Buffalo State

Great Lakes Center

Since 1966

Annual Report 2017-2018

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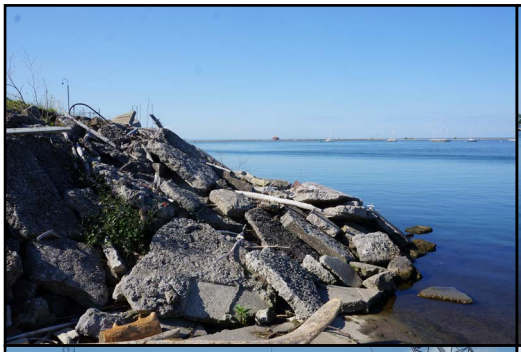
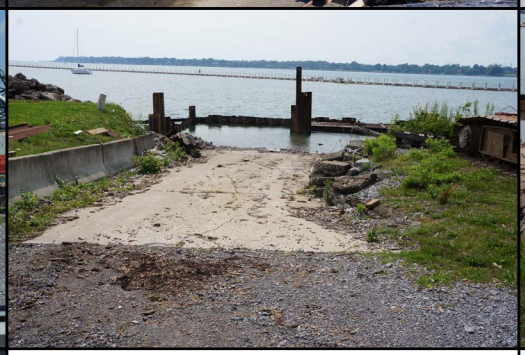
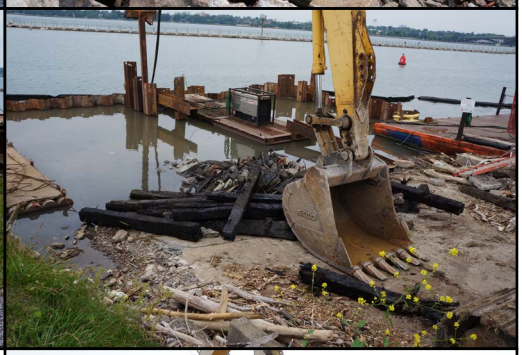
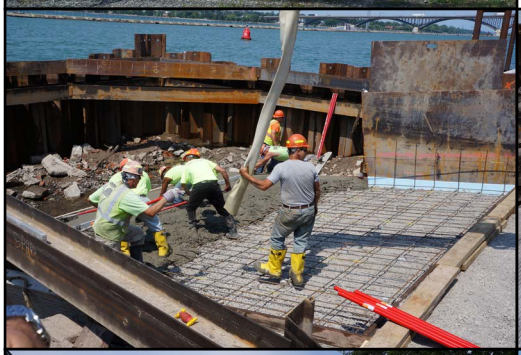
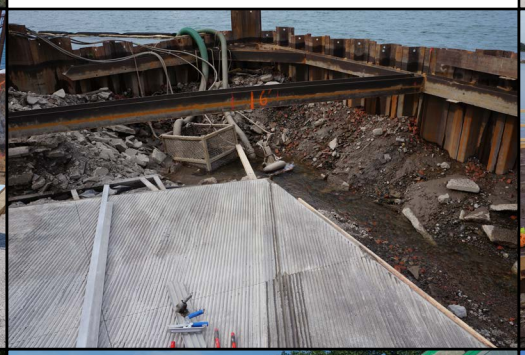





Field Station Boat Dock Renovation Project

Summer 2017





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 **17** peer-reviewed papers and **7** papers were submitted for publication.
- We presented **38** talks, including: **19** at national/international/regional conferences, **7** invited talks, and **12** presentations in non-refereed venues.
- We submitted **11** grant proposals with a total requested amount **$6,832,884**, including **$4,711,747** for Buffalo State.
- **Fourteen** projects for research and education (including multi-year grants) are currently funded in the GLC totaling **$14,244,626**, including **$8,153,924** for Buffalo State.
- **Eleven** students were enrolled in Great Lakes Ecosystem Science MA and MS programs.
- **Two** issues of GLC newsletters were produced over the last year.

I. Staff

GLC Personnel

Director: Alexander Karatayev
Research Scientists: Lyubov Burlakova
Mark Clapsadl (Field Station manager)
Knut Mehler
Christopher Pennuto
Alicia Pérez-Fuentetaja
Research Technicians: Susan Daniel
Brian Haas
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WNY PRISM Coordinator: Andrea Locke
Terrestrial IS manager: Lucy Nuessle
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WNY PRISM seasonal employees:
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Kevin Sanders (University at Buffalo)
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Parker Everhart (SUNY Environmental Science and Forestry)
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Students Research Assistants from SUNY Buffalo State:

Sonya Bayba	Dion Pace
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Emily Burch	Lysander Pope
Marisa Dyckman	Jared Powell
Chris Kalinowski	Brandon H. Surdi
Megan Kocher	Anthony Urena
Abby Mathew	Morgan Zyzik

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- Zy Biesinger, Fish Biologist, U.S. Fish and Wildlife Service
- Dimitry Gorsky, Fish Biologist, U.S. Fish and Wildlife Service
- Daniel Molloy, Scientist Emeritus, New York State Museum, Molloy & Associates, LLC
- Martin A. Stapanian, Research Ecologist, U.S. Geological Survey

GLC Affiliates (at SUNY Buffalo State)

- Kelly Frothingham, Chair, Geography and Planning Department
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- Richard Johnson, Sponsored Programs
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Collaborators

In New York State

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- Hanna Zhukava, Department of General Ecology and Methods of Biology Teaching, Belarusian State University, Minsk, Belarus
- Alexandra Zieritz, University of Nottingham Malaysia Campus, Malaysia

Left: Participants of the 2nd Biennial Canadian Freshwater Mollusc Research meeting, Canada, November, 2017. Right: Knut Mehler and Lyuba Burlakova with collaborator Frank Collas (Radboud University) at the ICAIS Meeting in Fort Lauderdale in October 2017.

Left: Participants of an international workshop at Cornell Biological Field Station, July 2017. Left to right – Hanna Zhukava (Belarusian State University), Alexander Karatayev, Boris Adamivich (Belarusian State University), Lars Rudstam (Cornell University), and Lyuba Burlakova. Right: Collaborators from Belarus and Cornell explored Lake Oneida at the Cornell Biological Field Station during the international meeting. Left to right – Hannah Rudstam, Boris Adamivich, Lars Rudstam, Lyuba Burlakova, Vadim Karatayev and Hanna Zhukava.

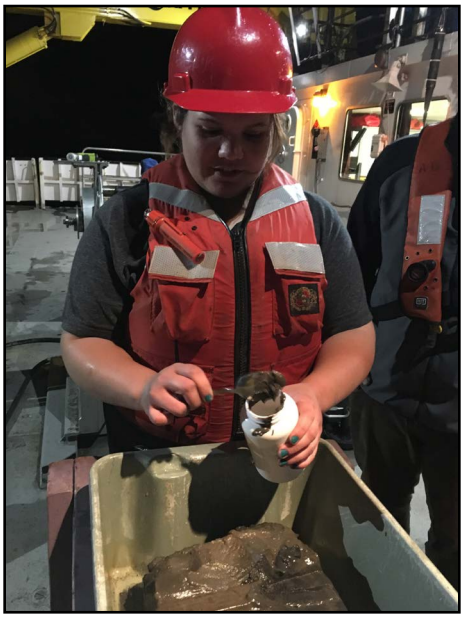
II. Research Activities

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. During 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 the evaluation of an early detection system for aquatic invasive species, the development of biotic indices of ecosystem health based on benthic invertebrates, the impact of dreissenids on the lower food web, and the development of remote sensing methods. We have identified benthic samples collected onboard the EPA R/V *Lake Guardian* in 2012-2016 from all Great Lakes. Based on these data we have made 32 presentations at various meetings and conferences and 8 manuscripts were accepted for publication in the Journal of the Great Lakes Research. We analyzed seventeen years of benthic data from the GLNPO Biology Monitoring Program to reveal temporal and spatial trends in benthic community structure across the lakes (Burlakova et al., 2018b). The authors distinguished the major groups of benthic invertebrates along depth and trophic gradients across the Great Lakes to identify the major abiotic and biotic factors likely influencing the patterns of distribution, abundance, and species richness of the Great Lakes benthos. Recent decreases in open-lake productivity initiated large changes in profundal communities and resulted in significant shifts in dominant taxa across all lakes except Lake Superior. The sensitivity of benthos to changes in productivity illustrates why benthic invertebrate biomonitoring has long been a tool of choice for assessing the impacts of disturbance in aquatic systems. The Oligochaete Trophic Index (OTI) is one such tool used by GLNPO to assess Great Lakes trophic status. We also used the GLNPO dataset to modify the OTI and tested a modeling approach using Modern Analogue Technique (MAT) transfer functions based on species responses to surface chlorophyll gradient (Burlakova et al., 2018a). All new indices had a stronger relationship with surface remote-sensed spring chlorophyll than did OTI, and among them MAT models performed the best.

