a Certificate of Appreciation for her service to the Board of IAGLR over the past few years.

Susan Dickinson:

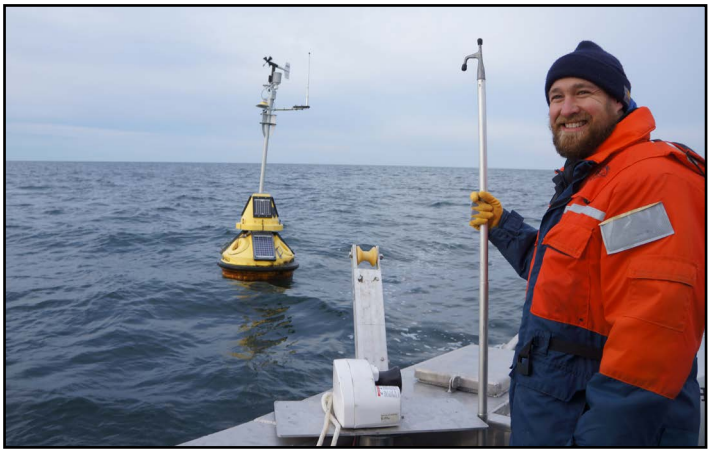
- Assisted in preparation of the Great Lakes Center Annual Report for publication.
- Organized Great Lakes Center Open House, September 2018.
- Assisted in preparation of the Great Lakes Center, Biology Department and Great Lakes Ecosystem Science Program Seminar Series.
- Helped to organize Lake Erie CSMI 2019 Planning Meeting, March 14–15, 2019, Buffalo, New York.
- Helped to organize CSMI Lake Ontario Data Synthesis Workshop, June 19–20, 2019, Buffalo, New York.
- Helped to prepare documents to invite two international visiting scholars, PhD students Martyna M. Bakowska and Natalia Mrozinska from Kazimierz Wielki University in Bydgoszcz, Poland, to the Great Lakes Center (June 15–September 15, 2019).


GLC staff, affiliates, and guests at the Great Lakes Center Open House, Field Station, September 7, 2018.

Brian Haas:

- Installed nesting structures at the field station and managed installation of the migratory bird garden.
- Provided assistance in the launching and retrieval of the GLOS buoy in Lake Erie.
- Offered support to local agencies including the NYSDEC and USFWS through general assistance and the use of the field station grounds and boat launch.
- Conducted benthic sorting and data entry for the U.S. EPA Great Lakes Long-term Biological Monitoring Program.
- Traveled to the western basin of Lake Erie and conducted benthic sampling of historic sites.
- Assisted in the field work and prepared vessels for the Lake Ontario *Cladophora* Project.
- Supported the Lake Erie Lower Trophic Level Monitoring Project through biweekly sampling from May through October during 2018.
- Provided assistance and oversight to the 2018 summer sampling crew for the Emerald Shiner Project.
- Helped graduate and undergraduate students from Buffalo State collect samples needed for their research.
- Attended local meetings outside of work to gain more knowledge on a variety of topics concerning the Great Lakes.
- Contacted and arranged meetings with local avian experts to gain further insight and help direct the habitat enhancements at the Field Station.

- Worked with Buffalo Public High School students on numerous occasions for field trips out onto the water and at the field station grounds.
- Led field trips onto Lake Erie for select Buffalo State classes.
- Received requests from field station neighbors including the West Side Rowing Club and the Navy Operational Support Center and provided assistance when possible.



Brian Haas prepares to retrieve the buoy at the end of the season, Fall 2019.

