The Great Lakes Center

Annual Report 2013-2014

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Buffalo State
State University of New York




Emerald Shiners in the Upper Niagara River

2013-2014




Lake Sturgeon in the Lower Niagara River

Spring 2014




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 **9** peer-reviewed papers, **5** papers were accepted and **7** papers were submitted for publication.
- We presented **22** talks, including: **12** at national/international/regional conferences, **4** invited talks, and **6** presentations in non-refereed venues.
- We submitted **10** grant proposals (total requested amount **$2,736,352**, including **$1,772,615** for Buffalo State).
- **Twelve** projects for research and education (including multi-year grants) are currently funded in the GLC totaling **$9,473,935**, including **$4,862,868** for Buffalo State.
- We also added **three** employees to our GLC staff. In 2014 we hired a new postdoc Knut Mehler to work on a benthic habitat assessment for lake sturgeon in the lower Niagara River. Andrea Locke will be the coordinator for the Western New York Partnerships for Regional Invasive Species Management (WNY PRISM) office. We also hired Wendy L. Paterson as a research technician in the Benthic Ecology Lab.
- International Exchange graduate student Frank Collas from the Netherlands conducted experiments with zebra and quagga mussels in our Field Station facility during the spring of 2014.
- Two new graduate programs in Great Lakes Ecosystem Science have finally been approved. In 2013/2014 we already had **15** students enrolled in these programs.

I. Staff

This year we suffered a great loss when research scientist Jagat Mukherjee died from a heart attack. He was a good scientist and a great colleague. We will deeply miss Jagat.

In 2014 we hired Knut Mehler from Germany as our new postdoc, Western New York Partnerships for Regional Invasive Species Management (WNY PRISM) coordinator Andrea Locke, and research technician Wendy L. Paterson.

GLC Personnel

Director:	Alexander Karatayev
Research Scientists:	Subodh Kumar
	Lyubov Burlakova
	Jagat Mukherjee
	Christopher Pennuto
	Alicia Pérez-Fuentetaja
	Knut Mehler
	Thomas Hahn (part time)
Research Technicians:	Susan Daniel
	Wendy L. Paterson
Secretary:	Cathleen Nasca
Field Station Personnel:	Mark Clapsadl, Manager
	Kit Hastings, Technician
	Joshua Fisher, Technician
WNY PRISM Coordinator:	Andrea Locke
WNY PRISM Seasonals:	Jerry Krajna (Buffalo State)
	Angela Klinczar (Miami University of Ohio)
	Andrew Stadler (SUNY ESF)
	Patrick Gormley (Niagara University)
Research Assistants:	Brianne Tulumello (SUNY Buffalo State)
	Keith Pawlowski (SUNY Buffalo State)
	Jacob Bajdas (SUNY Buffalo State)
	Odiri Ruth Agunu (SUNY Buffalo State)
	Steve Sliwinski (SUNY Buffalo State)
	Kayode Olorunfemi (SUNY Buffalo State)
	Vadim Karatayev (Cornell University)
	Jacob Cochran (SUNY Buffalo State)
	Christopher Osborne (SUNY Buffalo State)
	John Lang (SUNY Buffalo State
	Steve Fleck (SUNY Buffalo State)
	Hulgrid Gourgue (SUNY Buffalo State)

GLC Affiliates (at SUNY Buffalo State)

- Randal Snyder, Associate Professor, Biology Department
- Howard Riessen, Professor, Biology Department
- Gary Pettibone, Professor, Biology Department
- Daniel L. Potts, Assistant Professor, Biology Department
- Robert J. Warren, Assistant Professor, Biology Department
- Stephen Vermette, Professor, Geography and Planning Department
- Mary Perrelli, Geography and Planning Department
- Jill Singer, Professor, Earth Sciences and Science Education Department and Director of the Office of Undergraduate Research
- Jude Sabato, Assistant Professor, Earth Sciences and Science Education Department
- Catherine Lange, Assistant Professor, Earth Sciences and Science Education Department

GLC Adjunct Professors

- Dimitry Gorsky, Fish Biologist, U.S. Fish and Wildlife Service
- Martin A. Stapanian, Research Ecologist, U.S. Geological Survey
- Zy Biesinger, Fish Biologist, U.S. Fish and Wildlife Service

Collaborators

In New York State

- Daniel Molloy, State University of New York at Albany
- Denise Mayer, New York State Museum Field Research Laboratory
- Dianna Padilla, Department of Ecology and Evolution, State University of New York, Stony Brook University
- Lars Rudstam, Cornell University
- Joseph Makarewicz, Environmental Science and Biology, State University of New York in Brockport
- Joe Atkinson, Environmental Engineering, State University of New York at Buffalo
- Howard Lasker, Department of Geology, State University of New York at Buffalo
- Mary Alice Coffroth, Department of Geology & Graduate Program in Evolution, Ecology and Behavior, State University of New York at Buffalo
- Amy Mahar, New York State Department of Environmental Conservation, Avon, NY
- Jenny Landry, Region 8 Bureau of Wildlife, New York State Department of Environmental Conservation, Avon, NY
- Mike Goehle, US Fish and Wildlife Service
- Gregory Boyer, State University of New York, College of Environmental Science and Forestry, Syracuse
- David Campbell, The Paleontological Research Institution, Ithaca, NY
- Robert Baier, State University of New York at Buffalo
- Diana S. Aga, Chemistry Department, State University of New York at Buffalo