Susan Daniel and Brian Haas during the 2017 Summer Survey of the Great Lakes.



Gabriella Doud (Cornell University) collecting surface sediment to examine the abundance and diversity of small harpacticoid copepods that are severely understudied in the Great Lakes.

Changes in Lake Erie benthos over the last decades: Historical perspectives, current status, and main drivers

During the last 50 years the ecosystem of Lake Erie has experienced major environmental changes, from anthropogenic eutrophication in the 1930-1960s, to nutrient and pollution abatement in the 1970s, and then

the introduction of exotic dreissenids in the 1980s. Currently, the lake-wide benthic community is dominated by dreissenids. The number of exotic species increases every decade, and their impact has had enormous consequences for the whole ecosystem. In the summer of 2014, within the project "Lake Erie & Lake Michigan Benthos: Cooperative Science & Monitoring Initiative," we conducted a survey of the benthic community of Lake Erie using traditional (Ponar grabs, SCUBA) and modern (underwater video) survey methods. Data from the lake-wide survey and a survey of USGS sites in the western basin were compared to historical data to assess changes in benthic community and trends in dreissenid populations that have important management implications (Lake Erie and Michigan benthos final report). As of 2014, *Dreissena. r. bugensis* density was still increasing in the western basin, while a substantial part of the bottom at over 20 m depth in the central basin is largely free of *Dreissena* due to periodic hypoxia. In contrast, in the eastern basin *D. r. bugensis* forms high densities and biomass in the deep profundal zone that never goes hypoxic. A comparison with historical data (1978-1979) revealed an increase in species diversity lake-wide, and particularly in the western basin likely due to watershed improvements implemented in the 1970s and 1980s and the impacts of *Dreissena*. However, a comparison with more recent (2009-2012) benthic surveys indicated an escalating dominance of Oligochaeta that are tolerant to organic pollution in Lake Erie benthos, which was especially pronounced in the central basin with periodic hypoxia.

Lake Michigan Benthos Cooperative Science and Monitoring Initiative

In 2015, in collaboration with the U.S. EPA, University of Michigan, and NOAA, we conducted the first lake-wide survey of benthic community of Lake Michigan after the *Dreissena* spp. invasion. We collected and analyzed 421 PONAR samples from 143 stations located in all basins of the lake and depths ranging from 10 to 196 m. Over 110 different macroinvertebrate taxa were found in the lake, with Chironomidae and Oligochaeta being the most diverse taxon groups (Lake Erie and Michigan benthos final report). Perhaps the most significant finding in 2015 was the decline in densities of *D. r. bugensis* at depths < 90 m, while the biomass remained stable or slightly increased compared to 2010. In contrast, both density and biomass of *Dreissena* at > 90 m increased. *Dreissena polymorpha* has essentially been displaced by *D. r. bugensis* and was not found in 2015. The amphipod *Diporeia* continued to disappear. It was not collected at any sites < 90 m and only at 9 sites > 90 m. Molluscs Sphaeriidae progressively declined as well all depth intervals between 1992 and 2015. Based on comparisons to data collected in the southern basin in 1992-1993 and 1998-1999, densities of oligochaetes have progressively increased in shallower and mid-depth regions likely due to the increased amount of food resulting from the biodeposition of organic material by *Dreissena*.

Lake Superior Benthos: Cooperative Science and Monitoring Initiative

In September 2016, the GLC conducted a lake-wide nearshore benthic survey of Lake Superior as part of the CSMI to assess the status of the macroinvertebrate community with a focus on temporal trends. Benthic samples were collected at 59 nearshore stations, 25 of which were previously sampled in 1994, 2000, and 2003 (Scharold et al., 2009), and the rest were new locations selected using a GRTS sampling design. The most common benthic taxon by density in 2016 was *Diporeia*, followed by Oligochaeta, Sphaeriidae, and Chironomidae, comparable to the structure found in previous studies. Lake-wide, 94% of the 59 sampling stations in 2016 had high *Diporeia* densities. However, we found a significant decline of *Diporeia* densities in 2016 compared to 1994 at 95% of the 25 previously sampled stations, and *Diporeia* were not collected at three of these stations. In contrast to other Great Lakes, *Dreissena* spp. have not established a sizable population in Lake Superior and therefore cannot account for the decline in *Diporeia* abundance, suggesting that benthivorous fish predation or other environmental factors might have caused the changes. This apparent decline in nearshore *Diporeia* density could be an indication of a long-term trend of decreasing their densities or could be a result of inter-annual variation, reinforcing the importance of frequent monitoring to detect statistically significant temporal trends. Oligochaeta, Sphaeriidae and Chironomidae declined at some of the stations in 2016 compared to 1994, but the changes were not significant (Lake Superior benthos final report). The survey was conducted with the assistance of EPA GLNPO and in collaboration with EPA Mid-Continent Ecology Division (Duluth). This effort was funded by EPA through USGS (PIs Karatayev and Burlakova).

Investigating lake sturgeon habitat use, feeding ecology and benthic resource availability in the Lower Niagara River

Great Lakes Center researchers investigated lake sturgeon habitat use, feeding ecology and benthic resource availability in the lower Niagara River through a grant awarded by the Niagara Greenway Ecological Fund through 2018. The lower Niagara River provides habitat to one of the few remnant populations of lake sturgeon (*Acipenser fulvescens*) in the lower Great Lakes. Evidence shows that this population may be in recovery, but essential information about sturgeon ecology in this unique system was lacking. In this project, we studied the diversity, distribution and density of benthic forage resources and the biology and ecology of lake sturgeon in the lower Niagara River. By using remote sensing-based substrate maps in conjunction with biological sampling, we assessed the food availability and habitat preferences of lake sturgeon. An interesting finding of this study was that two non-native species dominated the diet of lake sturgeon: the amphipod Echinogammarus ischnus and round goby *Neogobius melanostomus*. Stable isotopes revealed that round goby was the primary contributor to the long-term (i.e., fin) average diet whereas short-term (i.e. blood) diet was more diverse. In contrast to findings from other systems, adult lake sturgeon in the lower Niagara River were primarily piscivorous, actively targeting live fish prey. The recovery of this population is potentially supported by high availability of energetically-rich, but non-native food resources. This work has resulted in three publications and numerous talks presented at national and international 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. For more information, see section VII. Western New York PRISM Activities or the WNY PRISM website.

Behavior across invasion fronts

This project is investigating whether the time since colonization or hydraulic conditions correlate with differences in the behavioral responses of the invasive round goby (*Neogobius melanostomus*). Fish from the newly colonized Lakes Oneida and Cayuga are being compared to fish from Lakes Ontario and Erie, as well as a comparison of upstream and downstream locations on Ellicott and Eighteen Mile Creeks, to determine if differences exist in risk-taking, aggressive, and exploratory behaviors. Determination of behavioral syndromes associated with expanding invasion fronts holds promise as a tool to exploit behavior in slowing the advance of invasive gobies into new habitats.

Two Lake Oneida test gobies chose close proximity to conspecifics, rather than spending time alone in the vacant half of the tank, during shoaling trials.

Nearshore-offshore migration in an invasive fish

Researchers in 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 annual offshore migration and return inshore. The benthic invader departs the nearshore in later fall, moving off to deeper waters (> 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.

Emerald shiner habitat conservation and restoration study in the upper Niagara River: Importance for sport fish, common terns and public education.

In this project we study the emerald shiner's use of the upper Niagara River for spawning, nursery habitat, pathways of migration and year-class formation. Results from habitat use by the shiner will be used to determine

restoration needs to provide enhanced spawning and nursery areas and to diminish impediments to fish movement in the river, such as areas with high water velocity from altered river shorelines like bulkheads and pilings. We are also studying food availability to larval, young-of-the-year and adult shiners as well as their contribution to the diets of sport fish, adult common terns and their offspring. Our focus is to determine critical habitat for reproduction and migration, and to evaluate the influence that these fish have on local sport fish and on the brood success of the common tern. Our results will answer questions about habitat conservation, restoration or possible modification to ensure the long-term success of emerald shiners, sport fish and common terns in the system.