Alexander Karatayev:

- Organized Great Lakes Center Open House, September 2018.
- Published Great Lakes Center 2017–2018 Annual Report, September 2018.
- Personnel Committee member, Biology Department.
- Member of the search committee for Research Scientist position at GLC, Spring 2019.
- Committee member for two GLES graduate students.
- Supervised internship of two international visiting scholars, PhD students Martyna M. Bakowska and Natalia Mrozinska from Kazimierz Wielki University in Bydgoszcz, Poland, in Great Lakes Center (June 15–September 15, 2019).
- Working on establishing a formal collaboration for joint research and student exchange (Agreement of Cooperation) between Buffalo State and Kazimierz Wielki University in Bydgoszcz, Poland.
- Organized Lake Erie CSMI 2019 Planning Meeting, March 14–15, 2019, Buffalo, New York.
- Organized CSMI Lake Ontario Data Synthesis Workshop, June 19–20, 2019, Buffalo, New York.
- Attended meeting with GLNPO in Chicago to present current progress on the ongoing projects and discuss future research and grant opportunities.
- 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.
- Participated in writing a letter from Great Lakes Center to Russian Ministry of Natural Resources and Ecology to express concern over proposed changes to discharge permissions into Lake Baikal, April 2019.
- Member of the International Planning Committee for the joint meeting of European Large Lakes Society and International Association for Great Lakes Research in Petrovadosk in 2021.
- Co-chair of the session, SS020 Large Lakes of the World: Detecting Changes Using Long-Term Monitoring. ASLO Aquatic Sciences Meeting, February 23–March 2, 2019, San Juan, Puerto Rico.
- Co-chair of the session, "Mud, Macrofauna, and Microbes: Benthic organisms-Abiotic Interactions

Participants of Lake Ontario CSMI Data Synthesis and Reporting for Management and Policy Making Workshop. Buffalo State, June 19–20, 2019.

at Varying Scales," at the 62nd Annual Conference on Great Lakes Research, June 10–14, 2019, Brockport, New York.

- Campus Representative for the Great Lakes Research Consortium.
- Member of Freshwater Mollusk 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 Freshwater Mollusk Conservation Society.
- Reviewed manuscripts for *Biological Conservation* and *Journal of the Great Lakes Research*.

Kit Hastings:

- Participated in field collection and laboratory studies in multiple projects conducted at the Field Station.
- Implemented the Lake Erie Lower Trophic Level Monitoring project.
- Member of Buffalo State's Institutional Animal Care and Use Committee.
- Member of WNY GIS User Group.
- Member of NYS GIS Association.
- Member of the International Association for Great Lakes Research.
- Played a key role in producing two issues of GLC Newsletters (editor), including writing multiple articles.
- Made GLC website more accessible for the visually impaired, in compliance with new guidelines for the college.
- Assisted in preparation of the GLC Annual Report publication.
- Updated GLC website.
- Assisted in lab work associated with the Great Lakes Long-term Biological Monitoring Program and Lake Huron CSMI projects (mounted oligochaete and chironomid slides and identified oligochaetes).
- QAQC manager for the Great Lakes Benthos Barcoding grant.
- Participated in benthic sample collection aboard the R/V *Lake Guardian*.
- Provided instructional support on field sampling procedures for multiple Buffalo State classes.
- Participated in Career Fair at Buffalo Schools.
- Trained volunteer for the CommuniTree Steward Project, a collaboration between Cornell Cooperative Extension of Erie County and the City of Buffalo.

Knut Mehler:

- Co-chair of the organizing committee of the 2019 CSMI Lake Ontario Data Synthesis Workshop, Buffalo, New York, June 19–20, 2019.
- Organized Lake Erie CSMI 2019 Planning Meeting, March 14–15, 2019, Buffalo, New York.
- Wrote articles for GLC Newsletter series.
- Participated in meetings with our partners from Cornell University on the Great Lakes Long-term Biological Monitoring Program.
- Member of the search committee for Research Scientist position at GLC, Spring 2019.
- Member of the International Association for Great Lakes Research.
- Member of the Freshwater Mollusk Conservation Society.
- Participated in Career Fair at Buffalo Schools.

- Session chair, 'Seeing Below the Surface: Quantifying the Underwater Environment with Image Analysis,' at the 62nd Annual Conference on Great Lakes Research (oral presentation), June 10–14, 2019, Brockport, New York.
- Session Co-chair, 'Mud, Macrofauna and Microbes: Benthic Organism-abiotic Interactions at Varying Scales,' at the 62nd Annual Conference on Great Lakes Research (oral presentation), June 10–14, 2019, Brockport, New York.
- Instructor of GLC 590 'Integrating Remote Sensing and Spatial Statistics in Invasive Species Ecology,' Spring 2019.