- Katherine Alben, Wasdworth Institute, Albany
- James Watkins, Cornell Biological Field Station, Cornell University
- Clifford Craft, Department of Natural Resources, Cornell University
- Jim Haynes, Biology & Environmental Science, SUNY College at Brockport
- Tim DePriest, NY Deptartment of Environmental Conservation
- Michael Wilkinson, NY Deptartment of Environmental Conservation
- Donald Einhouse, NY Deptartment of Environmental Conservation
- Andrew Hannes, US Army Corps of Engineers
- Renata Kraft, Buffalo Niagara Riverkeeper
- Kerry Gallo, Buffalo Niagara Riverkeeper
- Sarah Delavan, Department of Engineering, University at Buffalo

At Other US Institutions

- Jake Vander Zanden, Center for Limnology, University of Wisconsin, Madison, Wisconsin
- David Zanatta, Biology Department, Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan
- Daelyn A. Woolnough, Biology Department, Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan
- Bob Krebs, Department of Biology, Geology, Environmental Science, Cleveland State University, Cleveland, Ohio
- Jonathan Bossenbroek, Department of Environmental Sciences, University of Toledo
- Mary Walsh, Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy
- Elizabeth Meyer, Pennsylvania Natural Heritage Program
- Marsha May, Texas Nature Trackers, Wildlife Diversity Branch, Texas Parks and Wildlife Department, Austin, Texas
- Robert Gottfried, Texas Parks and Wildlife Department, Austin, Texas
- Thomas D. Miller, Lamar Bruni Vergara Environmental Science Center, Laredo Community College, Texas
- David J. Berg, Department of Zoology, Miami University, Ohio
- Brian Lang, Biologist, New Mexico Department of Game and Fish, New Mexico
- Charles Randklev, Texas Water Resources Institute, Texas A&M Institute of Renewable Natural Resources, San Antonio, Texas
- Michael R. Kidd, College of Arts and Sciences, Texas A&M International University, Laredo, Texas
- Donald Jerina, Laboratory of Bioorganic Chemistry NIDDK, National Institutes of Health, Bethesda, Maryland
- Kenneth Laali, Chemistry Department, Kent State University, Kent, Ohio
- David De Marini, Environmental Carcinogenesis Division (B-143-06), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina
- Kenneth Krieger, National Center for Water Quality Research, Heidelberg University, Tiffin, Ohio
- Jack Kramer, National Center for Water Quality Research, Heidelberg University, Tiffin, Ohio
- Gerald Matisoff, Department of Geological Sciences, Case Western Reserve University, Cleveland, Ohio
- Darren Bade, Kent State University, Kent, Ohio
- Christine Mayer, Department of Environmental Sciences and Lake Erie Center, University of Toledo, Ohio
- Don W. Schloesser, USGS, Great Lakes Science Center, Ann Arbor, Michigan
- Dima Beletsky, Cooperative Institute for Limnology and Ecosystems Research, University of Michigan, Ann Arbor, Michigan
- Thomas Nalepa, The Graham Sustainability Institute, University of Michigan, Ann Arbor, Michigan
- Tom Bridgeman, University of Toledo, Toledo, Ohio
- Glenn Warren, US EPA, Great Lakes National Program Office, Chicago, Illinois
- Elizabeth Hinchey Malloy, US EPA Great Lakes National Program Office, Chicago, Illinois
- Richard P. Barbiero, CSC and Loyola University, Chicago, Illinois
- Pawel Michalak, Bioinformatics Institute, Virginia Tech

International

- Demetrio Boltovskoy, University of Buenos Aires, Argentina
- Sergey Mastitsky, Integrative Bioinformatics and Systems Biology (iBioS), German Cancer Research Center, Heidelberg University, Germany
- Manuel Lopes-Lima, ICBAS - Abel Salazar Biomedical Sciences Institute, Laboratory of Ecophysiology, CIIMAR - Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Portugal
- Jan Ciborowski, Department of Biological Sciences, University of Windsor, Windsor, Ontario, Canada
- Renata Claudi, RNT Consulting Inc., Ontario, Canada
- Rob Leuven, Radboud University, Nijmegen, the Netherlands
- Frances Lucy, Institute of Technology, Sligo, Ireland
- Richard Soare, Department of Geography and Planning, Concordia University, Montreal, Canada
- Norman Yan, York University, York, Ontario, Canada
- Tamara A. Makarevich, Department of General Ecology, College of Biology, Belarusian State University, Minsk, Belarus

Frank Collas, international graduate student from Radboud University (the Netherlands), checking his experimental chambers in the field station plankton lab. During his visit in spring 2014, he was interested in the mechanisms and environmental factors determining the detachment of dreissenid mussels.