Bioaccumulation of flame retardants and emerging contaminants on fish and wildlife in the Niagara River

We are collecting and analyzing samples at different trophic levels to determine the prevalence of contaminants in fish and wildlife in the Niagara River, particularly those that contain halogenated compounds with a tendency to bioaccumulate. These contaminants are analyzed in water collected near wastewater treatment plants' outflow into the river and in predatory fish and avian and mammal wildlife. We are focusing on pharmaceuticals that enter the river routinely and may affect animal behavior. Our focus will include one of the most commonly prescribed antidepressants, selective serotonin reuptake inhibitors (SSRIs), which may cause impairments in fish and wildlife.

Antidepressant drugs in brains of fish from the Niagara River

We have found significant levels of antidepressant drugs in the brains of various species of fish from the Niagara River. These fish have been exposed to wastewater outflows from treatment plants and they have bioaccumulated these pharmaceuticals in their brains, where they could alter brain activity and behavior. In the next phase of this study, we will examine what metabolites are expressed in the fish brains as a result to exposure to antidepressant drugs. We will also examine the toxicity levels to fish and zooplankton of the drug cocktail commonly found in wastewater effluent.

Former biology graduate student John Lang holds a smallmouth bass collected by electrofishing in 2015. Predator fish caught as part of diet studies for the emerald shiner project were later tested for pharmaceuticals.

Long-term monitoring on Lake Erie

The GLC is 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 2008. During that time, 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, we collect physical limnology data, water samples, and plankton samples biweekly, and benthos monthly. Our efforts represent a significant contribution towards building a database of biotic and abiotic information from sampling stations throughout Lake Erie that describes annual trophic conditions.

Implementation of the Great Lakes Observing System

Since the spring of 2012, the GLC has been a participating member of the Great Lakes Observing System (GLOS), 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.

Grants and Funding

Ongoing grants, including seven newly received in 2017–2018 (Total $14,244,626, including $8,153,924 for Buffalo State)

Ongoing grants

1. Karatayev, A. Y., L. E. Burlakova, and D. Gorsky. Investigating Lake Sturgeon habitat use, feeding ecology, and benthic resource availability in the lower Niagara River. Greenway Ecological Standing Committee. **$835,829**. 2014–2018.
2. 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.
3. Karatayev, A. Y., and L. E. Burlakova. Lake Superior Benthos: Cooperative Science and Monitoring Initiative. U.S. EPA, U.S. Geological Survey. **$150,000**. 2016–2018.
4. Karatayev, A. Y. and L. E. Burlakova. Lake Erie and Lake Michigan Benthos: Cooperative Science and Monitoring Initiative. U.S. EPA, USGS. **$500,000**. 2014–2017.
5. Pennuto, C. M. Administration of the Western New York PRISM (Partnership for Regional Invasive Species Management). Department of Environmental Conservation, New York State. **$1,100,768**. 2012–2017.
6. Pérez-Fuentetaja, A., M. Clapsadl, R. Snyder, T. DePriest, M. Wilkinson, D. Einhouse, A. Hannes, R. Kraft, K. Hastings, and S. Delavan. Emerald shiner habitat conservation and restoration study in the upper Niagara River: Importance for sport fish, common terns and public education. Niagara Greenway Ecological Fund. **$766,488**. 2014–2017.
7. Rudstam, L., A. Y. Karatayev, and L. E. Burlakova. Great Lakes Long-term Biological Monitoring Program. U.S. EPA. **$3,867,525** (**$1,094,726** for Buffalo State). 2012–2017.

Received in 2017–2018

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.
4. Locke, A. and C. M. Pennuto. Slender false brome working group. GLRI, U.S. EPA. **$299,900**. 2017–2019.
5. 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.
6. 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.
7. 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.

Submitted in 2017–2018 (Total $6,832,884, including $ 4,711,747 for Buffalo State)

1. Pennuto, C. M. (one of 8 collaborators from Europe and Canada). Belmont Forum - BiodivERsA International joint call on "Scenarios of Biodiversity and Ecosystem Services." Uniting stakeholder needs and scientific practice to tackle the challenges to biodiversity and ecosystem services caused by invasive species: A multi-continental study of round goby invasions. (Pending). **$2,299,733** (total Euro) (**$178,596**

for Buffalo State). 2019–2021.

2. Pennuto, C. M. Administration of the Western NY Partnership for Invasive Species Management (WNY PRISM). Department of Environmental Conservation, New York State. **$4,234,526**. 2019–2023 (Pending).
3. Pérez-Fuentetaja, A., R. Snyder, M. Clapsadl, T. Lewis, J. Cochran, and J. Jaroz. Increasing resilience to climate change of coastal wetlands in the upper Niagara River (Great Lakes, NY) by preserving aquatic vegetation and native fish from habitat degradation by herbivory. NOAA Coastal Resilience Grants. (Congress did not allocate funds to this program). **$298,625**. 2018.

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. Seventeen manuscripts were published, and another 7 were submitted to peer-reviewed journals. A total of 38 presentations were made by the GLC researches, including 19 presentations at national/international/regional conferences, 7 invited talks, and 12 presentations made in non-refereed venues.

Refereed Journal Publications (published)

1. Arnnok, P., R. R. Singh, R. Burakham, A. Pérez-Fuentetaja, and D. S. Aga. 2017. Selective uptake and bioaccumulation of antidepressants in fish from effluent-impacted Niagara River. *Environmental Science & Technology* 51: 10652-10662.
2. Barbiero, R., B. M. Lesht, G. J. Warren, L. G. Rudstam, J. M. Watkins, E. D. Reavie, K. E. Kovalenko, and A. Y. Karatayev. 2018. A comparative examination of recent changes in nutrients and lower food web structure in Lake Michigan and Lake Huron. *Journal of the Great Lakes Research*. (First on-line).
3. Bossenbroek, J. M., L. E. Burlakova, T. C. Crail, A. Y. Karatayev, R. A. Krebs, and D. T. Zanatta. 2018. Modeling habitat of freshwater mussels (Bivalvia: Unionidae) in the lower Great Lakes 25 years after the *Dreissena* invasion. *Freshwater Science* 36(2). (First on-line) DOI: 10.1086/697738.
4. Bridoux, M. C., M. Sobiechowska, A. Pérez-Fuentetaja, and K. T. Alben. 2017. LC-PDA/APCIitMS identification of algal carotenoid and oxyterol precursors to fatty acid esters in hydrolyzed extracts of the freshwater mussel *Dreissena bugensis*. *Analytical Bioanalytical Chemistry* 409: 6745-6760.
5. Bridoux, M. C., M. Sobiechowska, R. G. Briggs, A. Pérez-Fuentetaja, and K. T. Alben. 2017. Separation and identification of fatty acid esters of algal carotenoid metabolites in the freshwater mussel *Dreissena bugensis*, by liquid chromatography with UV/visible wavelength and mass spectrometric detectors in series. *Journal of Chromatography* A 1513: 93-106. Available online.
6. Bruestle, E. L., C. Karboski, A. Hussey, A. T. Fisk, K. Mehler, C. Pennuto, and D. Gorsky. 2018. Novel trophic interaction between lake sturgeon (*Acipenser fulvescens*) and invasive species in an altered food web. *Canadian Journal of Fisheries and Aquatic Sciences* DOI: 10.1139/cjfas-2017-0282.
7. Burlakova, L. E., K. E. Kovalenko, K. L. Schmude, R. P. Barbiero, A. Y. Karatayev, and B. M. Lesht. 2018. Developing indices of water quality based on the profundal benthic communities of the Great Lakes: traditional and modeling approaches. *Journal of the Great Lakes Research*. (First on-line) DOI: 10.1016/j.jglr.2017.11.004.
8. Burlakova, L. E., R. P. Barbiero, A. Y. Karatayev, S. E. Daniel, E. K. Hinchey, and G. Warren. 2018. The benthic community of the Laurentian Great Lakes: analysis of spatial gradients and temporal trends from 1998–2014. *Journal of the Great Lakes Research*. (First on-line).
9. Burlakova, L. E., E. K. Hinchey, A. Y. Karatayev, and L. G. Rudstam. 2018. U.S. EPA Great Lakes National Program Office Monitoring of the Laurentian Great Lakes: Insights from 40 years of data collection. *Journal of the Great Lakes Research*. (First on-line).
10. Cava, Z., A. McMillan, C. Pennuto, and R. Warren. 2018. Hellbender prey preference is superseded by native and non-native prey behavior. *Journal of Herpetology* 52:162-170.