Christopher Pennuto:

- Graduate Committee member, Biology Department.
- Admissions Committee Chair for GLES Master Programs.
- College Personnel Committee.
- Reviewed manuscripts for *Oikos, Biological Invasions, Aquatic Invasions, Ecology of Freshwater Fish*.

Alicia Pérez-Fuentetaja:

- Biology Department: Personnel committee member.
- Biology Department: Advisement committee chair.
- Biology Department: Chair and adviser for the Master's Comprehensive Exam Program.
- Served as a PhD Committee Member for student Steven Travis at (Environmental) Chemistry Department at University at Buffalo.
- Member of the Steering Committee for the International Ramsar Denomination for the Niagara River as an important site for biodiversity.
- Reviewed article for *Journal of Great Lakes Research*.

V. Professional Development Activities

Lyubov Burlakova:

- Attended LGBTQ+ Cultural Competency seminar, Buffalo State, January 17, 2019.

Susan Daniel:

- Attended LGBTQ+ Cultural Competency seminar, Buffalo State, January 17, 2019.

Kit Hastings:

- Attended training course: "ArcGIS Pro: Migrating from ArcMap," on October 17, 2018.
- Attended training courses: "What are Microaggressions?" workshop on November 9, 2018, and "What are Microagressions Follow Up" workshop on January 15, 2019.
- Attended training course: "Opioid Overdose Prevention Training" on November 14, 2018.
- Attended training courses: "Inclusive Communication" workshop on February 27, 2019 and "Inclusive Communication Follow Up" on March 6, 2019.

VI. Field Station Activities

In 2018, we began work on the Osprey Nesting Platform and Habitat Enhancement Project funded through the Niagara River Greenway Commission ($94,104. PI's Clapsadl, Haas and Hastings). The project primarily involves installation of nesting structures and placement of native plants on the GLC Field Station grounds. In the fall of 2018, we installed an Osprey nesting platform, housing for a Purple Martin colony, as well as three large-scale plantings of a variety of native plants that were selected for their potential to provide food, cover and nesting sites for migrating and local birds (photos of this project). We were also able to engage with Buffalo Public School students in the Spring of 2019 with projects that included planting additional annual plants. We expect to continue our collaboration with BPS by involving students in additional projects associated to the native habitat plantings.

We recently finished work on a new gate and access road to make a direct connection between the boat storage shed (formerly the building and property owned by the Division of Naval and Military Affairs) and the Field Station grounds. This road facilitates access to the Boat Shed lot, greatly expanding our parking capacity, and it also permits us to move the research vessels back and forth between the FS and the shed lot without going out onto the public roads.

We have also continued to upgrade and maintain the GLC laboratory facilities. This past year, campus staff were able to paint the hallway portions of the laboratory and replace aged ceiling tiles.

Brian Haas working on the new access road, June 2019.

Research Vessels

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.

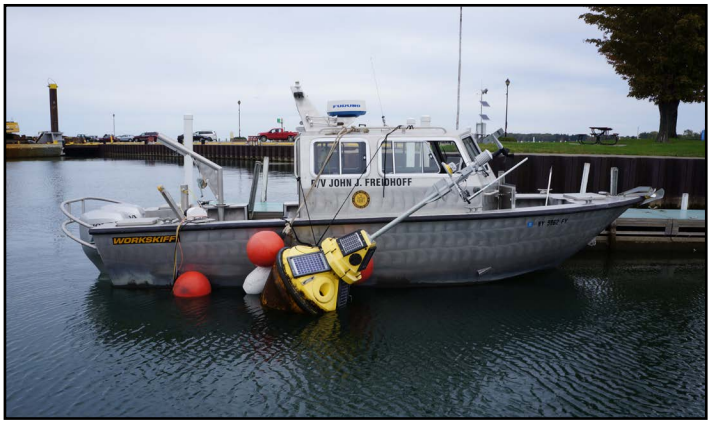
Instructional Support

- Provided field trip for BIO 315 Ecology.
- Provided laboratory support for multiple graduate student projects.
- Provided field support for BSC senior student project.