II. Research Activities

Current Projects

Monitoring of benthic invertebrates in the Great Lakes

The Great Lakes Center, in collaboration with Cornell University, was awarded a US EPA Great Lakes Long-term Biological Monitoring grant for 2012-2017. 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 from 2013 to 2017, analyze this data, and make it available to environmental and fisheries managers. Additional research projects include evaluation of early detection system for invasives, and evaluation of biotic indices of ecosystem health. We have identified the benthic samples collected in 2012, and in August 2013 collected over 200 benthic samples from all Great Lakes aboard the EPA's R/V *Lake Guardian*. Our preliminary results were presented on the 57th Annual Conference of the International Association for Great Lakes Research in May 2014. (Photo page at back of report.)

Round goby impacts on tributary stream leaf litter decomposition

The round goby has been implicated in the alteration of both macroinvertebrate and fish communities in tributary streams to the Great Lakes. This project assessed whether an invasive invertivorous, benthic fish-mediated trophic cascade (fish predator to insect shredders/grazers to microbial communities to leaf breakdown) influences microbial community structure. This was the first application of community respiration profiling to assess a possible cascade effect on microbes in a stream ecosystem. Continued research is investigating if round goby impacts on crayfish might also affect litter decomposition.

Graduate student Stephen Tentinger setting up a goby/crayfish exclosure study to investigate leaf break down dynamics.

Long-term changes in *Dreissena* spp. populations in Lake Erie.

Lake Erie has the longest history of colonization by both *Dreissena polymorpha* and *D. rostriformis bugensis* in North America, and is therefore optimal for the study of long-term dynamics of dreissenid species. *Dreissena* spp. distribution in Lake Erie varied depending on the time since the initial invasion, collection depth, and lake basin. During 2009-2012, quagga mussels were found at all depths and in all basins, while zebra mussels were common in the western basin only, and in the central and eastern basins were limited to shallow depths, resulting in an almost complete replacement of *D. polymorpha* with *D. r. bugensis* in the deep parts of the lake. In the shallow western basin of Lake Erie, zebra mussels represented >30% of the combined dreissenid density even after more than 20 years of coexistence. We found a sharp and significant decline in quagga mussel density and biomass in 2009-2012 that could be explained by *Dreissena* density-dependent processes, predation, or by a geographical sampling bias. Patterson et al. (2005) sampled the northern littoral zone of the eastern basin with extensive limestone outcroppings and high *Dreissena* density, while in 2009-2012 we sampled the southern littoral zone dominated by sand with low *Dreissena* density. In summer of 2014 we are going to collect over 300 *Dreissena* samples to determine the current status of zebra and quagga mussel populations in Lake Erie.

Changes in Lake Erie benthos over the last 50 years: 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 1930-1960s, to nutrient and pollution abatement in the 1970s, and then the introduction of exotic dreissenids in the 1980s. There was a significant temporal trend in community

composition changes from 1963 to 2012, and the largest difference was found between pre- and post-dreissenid invasion communities. Currently the lake-wide benthic community is dominated by dreissenids both in density (41%) and total wet biomass (97%), followed by oligochaetes and chironomids. The number of exotic species found in benthic surveys increased every decade, from 1 in 1963 to 10 in 2009-2012, and the majority of the invaders were molluscs. Whereas the role of benthic invaders in community diversity is still low, their impact has had enormous consequences for the whole ecosystem. In summer of 2014 we will participate in the Lake Erie Intensive Study to evaluate the lake's benthic community and compare its diversity and abundance to historical data.


Invasive *Dreissena* and native *Hexagenia* – the best known benthic species in Lake Erie.

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

Great Lakes Center researchers have been awarded a grant by the Niagara Greenway Ecological Fund to investigate lake sturgeon habitat use, feeding ecology and benthic resource availability in the Lower Niagara River for 2014-2017 (principal investigators Alexander Karatayev, Lyubov Burlakova, and Dimitry Gorsky from the USFWS). The lower Niagara River provides habitat to one of the few remnant populations of lake sturgeon in the lower Great Lakes. Evidence shows that this population may be in recovery, but information about diet and habitat use in this unique system is lacking. In this project we will study the diversity, distribution and density of benthic forage resources and the biology and ecology of lake sturgeon in the lower Niagara River. We will also determine lake sturgeon movement patterns, habitat use, and diet in the lower Niagara River and relate it to our benthic habitat analysis to determine substrate and habitat preferences and to predict a carrying capacity for lake sturgeon in the lower Niagara River. Our study will produce an assessment of food availability and habitat preferences of lake sturgeon in relation to restoration of the local population. This information will help researchers and managers develop opportunities to protect and enhance habitat to advance lake sturgeon recovery in the lower Niagara River. (Photo page at front of report.)