11. Karatayev, A. Y., L. E. Burlakova, K. Mehler, S. A. Bocaniov, P. D. Collingsworth, G. Warren, R. T. Kraus, and E. K. Hinchey. 2018. Biomonitoring using invasive species in a large lake: *Dreissena* distribution maps hypoxic zones. *Journal of the Great Lakes Research*. (First on-line) Open Access. Available online.
12. Karatayev, A. Y., V. A. Karatayev, L. E. Burlakova, M. D. Rowe, K. Mehler, and M. D. Clapsadl. 2018. Food depletion regulates the demography of invasive dreissenid mussels in a stratified lake. *Limnology and Oceanography*. (First on-line) DOI: 10.1002/lno.10924. Open Access.
13. Karatayev, A. Y., K. Mehler, L. E. Burlakova, E. K. Hinchey, and G. Warren. 2018. Benthic video image analysis facilitates monitoring of *Dreissena* populations across spatial scales. *Journal of the Great Lakes Research*. (First on-line).
14. Karatayev, A. Y., L. E. Burlakova, K. Mehler, R. P. Barbiero, E. K. Hinchey, P. D. Collingsworth, K. E. Kovalenko, and G. Warren. 2018. Life after *Dreissena*: The decline of exotic suspension feeder may have significant impacts on lake ecosystems. *Journal of the Great Lakes Research*. (First on-line).
15. Kovalenko, K. E., E. D. Reavie, R. P. Barbiero, L. E. Burlakova, A. Y. Karatayev, L. G. Rudstam, G. Warren, and J. M. Watkins. 2018. Patterns of long-term dynamics of aquatic communities and water quality parameters in the Great Lakes: Are they synchronized? *Journal of the Great Lakes Research*. (First on-line).
16. Lopes-Lima, M., L. E. Burlakova, A. Y. Karatayev, K. Mehler, M. Seddon, R. Sousa. 2018. Conservation of freshwater bivalves at the global scale: diversity, threats and research needs. *Hydrobiologia* 810: 1-14.
17. Pennuto, C. M., K. A. Cudney, and C. E. Janik. 2018. Fish invasion alters ecosystem function in a small heterotrophic stream. *Biological Invasions* 20:1033-1047.

GLC researchers and our collaborators were featrued in a special edition of *Hydrobiologia*, "Ecology and Conservation of Freshwater Bivalves."

Refereed Journal Publications Submitted (in review)

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). Submitted to: *Nautilus*.
2. Burlakova, L. E., D. Campbell, and A. Y. Karatayev. Status of rare endemic species: molecular phylogeny, biogeography, and conservation of freshwater molluscs *Truncilla macrodon* and *Truncilla cognata* in Texas. Submitted to: *Malacologia*.
3. 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*.
4. Karatayev, V. A., L. E. Burlakova, A. Y. Karatayev, L. Yang, and T. Miller. Habitat loss and advection interactively regulate persistence: maintaining threatened populations while restoring river hydrology. Submitted to: *Biological Conservation*.
5. Lang, J. J. V., R. J. Snyder, M. D. Clapsadl, P. Michalak, L. Kang, and A. Pérez-Fuentetaja. Morphometric differentiation and gene flow in emerald shiners (*Notropis atherinoides*) from the lower Great Lakes and the Niagara River. Submitted to: *Journal of the Great Lakes Research*.
6. Qiao, J., J. F. Atkinson, S. J. Bennett, and A. Pérez-Fuentetaja. Simultaneous measurement of turbulent velocities and fish movement in complex flows using large-scale particle tracking velocimetry and convolutional neural network. Submitted to: *Journal of Computing in Civil Engineering*.
7. 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, and J. D. Allan. Evidence for interactions among environmental stressors in the Laurentian Great Lakes. Submitted to: *Ecological Indicators*.

International/National/Regional Conference Presentations

1. Burlakova, L., A. Y. Karatayev, D. Schloesser, M. Stapanian. Trends in Lake Erie benthos: 1930–2014. 61st Annual Conference on Great Lakes Research. June 18–22, 2018, Toronto, Canada.
2. Burlakova, L. E. A. Y. Karatayev, K. Mehler, V. A. Karatayev, K. Mehler, E. K. Hinchey. Spatial patterns of emerging mussel reefs in the Laurentian Great Lakes and consequences for ecosystems. Ecological Society of America Annual Meeting. August 6–11, 2017, Portland, Oregon, USA.
3. Burlakova, L. E. A. Y. Karatayev, and S. Daniel. Effect of *Dreissena* on benthos of the Laurentian Great Lakes. International Conference on Aquatic Invasive Species. October 22–26, 2017, Fort Lauderdale, Florida, USA.
4. Clapsadl, M., J. Cochran, A. Pérez-Fuentetaja, and R. Snyder. A comparison of larval fish community diversity and growth in developed and undeveloped embayments of the upper Niagara River. Association for the Sciences of Limnology and Oceanography (ASLO). June 10–15, 2018, Victoria, BC, Canada.
5. Collas, F., A. Karatayev, L. Burlakova, and R. Leuven. Dreissenid mussel dispersal through boat hull mediated overland dispersal. International Conference on Aquatic Invasive Species. October 22–26, 2017, Fort Lauderdale, Florida, USA.
6. 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. 61st Annual Conference on Great Lakes Research. June 18–22, 2018, Toronto, Canada.
7. Hinchey, E., L. Burlakova, K. Mehler, M. Corcoran, and S. M. C. Bonina. Distribution of grain size and sediment nutrients in Lake Michigan surface sediments. 61st Annual Conference on Great Lakes Research. June 18–22, 2018, Toronto, Canada.
8. Karatayev, A., L. Burlakova, K. Mehler, V. Karatayev, T. Nalepa, A. Elgin, and E. Hinchey. Underwater video is an effective tool to reveal *Dreissena* spatial distribution. International Conference on Aquatic Invasive Species. October 22–26, 2017, Fort Lauderdale, Florida, USA.
9. Karatayev, A., L. Burlakova, V. Karatayev, K. Mehler, and T. Nalepa. Population dynamics of zebra and quagga mussels in the Great Lakes: Cross-lakes comparison. 61st Annual Conference on Great Lakes Research. June 18–22, 2018, Toronto, Canada.
10. Karatayev, A. Y., L. E. Burlakova, D. K. Padilla. Endangered and invaders: Can introduced species replace lost biodiversity? Ecological Society of America Annual Meeting. August 6–11, 2017, Portland, Oregon, USA.
11. Karatayev, A., L. Burlakova, K. Mehler, V. Karatayev, T. Nalepa, A. Elgin, and E. Hinchey. Underwater video is an effective tool to reveal *Dreissena* spatial distribution. State of Lake Michigan Conference. November 7–10, 2017, Green Bay, Wisconsin, USA.
12. Mehler, K., L. Burlakova, and A. Karatayev. Integrating remote sensing and underwater imagery to enhance invasive *Dreissena* distribution assessment in large rivers. International Conference on Aquatic Invasive Species. October 22–26, 2017, Fort Lauderdale, Florida, USA.

Break out session during the State of Lake Michigan meeting in Green Bay, WI in November 2017.

13. Mehler, K., L. Burlakova, A. Karatayev, T. Nalepa, A. Elgin, and E. Hinchey. Eighty-five years of Lake Michigan benthos: A comparative study. State of Lake Michigan Conference. November 7–10, 2017, Green Bay, Wisconsin, USA.
14. Mehler, K., L. Burlakova, A. Karatayev, C. Pennuto, and S. Ilyushkin. Using underwater imagery to monitor invasive species in the Great Lakes. 61st Annual Conference on Great Lakes Research. June 18–22, 2018, Toronto, Canada.

15. Mitchell, Z. A., L. E. Burlakova, A. N. Schwalb. Are long-term changes in mussel communities in tributaries of the Colorado River basin, TX due to a major drought event? Southwestern Association of Naturalists (SWAN) 65th Annual Conference. April 12–15, 2018.
16. Pennuto, C. M. and E. Gorski. 2018. Size differences in swimming behavior of the round goby from a core area and an invasion front in Lake Ontario. 61st Annual Conference on Great Lakes Research. June 18–22, 2018, Toronto, Canada.
17. Pérez-Fuentetaja, A., M. Clapsadl, R. Snyder, and J. Cochran. Migratory forage fish are a stabilizing force supporting ecosystem resilience: The emerald shiner in the Niagara River. Association for the Sciences of Limnology and Oceanography (ASLO). June 10–15, 2018, Victoria, BC, Canada.
18. Travis, S., A. Pérez-Fuentetaja, and D. Aga. Analysis of emerging and legacy flame retardants in common terns from the Niagara migration flyway using gas chromatography tandem mass spectrometry. Society of Environmental Toxicology and Chemistry (SETAC), North America 38th Annual Meeting. Minneapolis, MN, November 15, 2017.
19. Zyzik, M., L. Burlakova, and A. Karatayev. Compilation of wet-to-dry weight ratios of Great Lakes benthic organisms for long-term monitoring. 61st Annual Conference on Great Lakes Research. June 18–22, 2018, Toronto, Canada.