Research Activities

- Collected western basin Lake Erie benthic samples for Great Lakes Long-term Biological Monitoring project.
- Installed and operated the Great Lakes Observing System (GLOS) buoy in Lake Erie off Dunkirk, New York.
- Continued long-term sampling of the eastern basin of Lake Erie for the Lower Trophic Level Assessment, adding to fifteen years of data.
- Assisted Jill Singer with the Buffalo River current sonar modeling project.

- Provided support to U.S. Fish and Wildlife Service fish tracking project.
- Facilitated access to the boat launch for NYS Department of Environmental Conservation and U.S. Fish and Wildlife Service.
- Assisted with sample collections with Cornell University researchers.
- Assisted SUNY ESF in the deployment of a Great Lakes Observing System buoy in Lake Ontario.



The R/V *John J. Freidhoff* docked with the GLOS buoy in Dunkirk, NY.


Graduate students electrofishing in the upper Niagara River.

Outreach

- Hosted multiple Buffalo Niagara Waterkeeper kayaking touring events for public.
- Provided multiple field trips to Buffalo Public School system high school students, including students for the "My Brothers Keeper" program, students from South Park High School and students from Riverside High School.
- Hosted an outreach event for Helen Domske with New York Sea Grant.
- Provided access and support to the NYS Department of Environmental Conservation with multiple fisheries and Common Tern projects.
- Provided field station access and support to the U.S. Army Corps of Engineers.
- Provided access and support to the U.S. Navy Support Center.

The osprey nesting platform.


Tree swallows flying near the purple martin nesting gourds.

Field Station Habitat Improvements

Mark Clapsadl and Brian Haas constructing the osprey nesting platform.

Brian Haas installing the purple martin nesting colony.

One of the habitat gardens is under the trees in the middle of the yard.

Work crews placing plants at the new habitat planting by the fence.

The habitat planting by the fence in Spring 2019, after leaf out.

The habitat planting under the osprey pole.

VII. Western New York PRISM Activities

Western New York Partnership for Regional Invasive Species Management (WNY PRISM) is a sponsored program through the Research Foundation at Buffalo State and is hosted by the Great Lakes Center. Funding is provided by the Environmental Protection Fund through a contract with NYS Department of Environmental Conservation.

WNY PRISM works to address invasive species priorities using a coordinated partnership network, for which we provide leadership, information management and collaboration opportunities. Our goal is to improve, restore and protect local aquatic and terrestrial resources by improving the effectiveness of invasive species management efforts, and increasing awareness of invasive species issues throughout our eight-county region. By fostering regional collaboration, the impact of invasive species will be minimized, and the natural resources and beauty of western New York will be preserved. The WNY PRISM Office was established in 2014.

Program Highlights and Accomplishments

WNY PRISM's core functions include Partnership Coordination, Information Management, Education and Outreach, Prevention, Early Detection/Rapid Response, and Habitat Management and Restoration.

Partner/Network Coordination

- Held 2 Full Partner meetings and Quarterly Steering Committee meetings.
- Participated in PRISM Leader's quarterly meetings and monthly webinar series.
- Began development of 5-year Strategic Plan.
- Posted, interviewed and hired Education & Outreach and Aquatic Program Managers.
- Attended WNY PRISM Kick-off meeting with NYS DEC.
- Posted, interviewed and hired 2019 Seasonal Positions (1 E&O, 2 ISMA, 18 Boat Stewards, 2 Lead Stewards).
- Participated in Great Lakes Action Agenda meetings.
- Participated in *Hydrilla* Collaborative and NYS Hydrilla meetings.
- Participated in NYS Invasive Species (IS) Priorities Setting meetings.
- Served as regional representative for NYS Department of Environmental Conservation's Pesticide Regulations Stakeholder meetings.
- Met with municipal partners to discuss management, spread prevention, and human impacts.
- Participated in WNY and Chautauqua County Forest Pest Taskforces.
- Served on the Great Lakes *Phragmites* Collaborative Advisory Committee.