Conservation of native freshwater mussel refuges in Great Lakes coastal zones

Since the introduction of dreissenid mussels into the Laurentian Great Lakes in the late 1980s, the diverse native mussel communities of the region have declined sharply. However, there have been several locales identified as refuges in coastal and nearshore areas. During the last 3 years within this large collaborative project funded by the U.S. Fish and Wildlife Service we surveyed over a total of 198 sites at 88 locations in bays, coastal wetlands, and drowned river mouths in the lower Great Lakes region and collected 4,329 individual unionids of 26 species. While species assemblages in the lakes have shown major shifts, these findings are especially encouraging given that surveys shortly after the dreissenid invasion pointed toward total extirpation of the unionid fauna. We also found that the number and weight of dreissenids attached to unionid shells is tenfold fewer than in the early stages of invasion, indicating that the adverse impact of dreissenids on unionids has declined. We developed

models based on unionid presence/absence and habitat characteristics in unionid refuges to identify addition refuge locations and successfully applied it during Lake Ontario surveys. In summer 2012-2013, Isabel Porto Hannes (University at Buffalo) and GLC staff surveyed the U.S. part of Lake Ontario and obtained samples from other states to determine the phylogenetic relationship between *Lampsilis radiata* and *L. siliquoidea*, the levels of intermixing, and gene flow at different spatial scales. This information will help managers develop conservation strategies to sustain existing populations in these refuges. For more information please check the Great Lakes Unionid Refuge Project.

Isabel Porto Hannes, Susan Daniel, and others measuring unionids from Honeoye Creek, NY, July 2013. Also, *Lampsilis siliquoidea* in Nottawasaga River, Canada.

Long-term changes in the distribution range and population size of endangered Rio Grande endemic mollusc *Popenaias popeii*

The Texas Hornshell (*Popenaias popeii*) is listed as a Species of Greatest Conservation Need in Texas and New Mexico, as Endangered in both states, and is a candidate for listing in both states under the federal Endangered Species Act. Using an opportunity provided by US FWS for bilateral species conservation effort in New Mexico and Texas, we studied the current distribution and population densities of the unionid *P. popeii* endemic to the Rio Grande in Texas, and developed a method to reconstruct the historical range and population size of species to evaluate changes in the population's size and distribution range over the last 100 years. Sampling over 250 sites in four rivers, constituting the entire historical range of *P. popeii*, we found that the species has been extirpated from two rivers, a 76% decrease in the combined total length of the rivers populated by the mussel, and an 85% overall decline in the population size of *P. popeii*. The remaining population of this species in the Rio Grande is fragmented, with only one 190 km stretch between Laredo and Eagle Pass still supporting a high density of *P. popeii* in Texas.

Team of researchers and students from Great Lakes Center, Laredo Community College, and Texas International A&M University in Laredo studying Texas hornshell in the Rio Grande at the mark-recapture site, March 2014.

Invasion risk assessment for Ponto-Caspian fishes to the Great Lakes

A majority of invasive species discovered in the Great Lakes since 1994 are native to the Ponto-Caspian region, including species that have had strong negative impacts in the Great Lakes (for example, dreissenid mussels and the round goby). The rich biota of the Ponto-Caspian region coupled with a high volume of commercial shipping traffic strongly suggests that this region will continue to be a major source of invasive species to the

Great Lakes. To assess invasion risk in Ponto-Caspian fishes that had not been included in previous studies, we reviewed English-language publications and untranslated European literature (published primarily in Russian), focusing on physiological and ecological traits that have proven useful in previous risk assessments. We then used discriminant analysis to identify fishes that had a high probability of becoming established, spreading, and having significant negative impacts in the Great Lakes. Our updated listing of high-risk Ponto-Caspian fishes includes five species identified previously (the Black and Caspian Sea sprat, Eurasian minnow, big-scale sand smelt, European perch, and monkey goby) and five additional species (the Black sea shad, Caspian tyulka, Volga dwarf goby, Caspian bighead goby, and black-striped pipefish). Of these ten species, four (the monkey goby, big-scale sand smelt, Caspian tyulka, and black-striped pipefish) are likely to survive ballast water exchange as eggs, larvae, or adults based on salinity tolerances. Our results can be used to focus ongoing surveillance and rapid response efforts by highlighting Ponto-Caspian fishes that are of greatest risk of becoming established and having significant negative impacts in the Great Lakes.

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 high water velocity areas from altered river shorelines (bulkheads, pilings, etc). 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 the shiner's 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. (Photo page at front of report.)

Mark Clapsadl deploying a probe in December 2013 to monitor the temperature of the mouth of a tributary of the upper Niagara River, a likely place for emerald shiners to shelter from colder water in the spring.

Lake Erie Lower Trophic Level Assessment

The Great Lakes Center is an active member of the Forage Task Group of the Great Lakes Fishery Commission, represented by Dr. Alicia Perez-Fuentetaja. We have participated in a long term monitoring study in eastern Lake Erie since 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, we collect physical limnology data, water samples, and plankton samples biweekly, and benthos three times per season. 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.

Kit Hastings collecting a vertical profile with a multiparameter sonde, May 2014. There was still some ice on Lake Erie during this sample collection.

Implementation of the Great Lakes Observing System

Since spring of 2012 the GLC has been participating member of the Great Lakes Observation System (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 GLOS has been made by operating an observation buoy five miles offshore of Dunkirk, NY. This buoy records and transmits real time measurements of water temperature, wind speed, wave height, dissolved oxygen as well as 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

Alcohol and its role in PAH-induced carcinogenesis

Efforts are in progress to understand the tumor promoting mechanism of alcohol in PAH-induced carcinogenesis. Interference with PAH-induced cellular protective response of cell cycle arrest/apoptosis and the role of the transcription factor p53 has been implicated in this regard.