Invited Talks

1. Burlakova, L., A. Y. Karatayev, K., Mehler. Benthos Program update. Invited talk presented at EPA Great Lakes National Program Office, Chicago. February 14, 2018.
2. Karatayev, A. Y., L. E. Burlakova, K. Mehler, V. A. Karatayev. Preliminary results of *Dreissena* survey in Lake Huron 2017 Cooperative Science and Monitoring Initiative. Invited talk presented at EPA Great Lakes National Program Office, Chicago. February 14, 2018.
3. Mehler, K., S. Ilyushkin, A. Karatayev, and L. Burlakova. Update on the underwater imagery analysis from 2017 CSMI Lake Huron. Invited talk presented at EPA Great Lakes National Program Office, Chicago. February 14, 2018.
4. Mehler, K., Karatayev, A., Burlakova, L. Underwater imagery as a tool to monitor invasive species in the Great Lakes. Invited talk presented at the Evolution, Ecology and Behavior Seminar, University of Buffalo. March 14, 2018.
5. Mehler, K., Karatayev, A., Burlakova, L. Using underwater imagery to monitor invasive species in the Great Lakes. Invited talk presented at the "Lake Ontario Evenings" Speaker Series, Toronto, Canada. June 19, 2018.
6. Pennuto, C.M. The role of behavior in fish invasion success. Cornell Summer Ecology Series, Shackleton Point. July 2017.
7. Pérez-Fuentetaja, A. Research and Education: Ecology of the Niagara River. College Council Meeting. Presentation to Showcase Research at Buffalo State. December 12, 2017.

Presentations at local Conferences and workshops (non-refereed)

1. Karatayev, A., Burlakova, L., Daniel, S., Mehler, K., K. Hastings, and B. Haas. Great Lakes Center is in charge of the largest monitoring of benthic invertebrates in the Great Lakes. 18th Annual Faculty/Staff Research and Creativity Fall Forum, Buffalo State. November 2, 2017 (poster).
2. Mehler, K., L. E. Burlakova, and A. Y. Karatayev. Using underwater video to reveal spatial distribution of invasive mussels in the Great Lakes. 18th Annual Faculty/Staff Research and Creativity Fall Forum, Buffalo State. November 2, 2017 (poster).
3. Locke, A. Aquatic Invasive Species Management Workshop. Lake Erie Seaway Trail Center, Hamburg, New York. July 6, 2017.
4. Locke, A. Asian Longhorned Beetle: Identification, Prevention and Management. St. Bonaventure University Campus Conservationists, St. Bonaventure University, Saint Bonaventure, New York.

September 15, 2017.

5. Locke, A. Great Lakes Slender False Brome Working Group. New York Invasive Species Research Institute, New York State Webinar Series. October 25, 2017.
6. Locke, A. Invasive Species Project Prioritization. New York State Invasive Species Conference, Ithaca, New York. November 15, 2017.
7. Locke, A. Invasive Species Management Planning Workshop. Reinstein Woods Nature Preserve, Depew, New York. December 14, 2017.
8. Locke, A. Keep a Lookout: New invasive species in Western New York. Cornell Cooperative Extension of Allegany County, Rural Landowners Workshop, Yorkshire, New York. March 3, 2018.

Knut Mehler, Lyuba Burlakova, Susan Daniel, and Sasha Karatayev at the 18th Annual Faculty/Staff Research and Creativity Fall Forum at Buffalo State..

9. Locke, A. Preparing for Invasion: Addressing early detection and approaching region species. Niagara Frontier Botanical Society, Amherst, New York. March 13, 2018.
10. Locke, A. Emerging Invasive Species: Volunteer management of early detection species. Cornell Cooperative Extension, Master Gardeners Volunteer Conference, Warsaw, New York. April 6, 2018.
11. Locke, A. Keep a Lookout: New invasive species in Western New York. Genesee Valley Conservancy, Genesee Valley Landowners Workshop, Mt. Morris, New York. April 11, 2018.
12. Locke, A. Invasive Species: Invasive Terrestrial Plants. Cornell Cooperative Extension of Orleans County, Master Gardeners Training Course, Albion, New York. April 12, 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 Ecosystem 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 Ecosystem Science (GLES). The GLES programs provide an opportunity for students to pursue graduate studies through a thesis-based Master of Arts (MA) or 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 2017-2018:

Master of Art:	**Master of Science:**
Michael Borrelli	Zachary Adams
Eric Bruestle	Joseph Bodnarchuk
YingYu Zhang	Jim Damon
	Alyssa Hessler
	Michael Radomski
	Sean Ryan
	Yusheng Ye
	Morgan Zyzik

Advising Undergraduate and Graduate Students

- Lyubov Burlakova was the major professor for the Integrative Graduate Education and Research Traineeship Ph.D. Program (Isabel Porto Hannes), State University of New York at Buffalo. She was also a faculty Mentor/Advisor for GLES MS students Morgan Zyzik and Jim Damon, and a member of the graduate committee for Erik Bruestle in the GLES MA program at Buffalo State.
- Alexander Karatayev was a member of the Graduate Committee for a Ph.D. student at State University of New York at Buffalo (Isabel Porto Hannes).
- Mark Clapsadl was a committee member for two graduate students.
- Knut Mehler was a member of the Graduate Committee for Eric Bruestle in the MA Great Lakes Ecosystem Science Graduate Program.
- Chris Pennuto was the advisor of one graduate student and a committee member for four graduate students.
- Alicia Pérez-Fuentetaja was the advisor for one graduate student and a committee member for one graduate student.

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 2017–2018, we invited 8 speakers to present talks at our seminar series, including:

1. Mark Rowe, NOAA. "Upwelling and downwelling dynamics influence spatial patterns of hypoxia and nearshore hypoxia events in the central basin of Lake Erie." October 2, 2017.
2. Martin Stapanian, U.S. Geological Survey. "Land cover types as predictors of wetland vegetation quality." October 30, 2017.
3. Ed Rutherford, NOAA. "Disentangling *Dreissena* mussels effects on larval fish growth, survival, condition, and potential recruitment in Great Lakes ecosystems." November 13, 2017.
4. Katya E. Kovalenko, NRRI, University of Minnesota, Duluth, MN. "Patterns of long-term dynamics of aquatic communities and water quality parameters in the Great Lakes: Are they synchronized?" December 13, 2017.
5. Hannah Fazekas, Wright State University, Dayton, OH. "Attached algae as indicators of stream ecosystem function in headwaters of the Lake Erie watershed." March 19, 2018.
6. Leon Katona, Wright State University, Dayton, OH. "Estimates of depth-specific benthic primary productivity in Lake Erie and Lake Huron." March 19, 2018.
7. Catherine Riseng, University of Michigan, Ann Arbor, MI. "The Great Lakes Aquatic Habitat Framework: a spatial framework, ecosystem classification and tools to meet the needs of Great Lakes management and research." April 23, 2018.
8. Isabel Porto-Hannes, University at Buffalo. "Use of molecular genetics for the conservation of species of concern." April 30, 2018.

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:

- Coordinator of the Great Lakes Center and Biology Department Seminar Series.
- Member of Committee, Vision for the Great Lakes Center.
- Helped to organize the Great Lakes Center Open House (October 2017).
- Assisted in publishing Great Lakes Center 2015–2016 Annual Report (November 2016).
- Hooder, 146th Commencement at Buffalo State, May 19, 2018.
- Helped in preparation of the Great Lakes Center 2016–2017 Annual Report.
- Participated in the Great Lakes Center retreat, May 24, 2018.
- Member of the Buffalo State's "The Friends of the Maud Gordon Holmes Arboretum."
- Invited Julianna Ducato, a 13-year-old student from Saint Benedict's school in Amherst to shadow GLC researchers, March 13, 2018.
- Participated in preparation of the State of the Great Lakes 2017 and 2019 reports.
- Attended meeting with GLNPO in Chicago to present current progress on the ongoing projects and discuss future research and grant opportunities.
- Participated in 2017 Great Lakes Biology Monitoring Program Assessment, U.S. EPA GLNPO, Chicago, IL, May 30, 2017.
- Participated in the International Workshop to explore the effect of biological invasions on aquatic ecosystems in Belarus and in North America, Cornell Biological Field Station, July 2017.
- 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.
- Co-editor of the Special Issue of *Hydrobiologia* on Ecology and Conservation of Freshwater Bivalves.
- Main Editor of the Special Issue of *Journal of Great Lakes Research*, "U.S. EPA GLNPO Great Lakes Monitoring."
- Co-chair of the session, "Long-term Monitoring: Achievements, challenges, and solutions," at the 61st Annual Conference on Great Lakes Research, June 18–22, 2018, Toronto, Canada.
- Session Presider, "COS 81 - Communities: Spatial Patterns and Environmental Gradients," 2017 ESA Annual Meeting, August 9, 2017.
- Member of Freshwater Mollusk Conservation Society *ad hoc* International Committee.
- Member of the Association for the Sciences of Limnology and Oceanography, the International Association for Great Lakes Research, the Ecological Society of America, and the Freshwater Mollusk Conservation Society.
- Reviewed a proposal for Michigan Sea Grant, July 2017.
- Reviewed 11 proposals for IAGLR Ph.D. Scholarship Committee, February 2018.
- Reviewed manuscripts for *Journal of the Great Lakes Research*, *Freshwater Science*, *Global Change Ecology*, *Limnology & Oceanography*, *North American Journal of Aquaculture*, *Southwestern Naturalist.*