Members of the Great Lakes Slender False Brome Working Group toured the management research sites at Genesee County Park and Forest in October, after the first year of treatment. Photo: WNY PRISM.

- Provided Letters of Support to partners seeking grant funds.

WNY PRISM ISMA, Julia Kostin, staffed an informational table at the Alfred Farmers Market during Invasive Species Awareness Week. Photo: WNY PRISM.

Information Management

- Identified data gaps within iMapInvasives for project planning.
- Assisted with development of iMap 3.0.
- Implemented 6 invasive species mapping projects and submitted 560 observations, including 42 species, from efforts in 11 counties.
- Provided survey summaries and management recommendations to partners.
- Worked with partners to identify invasive species research needs and coordinated with New York Invasive Species Research Institute.
- Updated WNY PRISM priority species lists and created new Watchlist/Approaching Region list.
- Began process of ranking invasive species using the new management tier ranking criteria developed by the NYS Invasive Species Program, completed 72 species.
- Maintained WNY PRISM Listserv serving 265 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.

Education and Outreach

- Conducted assessment of WNY PRISM website and developed plan for content and structural improvements.
- Interviewed for 2-the-Outdoors news program about knotweed and other widespread invasive species.
- Coordinated ISAW planning for WNY PRISM Region which held 36 events, the most among PRISM regions.
- Conducted outreach at 19 events, held 5 workshops, 2 volunteer workdays and gave 17 presentations.
- WNY PRISM made 2524 direct contacts, and the combined number of attendees at all outreach related events reached 285,933.

Prevention

- Developed new Watercraft Inspection Program for 2019.
- Selected 22 priority sites to host Boat Stewards.
- Conducted 2-day training for 18 Boat Stewards and 2 Lead Boat Stewards.
- Produced weekly reports on Boat Steward data collection and interactions (>4000 inspections and >9000 interactions).

- Developed and placed 3 Boot Brush Stations in 2018 and received requests for 7 in 2019.
- Identified Pathways of Invasion for priority invasive species.

Early Detection and Rapid Response

- Worked with Paul Simonin on eDNA NYS Harbors Project to collect samples within the Buffalo Outer Harbor.
- Conducted Early Detection site monitoring at 24 sites and surveyed areas near new early detection reports.
- Removed water lettuce from Ellicott Creek.
- Conducted Japanese stiltgrass surveys and identified 7 new sites.
- Held Japanese stiltgrass public meeting in East Aurora to update residents on survey and management efforts.

Rebecca Mann and the WNY PRISM Crew surveyed Ellicott Creek for water lettuce, finding and removing a dozen plants in 2018. Photo: WNY PRISM.

- Developed mile-a-minute outreach and mailed post cards with ID and reporting instructions to residents within 2.5 miles of infestation in Genesee County.
- Organized mile-a-minute working group and held meetings to address continued management needs.
- Distributed spotted lanternfly information to partners.
- Completed plans to treat Japanese stiltgrass and Japanese angelica tree in 2019.

Management and Habitat Restoration

- Assisted partners in development of invasive species and restoration management plans.
- Met with partners to discuss new and ongoing management projects.
- Released Request for 2019 Partner Crew Assistance Program, accepted and reviewed requests with Steering Committee. Received 21 requests for assistance, from 14 partners.
- Crew Assistance Program: completed identified 2018 projects and reviewed, prioritized and selected projects for 2019.
- Implemented invasive species removal projects at Seneca Bluffs Natural Habitat Park, Kenneglenn Scenic and Nature Preserve, Niagara Escarpment Preserve, Fredonia's College Lodge, North Tonawanda Audubon Preserve, Rosche Preserve (formerly Conewango Wetland Preserve), Audubon Community Nature Center, Woodlawn Beach State Park, and Bergen Swamp, among others.

WNY PRISM's 2018 Crew (Emily Thiel, Julia Kostin, Rebecca Mann and Terrestrial Project Manager Lucy Nuessle) treated slender false brome at Genesee County Park and Forest. Photo: WNY PRISM.