Role of long chain saturated fatty acids in cellular protective response of apoptosis against PAH-induced carcinogenesis

Efforts are in progress to decipher a new mechanistic insight with regard to the role of saturated fatty acids in PAH-induced apoptosis in p53-independent manner. In this context we will examine the effect of modulation of lipid metabolism on PAH-induced apoptosis response.

Long chain fatty acids as chemo-preventive agents against PAH-induced carcinogenesis

Studies undertaken include examination of the effect of long chain saturated fatty acids on PAH-induced tumorigenesis. In this context we will examine the regulation of fatty acid desaturase and AGPAT-9 which are involved in fatty acid metabolism.

Research on microbiome

We are also involved in developing a new area of research in the field of microbiome. It has recently been recognized that human organs harbor commensal bacteria (microbiomes) which outnumber human cells. There is emerging evidence that these commensal bacteria may be playing important role in maintaining healthy organs free of diseases including cancer, such as, skin cancer and breast cancer. The present aim is to identify these probiotic microorganisms and underlying mechanism by which these microorganisms protect human skin and breast from developing cancer.

Jagat Mukherjee with a student in the new Environmental Toxicology lab in the SAMC building, November 2013.

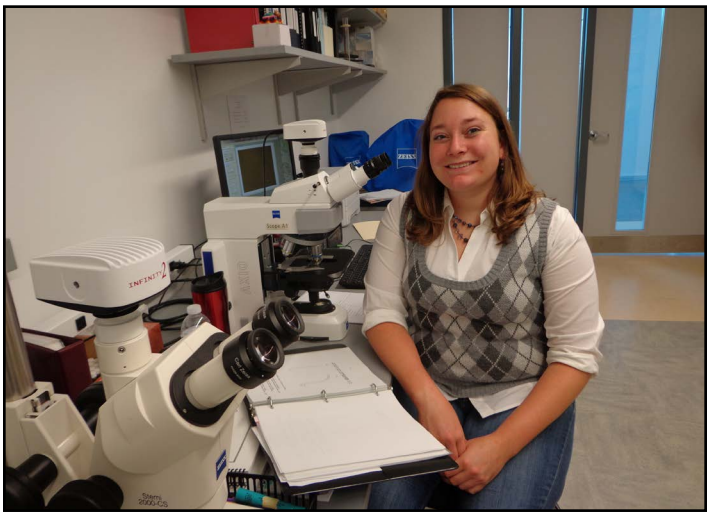
Grants and Funding

Ongoing Grants (Total $9,473,935, including $4,862,868 for Buffalo State)

1. Burlakova, L. E., A. Y. Karatayev, M. E. May, and B. Lang. Survey of Texas Hornshell populations in Texas. U.S. Fish and Wildlife Service, and Texas Parks and Wildlife Department, Traditional Section 6, Bilateral species conservation effort in New Mexico and Texas. **$143,000**. 2011-2014.
2. Hahn, T. and A. Y. Karatayev. Effects of multiple acoustic scattering from realistic oceanic bubble and fish assemblages. **$151,468**. 2011-2013.
3. 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**. 2014-2017.
4. Karatayev, A. Y. and M. Clapsadl. Implementation of the Great Lakes Observing System. US Department of Commerce. **$87,678**. 2011-2014.
5. Mukherjee, J. J., and S. Kumar. Alcohol and PAH-induced carcinogenesis. National Institutes of Health. **$147,000**. 2012-2014.
6. Pennuto, C. M., A. Y. Karatayev, A. Pérez-Fuentetaja, L. E. Burlakova, D. Bade, G. Matisoff, J., Kramer, and C. Mayer. The Lake Erie Nearshore and Offshore Nutrient Study (LENONS). U.S. EPA Great Lakes Restoration Initiative 2010. **$615,813**. (**$365,101** for Buffalo State). 2010-2013.
7. 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.
8. Pérez-Fuentetaja, A., M. Clapsadl, R. Snyder, T. DePriest, M. Wilkinson, D. Einhouse, A. Hannes, R. Kraft, D. Potts, K. Hastings, 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**. 2014-2016.
9. Pérez-Fuentetaja, A., M. Clapsadl, R. Snyder, T. DePriest, M. Wilkinson, D. Einhouse, A. Hannes, R. Kraft, D. Potts, K. Hastings, S. Delavan. Emerald shiner habitat conservation and restoration study in the upper Niagara River: importance for sport fish, common terns and public education. Great Lakes Remedial Action Plan. US Army Corps of Engineers. **$1,331,247** (Funds are in-kind). 2014-2016.
10. Rudstam, L., A. Y. Karatayev, L. E. Burlakova. Great Lakes Long-term Biological Monitoring Program. U.S. EPA. **$3,867,525** (**$1,094,726** for Buffalo State). 2012-2017.
11. Snyder, R. J., L. E. Burlakova, D. B. MacNeill, and A. Y. Karatayev. Enhanced early detection of invasive Ponto-Caspian fishes in the Great Lakes. U.S. EPA Great Lakes Restoration Initiative. **$99,756**. 2012-2013.
12. Zanatta, D., L. E. Burlakova, A. Y. Karatayev, R. Krebs, M. Hoggarth, F. de Szalay, J. Bossenbroek, E. Meyer, and M. Walsh, Collaborators: M. Schlesinger, R. Haas, T. Crail, P. Badra, N. Welte, and L. Holst. Conservation of native freshwater mussel refuges in Great Lakes coastal zones. Great Lakes Fish and Wildlife Restoration Act FY 2010. **$327,363** (**$71,054** for Buffalo State). 2010-2013.