Mark Clapsadl:

- Participated in and supervised the Lake Erie Long-Term Lower Trophic Level Monitoring Project.
- Played a key role in the Dock and Shoreline Improvement Project, working with Facilities Planning staff, as well as engineers, consultants, and contractors.
- Worked with outside groups to help connect Buffalo State to the local high school to provide local students experience that will enrich their education and as well to create awareness of opportunities to enroll at Buffalo State after completing high school.
- Served on the Project Advisory Committee for the Regional Niagara River Lake Erie Watershed Management Plan.
- Provided significant support to numerous GLC research projects, as well as support to outside agencies and organizations.

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).
- Oversaw Laboratory Safety Training for GLC Employees, September 4, 2017.
- Donated two trees to campus to commemorate graduation and beautify the campus.
- Invited Julianna Ducato, a 13-year-old student from Saint Benedict's school in Amherst to shadow GLC researchers, March 13, 2018.
- Presented at the annual Career Exploration Fair at Lovejoy Discovery School #43 on March 21, 2018.
- U.S. Student Board Member of the International Association for Great Lakes Research.
- Publications Committee, International Association for Great Lakes Research.
- Awards Committee Co-Chair, International Association for Great Lakes Research.
- Participated in benthic presentation to public during tours on R/V *Lake Guardian* with U.S. EPA officials, Duluth, Minnesota, August 2017.
- Trained Benthic Taxonomy to Visiting Collaborator Michael Spears and student from UW-Madison.
- Volunteered with UUP Campus Cleanup, April 2018.

Susan Dickinson:

- Assisted in preparation of the Great Lakes Center Annual Report for publication.
- Organized Great Lakes Center Open House, October 2017.
- Assisted in preparation of the Great Lakes Center, Biology Department and Great Lakes Ecosystem Science Program Seminar Series.
- Help to organized Great Lakes Center retreat, May 24, 2018.
- Organized a passenger van safe driving course.
- Organized move of WNY PRISM offices from the GLC Field Station to Buffalo State campus.
- Volunteer, SPCA of Niagara.

- **Brian Haas:**
- Provided assistance for the U.S. EPA Great Lakes Long-term Biological Monitoring grant, including benthic collection on the R/V *Lake Guardian* for 2 weeks in August 2017, benthic sorting, and data entry.
- Assisted in the field work pertaining to the Lake Erie Lower Trophic Level Monitoring Project through biweekly sampling from May through October.
- Collected specimens for the Emerald Shiner Project and cared for them at the Field Station until swimming trials could be performed.
- Helped graduate and undergraduate students from Buffalo State and University at Buffalo collect samples and specimens needed for their research.
- Offered support to local agencies including the NYSDEC and USFWS through general assistance and the use of the Field Station grounds and boat launch.
- Provided maintenance and repair to equipment and assets located at the Great Lakes Field Station including but not limited to boats, vehicles, and field and lab equipment.
- Aided in the remodeling of the Field Station conference room.
- Assisted with field trips and Field Station visits for a variety of audiences. Took local high school students from Riverside Academy out onto the upper Niagara River in one of our boats.
- Ensured faculty and staff were able to effectively use our facilities for a variety of purposes.
- Trained 2 new students working on the Emerald Shiner project on boat safety, trailering, species identification, and electrofishing techniques.
- Provided personalized career advice to graduating Buffalo State students.

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.
- Played a key role in producing two issues of the GLC Newsletter (editor) and revamping the GLC website.
- Wrote multiple articles for GLC Newsletter series.
- Assisted in preparation of the GLC Annual Report publication.
- 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).
- Participated in benthic samples collection for Lake Huron CSMI aboard the R/V *Lake Guardian*.
- QAQC manager for the Great Lakes Benthos Barcoding grant.
- Provided instructional support on field sampling procedures for multiple Buffalo State classes.
- Aided in the remodeling of the Field Station conference room.
- Member of the Institutional Animal Care and Use Committee.
- Sustainability Council member.
- Member of WNY GIS User Group and NYS GIS Association.
- Presented at the annual Career Exploration Fair at North Park Middle Academy #66 on March 15, 2018.
- Volunteered with Buffalo Niagara Waterkeeper to plant shrubs along Gill Creek in Niagara Falls, April 2018.
- Volunteered with UUP Campus Cleanup, April 2018.
- Trained volunteer for the CommuniTree Steward Project, a collaboration between Cornell Cooperative Extension of Erie County and the City of Buffalo.

Alexander Karatayev:

- Organized Great Lakes Center Open House, October 2017.
- Published Great Lakes Center 2015–2016 Annual Report, September 2017.
- Organized Great Lakes Center retreat, May 24, 2018.
- Personnel Committee member, Biology Department.
- Wrote multiple articles for GLC Newsletter series.
- Member of the Buffalo State's "The Friends of the Maud Gordon Holmes Arboretum."
- Participated in preparation of the State of the Great Lakes 2017 and 2019 reports.
- Attended meeting with GLNPO in Chicago to present current progress on the ongoing projects and discuss future research and grant opportunities.
- Participated in 2017 Great Lakes Biology Monitoring Program Assessment, U.S. EPA GLNPO, Chicago, IL, May 30, 2017.
- Participated in an International Workshop to explore the effect of biological invasions on aquatic ecosystems in Belarus and in North America, July 2017, Cornell Biological Field Station.
- 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.
- Co-editor of the Special Issue of *Hydrobiologia* on Ecology and Conservation of Freshwater Bivalves.
- Co-editor of the Special Issue of *Journal of Great Lakes Research*, "U.S. EPA GLNPO Great Lakes Monitoring."
- Chair of the sessions "Impacts III" and "Information Management" at the International Conference on Aquatic Invasive Species, October 22–26, 2017, Fort Lauderdale, Florida, USA.
- Co-chair of the session, "Long-term monitoring: Achievements, challenges, and solutions," at the 61st Annual Conference on Great Lakes Research, June 18–22, 2018, Toronto, Canada.
- Reviewed 13 papers for IAGLR's "Best Paper Award 2017."
- Campus Representative for the Great Lakes Research Consortium.
- Member of Freshwater Mollusk Conservation Society *ad hoc* International Committee.
- Multiple interviews for various mass media.
- Member of the Association for the Sciences of Limnology and Oceanography, the International Association for Great Lakes Research, the Freshwater Mollusk Conservation Society, the Ecological Society of America.
- Reviewed manuscripts for *Ecology*, *Journal of Molluscan Studies*, and *Journal of the Great Lakes Research*.

Knut Mehler:

- Helped to organize the Great Lakes Center Open House, October 2017.
- Helped in preparation of the Great Lakes Center 2016–2017 Annual Report.
- Participated in the Great Lakes Center retreat, May 24, 2018.
- Wrote multiple articles for GLC Newsletter series.
- Participated in the 1st Annual Career Exploration Fair at the Marva J. Daniel Futures Preparatory School, Buffalo, May 15, 2018.
- Participated in the Patchwork Lecture Series at Rustbelt Bookstore, Buffalo. May 17, 2018.
- Participated in preparation of the State of the Great Lakes 2017 and 2019 reports.