Lucy Nuessle helped plant native trees and shrubs as part of the Tifft Vernal Pool Restoration Project. Photo: WNY PRISM.

WNY PRISM worked with Tifft Staff and Volunteers to plant native trees and shrubs as part of the Tifft Vernal Pool Restoration Project. Photo: WNY PRISM.

Projects

Great Lakes Slender False Brome Working Group.

Slender false brome (*Brachypodium sylvaticum*) is an invasive species of grass that threatens a wide range of habitats including forests, wetlands and grasslands, and is capable of dominating areas to the near complete exclusion of native species. A large infestation was discovered in New York in 2009, far from all other known occurrences in the Pacific Northwest. The Great Lakes Slender False Brome Working Group provides information and coordination for this species within the Great Lakes Basin, with a focus on New York. Work includes species surveys, development of best management practices, implementation of removal projects and regional outreach.

Priority Lands Invasive Species Removal and Volunteer Monitoring Program.

Invasive species removal and monitoring efforts will take place on high conservation value lands located within Erie and Niagara Counties of NYS and owned by the Land Conservancy and Buffalo Audubon Society. WNY PRISM will 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.

Vernal Pool Enhancement Project at Tifft Nature Preserve.

This project involves vernal pool enhancement including invasive species removal and habitat restoration within the vernal pools and adjacent upland habitats. WNY PRISM is working to remove common buckthorn, phragmites and knotweed species from the project area, as well as assisting with native plant community restoration and project design planning. The completed project (Fall 2018) includes six acres of restored vernal pool communities, surrounded by a deer exclosure fence to ensure successful establishment of native plant communities.

Collaborators

WNY PRISM Steering Committee Members:

- Alisia Vilonen (NY State Department of Transportation)
- Bob Smith (NY State Certified Nursery and Landscape Association)
- Gregg Sargis (The Nature Conservancy)
- Helen Domske (NY Sea Grant)
- Jonathan Townsend (Chautauqua Watershed Conservancy)
- Jennifer Dunn (NY State Department of Environmental Conservation)
- John Grabowski (Buffalo Niagara Waterkeeper)
- Lynn Greer (U.S. Army Corps of Engineers)

- Meg Janis (NY State Office of Parks, Recreation and Historic Preservation)
- Paul Fuhrmann (Ecology & Environment, Inc.)
- Colleen Kolb (U.S. Fish and Wildlife Service)
- Shanna Shaw (U.S. Department of Agriculture)
- Sharon Bachman (Cornell Cooperative Extension of Erie County)

WNY PRISM collaborates with over 80 Partners. For a complete list of WNY PRISM Partners, please see WNY PRISM Annual Reports.

Invited Talks

Presentations, Workshops and Trainings

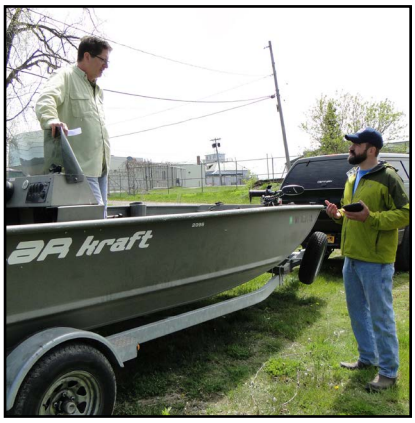
- Hernon, B. Environmental Science Careers. Genesee County Park and Forest, East Bethany, New York. July 9, 2018.
- Locke, A. Invasive Species Field Workshop, Master Naturalists. Cornell Cooperative Extension of Erie County, Emery Park, South Wales, New York. July 24, 2018.
- Locke, A. Niagara Gorge Restoration Invasive Species Hike. Western New York Land Conservancy, Niagara Falls, New York. August 1, 2018.
- Locke, A. Invasive Species Identification and Management. New York State Office of Parks, Recreation and Historic Preservation and My Brother's Keeper, Buffalo, New York. August 1, 2018.
- Hernon, B. Backyard Invaders. Genesee County Soil & Water Conservation District, Backyard Invaders Workshop, Batavia, New York. August 25, 2018.
- Hernon, B. Slender False Brome (*Brachypodium sylvaticum*) Identification and Survey Workshop. Letchworth State Park, Castile, New York. August 29, 2018.
- Locke, A., E. Thiel. Gill Creek Volunteer Workshop, Gil Creek Park, Niagara Falls, New York. September 13, 2018.
- Locke, A. Understanding Japanese Knotweed Management. Lily Dale Environmental Committee, Lily Dale, New York. September 17, 2018.
- Locke, A. WNY PRISM Update. WNY PRISM, Full Partner Meeting, Buffalo, New York. October 11, 2018.