Submitted in 2013-2014 (Total $2,736,352, including $1,772,615 for Buffalo State)

1. Aga, D. S., T. Wood, B. J. Brownawell, A. McElroy, A. Perez-Fuentetaja, W. O. Khunjar. Contaminants: collaborations in understanding tisks of emerging contaminants. SUNY 4E Network of Excellence: Energy, Environment, Education and Economics. **$149,992**. 2014. C.U.R.E. (Not Funded).
2. Burlakova L. E., A. Y. Karatayev, M. E. May, and B. Lang. Survey of Texas Hornshell populations in Texas. Texas Parks and Wildlife Department Section 6. **$162,000**. 2014-2017. (Pending).
3. Karatayev, A. Y., L. E. Burlakova. Lake Erie and Lake Michigan Benthos: Cooperative Science and Monitoring Initiative. U.S. EPA. **$500,000**. 2014-2016. (Awarded).
4. Kapuscinski, K. L, Crane, D., Clapsadl, M. D, and D. Einhouse. Energetic changes in forage fishes of nearshore areas of the Great Lakes and implications for predator growth and mortality. Great Lakes Fishery Trust. **$68,954**. (Not for Buffalo State). 2014. (Pending).
5. Kapuscinski, K. L, Crane, D., Clapsadl, M. D, and D. Einhouse. Quantifying and comparing energy densities of native and invasive nearshore forage fishes of the Great Lakes. Great Lakes Fishery Commission. **$94,266**. (Not for Buffalo State). 2014. (Not Funded).
6. Kumar, S. and J. J. Mukherjee. Elucidating the role of human skin microbiome in benzo[a]pyrene-induced DNA. National Institutes of Health. **$347,500**. 2014. (Not Funded).
7. Kumar, S. and J. J. Mukherjee. Cellular protective response to PAH-induced DNA damage. National Institutes of Health. **$347,500**. 2014. (Not Funded).
8. Kumar, S. and J. J. Mukherjee. Cellular protective response of apoptosis against carcinogenic PAHs. National Institutes of Health. **$147,000**. 2014. (Not Funded).
9. Randklev, C. R., J. H. Kennedy, N. Johnson, L. E. Burlakova, and A. Y. Karatayev. Surveys of endangered freshwater mussels in Texas. The Texas Comptroller of Public Accounts (subcontract from Texas A&M Agrilife Research). **$899,891** (**$99,374** for Buffalo State). 2014-2016. (Awarded).
10. Pennuto, C. M. and J. Haynes. Has the benthic macroinvertebrate community in southwestern Lake Ontario changed since the round goby (*Neogobius melanostomus*) invasion? Great Lakes Research Consortium, Small Grants Program. **$19,249**. (Pending).



Susan Daniel identifying oligochaete worms for the Great Lakes Long-term Biological Monitoring project. Brianne Tulumello is processing a benthic sample to separate out the different types of benthic invertebrates from the sediment.

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. Nine manuscripts were published, another 5 were accepted for publication and/or published online, and 7 were submitted to peer-reviewed journals. A total of 22 presentations were made by the GLC researches, including: 12 presentations at national/international/regional conferences, 4 invited talks, and 6 presentations were made in non-refereed venues.

Refereed Journal Publications (published)