- 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.
- Co-editor of the Special Issue of *Hydrobiologia* on Ecology and Conservation of Freshwater Bivalves.
- Session-chair of the session, "Seeing below the surface: Quantifying the underwater environment with image analysis," at the 61st Annual Conference on Great Lakes Research. June 18–22, 2018, Toronto, Canada.
- Member of the Association for the Sciences of Limnology and Oceanography, the International Association for Great Lakes Research, the Nevada Water Resources Association, the American Society of Limnology and Oceanography, the Society of Freshwater Science.
- Reviewed a proposal for NOAA's National Centers for Coastal Ocean Science 2018 Coastal Hypoxia Research Program (CHRP), March 2018.
- Reviewed a proposal for the National Science Center Poland, March 2018.
- Reviewed manuscripts for *Journal of the Great Lakes Research*, *Limnology & Oceanography*, *Biological Invasions*, *Management of Biological Invasions*.

Christopher Pennuto:

- Curriculum Committee Chair, Biology Department.
- Admissions Committee Chair for GLES Master Programs.
- College Personnel Committee.
- Reviewed manuscripts for *Ecotoxicology*, *Biological Invasions*, *Aquatic Invasions*, *Canadian Journal of Zoology*, *Ecology of Freshwater Fish*.
- Student judge, IAGLR.

Alicia Pérez-Fuentetaja:

- Graduate Committee Chair, Biology Department.
- Chair of the Committee for Great Lakes Center Vision.
- Multiple national and international press, radio and TV interviews for our publication on antidepressants in fish brains from the Niagara River.
- Testified for the Erie County Legislature Energy and Environment Committee on a bill for the Erie County Pharmaceutical Pollution Act.
- Member of the Steering Committee for the International Ramsar Denomination for the Niagara River as an important site for biodiversity.
- Reviewed articles for *Journal of Great Lakes Research*, and *The Science of the Total Environment*.

V. Professional Development Activities

Lyubov Burlakova:

- Completed CITI On-line Ethics Training, October, 2017.
- Completed Conflict of Interest Training, October, 2017.

Brian Haas:

- Completed conflict of interest training through the CITI (Collaborative Institutional Training Initiative) program.
- Completed training at a Blanding's Turtle Habitat Workshop at SUNY Potsdam.
- Completed a course in Limnology at Buffalo State.
- Built upon my knowledge of benthic organisms and learned techniques for measuring and weighing *Dreissena* and oligochaetes.
- Trained on and became proficient using the bomb calorimeter.
- Developed a firm understanding of the Field Station's major components including the HVAC and water treatment system.

Susan Daniel:

- Completed online management class to prevent discrimination and harassment in the workplace, June 4, 2018.
- Completed online ethics training, October 13, 2017.

Kit Hastings:

- Attended training course, "The times are changing – Strategies to personally manage transitions at work," on October 26, 2017.
- Attended training course, "Setting the stage for quality audio and video," on November 9, 2017.
- Attended GIS Day (WNY GIS Users Group) on November 15, 2017.
- Attended training course, Intro to ArcGIS Pro, on November 16, 2017.
- Attended training course, "Learn basic American Sign Language: Helping to connect the deaf and hearing communities together," on January 17, 2018.
- Completed CITI Conflict of Interest training on February 20, 2018.
- Completed online management class to prevent discrimination and harassment in the workplace, June 5, 2018.

Alexander Karatayev:

- Completed CITI On-line Ethics Training, October, 2017.
- Completed Conflict of Interest Training, October, 2017.

Knut Mehler:

- Completed CITI On-line Ethics Training, October, 2017.
- Completed Conflict of Interest Training, October, 2017.
- Completed online management class to prevent discrimination and harassment in the workplace, June, 2018.

VI. Field Station Activities

This year we intiated several facilities improvement projects. First, we completed the construction of the Dock, Ramp, and Shoreline Improvement Project, the largest station improvement project to take place here in over 20 years. With completion of this project our boat ramp is now functional in all water level conditions. Improvements to our existing dock include the addition of a floating dock system, creating a space to safely tie boats in all weather conditions, as well as installing a wheelchair ramp for accessibility. We also installed stone revetment along the shoreline south of the boat ramp, greatly improving the aesthetics of the facility. Funding for this project was provided by the NYS Department of Environmental Conservation, the Oishei Foundation and the SUNY construction fund. We are very grateful for all the campus staff that have helped secure funding for this work and for shepherding the project through the complex process of design, contract awards and construction. In addition to this project, we (mostly Brian Haas) have replaced the support structures of the research tanks in the Fish Lab. Kit Hastings and Brian Haas also oversaw much of the work for our conference room remodeling project.

The Field Station before (left) and after (right) recent dock and shoreline improvements. More pictures of the project can be found in the front cover of this report.

We were also recently funded through the Niagara River Greenway Commission ($94,104) to begin work on the Osprey Nesting Platform and Habitat Enhancement Project. This project will see the installation of an osprey nesting platform, purple martin houses and multiple large-scale plantings that will serve to provide food, cover and nesting sites for migrating and local birds. We are working with the Buffalo Public Schools to leverage the maximum educational opportunities of this project. Through this project, we will be providing opportunity for hundreds of BPS students annually to engage in and learn about natural ecosystems.

Research Vessels

We have a rigorous regular maintenance program in place 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

- BIO 315 Ecology class was given a limnology equipment demonstration and lecture in the fall.
- GES 460 was given a limnology equipment demonstration and lecture in the spring.
- Provided laboratory support for two graduate student projects.

Research Activities

- Installed and operated the GLOS (Great Lakes Observing System) 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 logistics for 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.

Outreach

- Hosted multiple Buffalo Niagara Waterkeeper kayaking touring events for public education.
- Provided multiple field trips to Buffalo school system high school students.
- 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.

Our new dock covered in ice from Lake Erie this spring.

Left: Conference room before renovation. Right: Conference room after renovation. New carpet, paint, and cabinets were installed.

VII. Western New York PRISM Activities

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 provides a significant service to the greater Buffalo community and western New York. A partnership organization focused on invasive species management, WNY PRISM's mission is to address invasive species priorities using a coordinated partnership network, for which we provide leadership, information management, and collaboration opportunities. Invasive species pose a significant threat to our environment, economy, and human health. By fostering regional collaboration, the impacts of invasive species are minimized and the natural resources and beauty of western New York will be preserved. We have increased Buffalo State's profile within both the professional and public communities through state and regional meeting, workshops, and extensive education and outreach. We have also presented at and attended various Buffalo State events. For more information on WNY PRISM and the invasive species impacting western New York, visit our website.

Ongoing Projects

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. The office hires seasonal crew members each summer to aide in its management and restoration efforts, in addition to employing a full-time Coordinator and Projects Manager. Additional seasonal staff include Watercraft Inspection Stewards. The office coordinates management activities and public outreach efforts among a wide diversity of partners in the region, including NGOs, state and federal agencies, and academic institutions.

Buffalo River Watershed Environmental Stewardship.

This project involved the creation of a stewardship worker program and Buffalo River streambank restoration. WNY PRISM provided multiple training modules for program participants including invasive species identification, an introduction to invasive species ecology, use of iMapInvasives and development of management plans. WNY PRISM also worked alongside partners to develop and implement a streambank restoration project along the Buffalo River at Silo City.

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 finished project will include six acres of restored vernal pool communities, surrounded by a deer exclosure fence to ensure successful establishment of native plant communities.

WNY PRISM removing common buckthorn from Tifft Nature Preserve as part of theTifft Nature Preserve Vernal Pool Restoration Project (August 2017). Credit: WNY PRISM

Eastern 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 Eastern Slender False Brome Working Group will provide 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 that are 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.

Crew member Heather Zimba cuts common buckthorn at Bergen Swamp. Credit: WNY PRISM

The WNY PRISM Strategic Plan identifies six goals including:

1. Partner/Network Coordination,
2. Information Management,
3. Education and Outreach,
4. Prevention, Early Detection,
5. Management,
6. Habitat Restoration

The following is a brief description of WNY PRISM accomplishments within the past year, provided by WNY PRISM coordinator, Andrea Locke.

Partner/Network Coordination

- Held two Full Partner Meetings.
- Held Quarterly Steering Committee Meetings.
- Participated in PRISM Leader's Quarterly Meetings and Monthly webinar series.
- Participated in Great Lakes Action Agenda Meetings.
- Participated in *Hydrilla* Collaborative and NYS *Hydrilla* Meetings.
- Participated in NYS Invasive Species (IS) Priorities Setting Meetings.

Spring Partner Meeting held at Reservoir State Park in April 2018. Credit: WNY PRISM

- Participated in NYS Comprehensive Invasive Species Management Plan Meetings.
- Participated in NYS Invasive Species Documentary Planning Meetings.