2018 Lead Boat Steward, Morgan Leigh Beatey, inspected a boat for hitchhiking invasive species before it entered Tonawanda Creek/Erie Canal. Photo: WNY PRISM.

WNY PRISM's 2019 Boat Stewards. Photo: WNY PRISM.

- Hernon, B. Great Lakes Slender False Brome Working Group Project Updates. WNY PRISM, Full Partner Meeting, Buffalo, New York. October 11, 2018.
- Nuessle, L. 2018 WNY PRISM Crew Assistance Program. Buffalo State Great Lakes Center Field Station, Buffalo, New York. October 11, 2018.
- Nuessle, L. Early Detection and Approaching Region Invasive Species. Erie County Master Gardeners, Erie County Cornell Cooperative Office, East Aurora, New York. November 6, 2018.
- Hernon, B. Early Detection Survey Protocol and Habitat Suitability Modeling for Slender False Brome, an Invasive Bunch Grass. The Stewardship Network Conference, East Lansing, Michigan. January 12, 2019.
- Locke, A. Invasive Species Management Programs and Resources. Erie County Water Quality Committee, Depew, New York. January 16, 2019.
- Locke, A., Nuessle, L. Japanese Stiltgrass Update, WNY PRISM, Aurora Senior Center, East Aurora, New York. February 25, 2019.
- Locke, A. Invasive Species and Birds. Rural Landowners Workshop, Cornell Cooperative Extension of Allegany County, Pioneer High School, Yorkshire, New York. March 2, 2019.
- Locke, A. Invasive Species Management: Introduction to Site-Weed Management Planning. Rural Landowners Workshop, Cornell Cooperative Extension of Allegany County, Pioneer High School, Yorkshire, New York. March 2, 2019.
- Nuessle, L. The Battle Against Invasive Species: WNY PRISM Recent Projects. Niagara Frontier Botanical Society, Harlem Road Community Center, Amherst, New York. March 12, 2019.

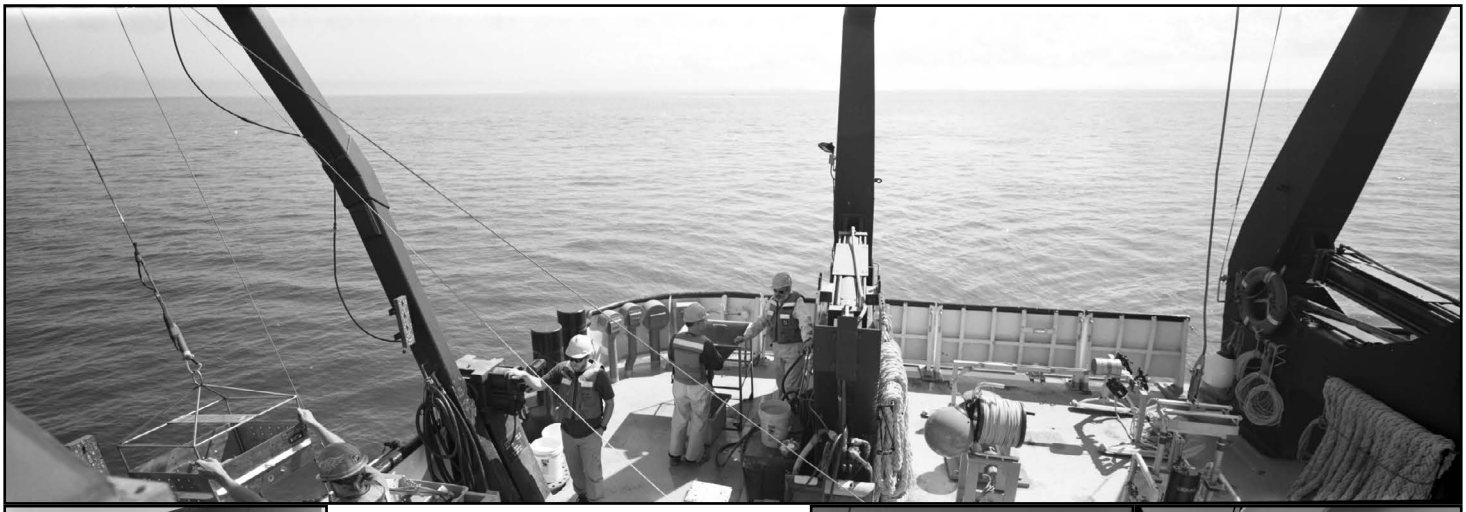
WNY PRISM Boat Stewards were trained on aquatic invasive species ID. Photo: WNY PRISM.