1. Karatayev, V. A., A. Y. Karatayev, L. E. Burlakova, and D. K. Padilla. 2013. Lakewide dominance does not predict the potential for spread of dreissenids. *Journal of Great Lakes Research* 39: 622-629.
2. Karatayev, A. Y., L. E. Burlakova, and D. K. Padilla. 2014. General overview of zebra and quagga mussels: what we do and do not know. In T. F. Nalepa and D. W. Schloesser (eds.) Quagga and Zebra Mussels: Biology, Impacts, and Control. 2nd Edition. CRC Press, Boca Raton, FL. pp. 695-703.
3. Mastitsky, S. E., A. Y. Karatayev, and L. E. Burlakova. 2014. Parasites of aquatic exotic invertebrates: identification of hazards posed to the Great Lakes. *Human and Ecological Risk Assessment* 20: 743-763
4. Mayer, C. M., L. E. Burlakova, P. Eklöv, D. Fitzgerald, A. Y. Karatayev, S. A. Ludsin, S. Millard, E. L. Mills, A. P. Ostapenya, L. G. Rudstam, B. Zhu, and T. V. Zhukova. 2014. Benthification of freshwater lakes: exotic mussels turning ecosystems upside down. In T. F. Nalepa and D. W. Schloesser (eds.) Quagga and Zebra Mussels: Biology, Impacts, and Control. 2nd Edition. CRC Press, Boca Raton, FL. pp. 575-586.
5. Mukherjee, J. J. and S. Kumar. 2013. DNA synthesis inhibition in response to benzo[a]pyrene dihydrodiol epoxide is associated with attenuation of p34cdc2: Role of p53. *Mutation Research* 755: 61-67.
6. Pérez-Fuentetaja, A. and J. Wuerstle. 2014. Prey size selection and feeding ecology of an omnivorous invader: *Hemimysis anomala*. *Journal of Great Lakes Research* 40(2): 257–264.
7. Pérez-Fuentetaja, A., M. D. Clapsadl, and W. T. Lee. 2014. Comparative role of dreissenids and other benthic invertebrates as links for type-E botulism transmission in the Great Lakes. In T. F. Nalepa and D. W. Schloesser (eds.) Quagga and Zebra Mussels: Biology, Impacts, and Control. 2nd Edition. CRC Press, Boca Raton, FL. pp. 705-712.
8. Randklev, C. R., E. T. Tsakiris, M. S. Johnson, J. Skorupski, L. E. Burlakova, J. Groce, and N. Wilkins. 2013. Is False Spike, *Quadrula mitchelli* (Bivalvia: Unionidae), extinct? First account of a very recently deceased individual in over thirty years. *The Southwestern Naturalist* 58: 247-259.
9. Snyder, R. J., L. E. Burlakova, A.Y. Karatayev, and D. B. MacNeill. 2014. Updated invasion risk assessment for Ponto-Caspian fishes to the Great Lakes. *Journal of Great Lakes Research* 40: 360-369. DOI: 10.1016/j.jglr.2014.03.009.

Refereed Journal Publications (accepted/in press)

1. Burlakova, L. E., A. Y. Karatayev, C. Pennuto, and C. Mayer. 2014. Changes in Lake Erie benthos over the last 50 years: historical perspectives, current status, and main drivers. *Journal of Great Lakes Research*. DOI: 10.1016/j.jglr.2014.02.008.
2. Karatayev, A. Y., L. E. Burlakova, C. Pennuto, J. Ciborowski, V. A. Karatayev, P. Juette, and M. Clapsadl. 2014. Twenty five years of changes in *Dreissena* spp. populations in Lake Erie. *Journal of Great Lakes Research*. DOI: 10.1016/j.jglr.2014.04.010.
3. Karatayev, A. Y., L. E. Burlakova, and D. K. Padilla. 2014. Zebra versus quagga mussels: a review of their spread, population dynamics, and ecosystem impacts. *Hydrobiologia*. DOI: 10.1007/s10750-014-1901-x
4. Karatayev V. A., A. Y. Karatayev, L. E. Burlakova, and L. G. Rudstam. Eutrophication and *Dreissena* invasion as drivers of biodiversity: a century of change in the mollusc community of Lake Oneida. *PLOS ONE*.
5. Pennuto, C. M., L. E. Burlakova, A. Y. Karatayev, J. Kramer, A. Fisher, and C. Mayer. 2014. Spatiotemporal

characteristics of nitrogen and phosphorus in the benthos of nearshore Lake Erie. *Journal of Great Lakes Research*. DOI: 10.1016/j.jglr.2014.02.013.

Refereed Journal Publications Submitted (in review)