- Participated in WNY and Chautauqua County Forest Pest Taskforces.
- Participated in Great Lakes *Phragmites* Collaborative Advisory Committee and worked with *Phragmites* Adaptive Management Framework to bring training to western New York.
- Released Call for 2018 Partner Crew Project Requests, accepted and reviewed requests with Steering Committee.
- Posted, interviewed and hired 2018 Summer Seasonal Positions (1 E&O, 2 ISMA, 2 WIS).
- Distributed funding opportunities to partnership through listserv and assisted with project/proposal development.
- Provided Letters of Support to multiple Partners seeking grant funds.

Information Management

- Mapped invasive species at 8 sites including surveys at multiple Chautauqua Watershed Conservancy preserves.
- Provided Survey Summaries and Management Recommendations to Partners.
- Provided iMapInvasives Training for NYSFOLA Region 1, 2017 & 2018 Spring Training Blitz and PUSH Buffalo worker training program.
- Provided management recommendations for multiple Partners to begin project planning.
- Identified data gaps with iMapInvasives for 2018 project planning.

iMap Spring Training Blitz Workshop held at Iroquois National Wildlife Refuge in May, 2018. Credit: WNY PRISM

- Reached out to partners through listserv requesting information on invasive species activities implemented in 2017 and to identify new and ongoing research needs.
- Held Conservation Targets Working Group Meetings.
- Released bi-monthly 'Round-Up' through listserv featuring News, Grant Opportunities and Events in WNY.
- Posted resource documents on website: Contractors, Private Lands Programs, and Native Plant Suppliers.
- Updated grant and funding resource—available on website.

Education and Outreach

- Held Aquatic Invasive Species Workshop.
- Released Fall and Spring eNewsletters.
- Interviewed by multiple media outlets for invasive species stories: '2 the Outdoors', NPR - Great Lakes Today, and local NBC segment on high Lake Erie water temperatures and related impacts on invasive species.

- Staffed PRISM Table/Display at multiple outreach events including Reinstein Woods Fall Festival and Spring into Nature.
- Coordinated ISAW Planning for WNY PRISM Region.
- Submitted surveys and data from WNY ISAW events to ISCS.
- Held Education and Outreach Working Group Meetings.
- Updated website with blog posts and new invasive species information.
- Developed WNY PRISM Lending Library.
- Presented over 20 programs on invasive species issues and management.

Prevention

- Developed Watercraft Inspection Stewardship Program for 2018 implementation.
- Provided programs on Asian Long-horned Beetle including tree tagging events.
- Continued Boot Brush Station Pilot Project and Research: collected seed from 5 project locations, to be grown out in Buffalo State's greenhouse.
- Included prevention messaging in all education and outreach efforts.

Early Detection and Rapid Response

- Conducted Early Detection site monitoring for 15 identified sites including 5 species.
- Developed Japanese stiltgrass (*Microstegium vimineum*) outreach program with Town of Aurora and Village of Aurora to address infestation identified in 2017.
- Held Great Lakes Slender False Brome Working Group Meetings and implemented Great Lakes Slender False Brome Working Group Project.
- Collected and submitted herbarium specimens for early detection species.
- Conducted site assessment for new early

Lucy Nuessle in the emerald ash borer costume at Tifft Nature Preserve's Insectival in August, 2017. Credit: WNY PRISM

A boot brush station installed at a trail head near slender false brome infestations. Credit: WNY PRISM

Great Lakes Slender False Brome Working Group Project Manager, Brittany Hernon, presented on slender false brome at the well attended Bergen Swamp Preservation Society Meet and Greet held in April, 2018. Credit: WNY PRISM

detection report for water hyacinth and removed all visible plants.

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.
- Crew Assistance Program: completed the identified 2017 projects and reviewed, prioritized and selected projects for 2018.
- Provided summaries of Summer Crew Projects to Partners.
- Implemented invasive species removal projects and volunteer workdays including, but not limited to, Seneca Bluffs and Franklin Gulf County Parks, North Tonawanda Audubon Preserve, Woodlawn Beach State Park, Bergen Swamp, and Fuhrman Fen.
- Implemented common buckthorn removal as part of Tifft Nature Preserve Vernal Pool Restoration Project.
- Implemented invasive species removal as part of PUSH Buffalo Watershed Stewardship Worker Training Program.

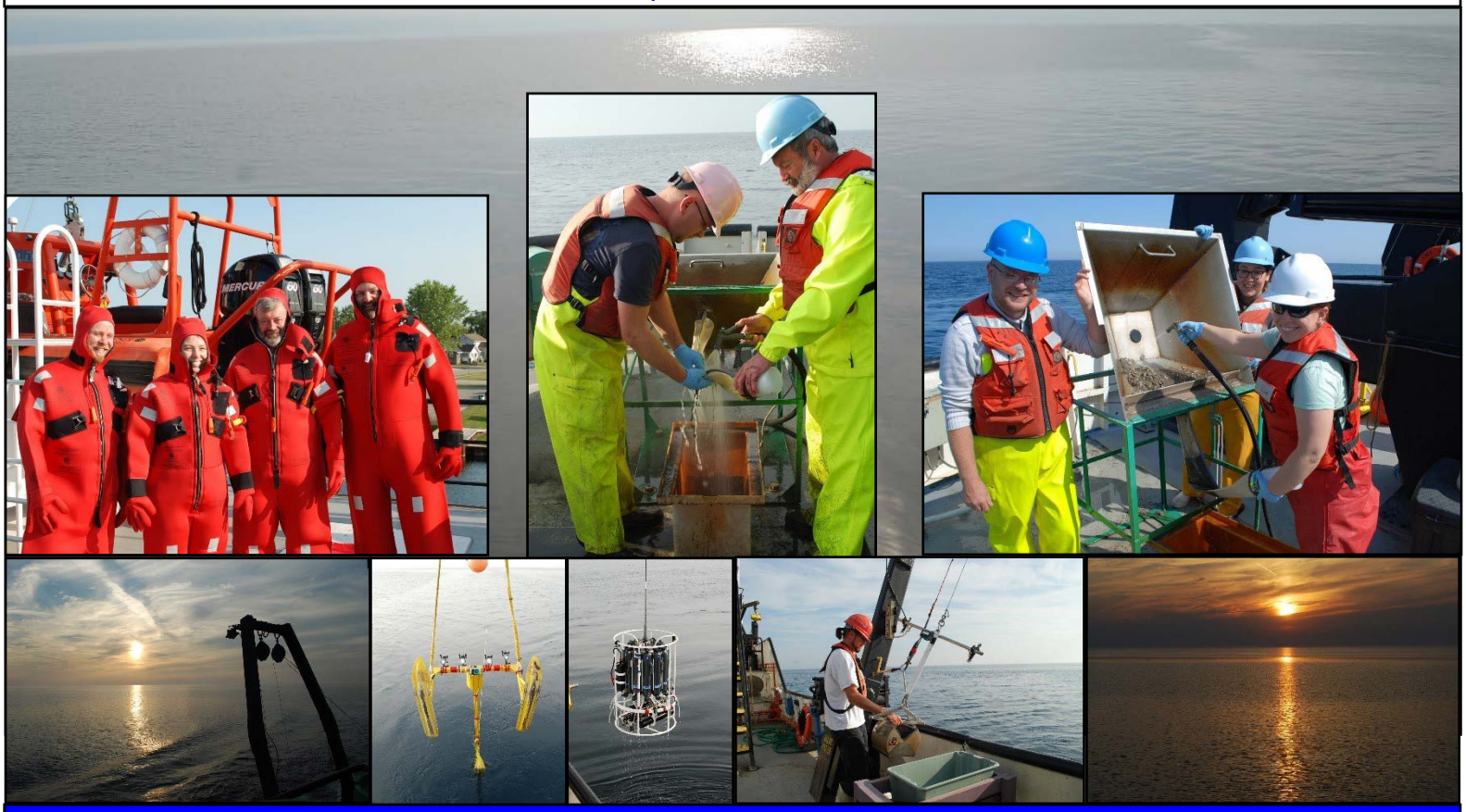
Additional Program Elements

- Completed and released 2017 Annual Report.
- Developed and released 2018 Annual Work Plan.
- Received funding through GLRI and EPA for slender false brome working group and through USFS for invasive shrub removal on priority conservation lands.

In September, 2017, WNY PRISM worked with partners to install native plants at Seneca Bluffs, in areas where the WNY PRISM Crew removed invasive species. Credit: WNY PRISM

Great Lakes Long-term Biological Monitoring Program
Cooperative Science and Monitoring Initiative
Lake Huron Benthic Survey

September 2017



GLRI-funded Project:
DNA Barcode Reference Library: Mollusca, Annelida, and minor phyla