WNY PRISM held a two-day training for Boat Stewards that concluded with an afternoon of practice boat inspections. Photo: WNY PRISM.

- Hernon, B. Great Lakes Slender False Brome Working Group Management Research. New York Invasive Species Research Institute, New York State Webinar Series. April 24, 2019.
- Locke, A. Invasive Species and Pollinators: Understanding the relationship between invasive species, pollinators and restoration of healthy landscapes. Buffalo Niagara Heritage Village, Amherst, New York. May 11, 2019.
- Hernon, B. Great Lakes Slender False Brome Working Group. NYS Office of Parks, Recreation and Historic Preservation, FORCES Training, Castile, New York. May 30, 2019.
- Thiel, E. Invasive Species Spread Prevention. Niagara County Soil and Water Conservation District, Royalton, New York. June 4, 2019.
- King, K. Aquatic Invasive Species Spread Prevention Methods. WNY PRISM, Audubon Public Library, Amherst, New York. June 29, 2019.
- Locke, A. Aquatic Invasive Species Management. WNY PRISM, Audubon Public Library, Amherst, New York. June 29, 2019.

Please visit the WNY PRISM website for more information and for WNY PRISM's Annual Reports.



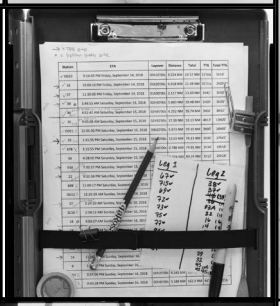
Documenting 2018 Lake Ontario Benthic Survey

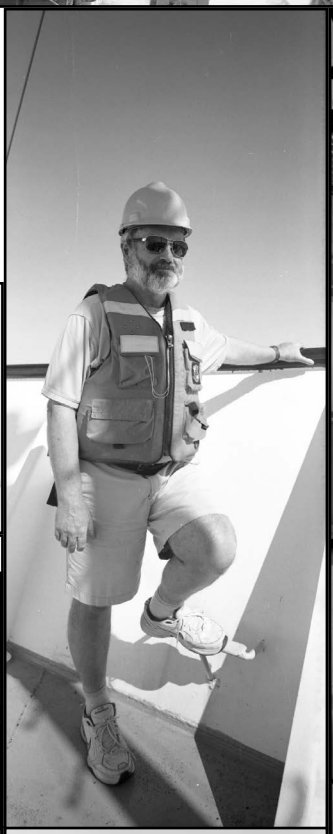
Photos by Yola Monakhov Stockton

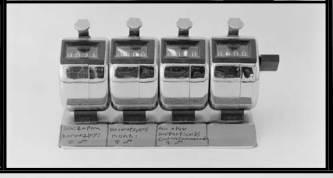
Art & Design Department

SUNY Buffalo State

Exhibit presented at the 62nd Annual Conference on Great Lakes Research, June 2019







Courtesy of Rick Wester Fine Art.