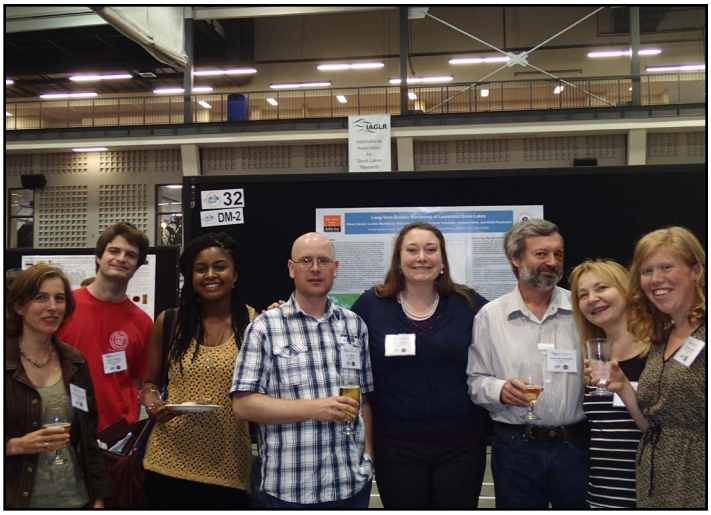
1. Burlakova, L. E., B. L. Tulumello, A. Y. Karatayev, R. A. Krebs, D. W. Schloesser, D. T. Zanatta, W. L. Paterson, T. A. Griffith, M. W. Scott, and T. Crail. Twenty-five years of *Dreissena* spp. impacts on native Unionidae in the lower Great Lakes: dreissenid species matters. Submitted to: *Biological Conservation*.
2. Karatayev, A. Y., L. E. Burlakova, S. E. Mastitsky, and D. K. Padilla. Predicting the spread of aquatic invaders: insight from 200 years of invasion by zebra mussels, Submitted to: *Ecological Applications*.
3. Karatayev, A., D. Boltovskoy, L. Burlakova, and D. Padilla. Parallels and contrasts between *Limnoperna fortunei* and *Dreissena* species. In: *Limnoperna fortunei*: the ecology, distribution and control of a swiftly spreading invasive fouling mussel.
4. Lopes-Lima, M., R. Sousa, J. Geist, D. C. Aldridge, R. Araujo, J. Bergengren, Y. Bespalaja, E. Bodis, L. Burlakova, D. Van Damme, K. Douda, E. Froufe, D. Georgiev, C. Gumpinger, A. Karatayev, U. Kebapci, I. Killeen, J. Lajtner, B. M. Larsen, R. Lauceri, A. Legakis, S. Lois, S. Lundberg, E. Moorkens, G. Motte, K.-O. Nagel, P. Ondina, A. Outeiro, M. Paunovic, V. Prie, T. von Proschwitz, N. Riccardi, M. Rudzīte, M. Rudzītis, C. Scheder, M. Seddon, H. Sereflisan, V. Simić, S. Sokolova, K. Stoeckl, J. Taskinen, A. Teixeira, F. Thielen, T. Trichkova, S. Varandas, H. Vicentini, K. Zajac, T. Zajac, S. Zogaris. Conservation status of freshwater mussels in Europe: state of the art and future challenges. Submitted to: *Biological Reviews*.
5. Pennuto, C. M. and M. Smith. From midges to spiders: mercury biotransport in riparian zones near the Buffalo River Area of Concern (AOC), USA. Submitted to: *Ecotoxicology*.
6. Pennuto, C. M., L. Dayton, D. Kane, and T. Bridgeman. Lake Erie nutrients: from watersheds to open water. Submitted to: *Journal of Great Lakes Research*.
7. Pérez-Fuentetaja, A., S. A. Mackintosh, L. R. Zimmerman, M. D. Clapsadl, M. Alaee, D. S. Aga. PBDEs in the food web of Lake Erie (Great Lakes): Do non-native species contribute to their bioaccumulation? Submitted to: *Canadian J. Fisheries and Aquatic Sciences*.

International/National/Regional Conference Presentations

1. Burlakova, L. E, A. Y. Karatayev, B. L. Tulumello, D. T. Zanatta, F. E. Lucy, and S. E. Mastitsky. *Dreissena* impacts on Unionidae: a synthesis of trends in North America and Europe and recent findings from the lower Great Lakes World Congress of Malacology. July 22-26, 2013, Azores, Portugal.
2. Burlakova, L. E., A. Y. Karatayev, C. Pennuto, and C. Mayer. Changes in Lake Erie benthos over the last 50 years: historical perspectives, current status, and main drivers. 7th biennial meeting of the Lake Erie Millennium. The status of Lake Erie: management needs and research questions. October 29-31, 2013. University of Windsor, Windsor, Canada.
3. Burlakova, L. E., A. Y. Karatayev, C. Pennuto, and C. Mayer. Changes in Lake Erie benthos over the last 50 years: historical perspectives, current status, and main drivers. 57th Annual Conference on Great Lakes Research. May 26-30, 2014, Hamilton, Ontario, Canada**.**
4. Clapsadl, M., K. Hastings, and A. Karatayev. Hypoxia event in the eastern basin of Lake Erie: Intrusion of anoxic water 2013. International Society of Limnology. 32nd Congress, August 4-9. Budapest Hungary.
5. Daniel, S., L. Burlakova, A. Karatayev, B. Tulumello, J. Fisher, K. Hastings, and K. Pawlowski. Long-Term Benthic Monitoring of Laurentian Great Lakes. 57th Annual Conference on Great Lakes Research. May 26-30, 2014, Hamilton, Ontario, Canada.
6. Karatayev, A. Y., L. E. Burlakova, and D. K. Padilla. The most aggressive freshwater invaders: Parallels, contrasts, spread, and ecosystem impacts of zebra and quagga mussels. World Congress of Malacology. July 22-26, 2013, Azores, Portugal.
7. Karatayev, A. Y., L. E. Burlakova, and D. K. Padilla. Spread, population dynamics and ecosystem impacts of zebra versus quagga mussels. 57th Annual Conference on Great Lakes Research. May 26-30, 2014,

Hamilton, Ontario, Canada.

8. Pennuto, C. M., K. Cudney, C. Janik, and A. Fischer. 2014. Stream macroinvertebrate communities and leaf litter processing are changed by the presence of round gobies in Lake Erie tributary streams. 57th Annual Conference on Great Lakes Research. May 26-30, 2014, Hamilton, Ontario, Canada.
9. Pennuto, C. M. 2014. Biomonitoring for environmental quality. 22nd Annual Rural Landowner workshop. Yorkshire, NY.
10. Pennuto, C. M. and S. Bachman. 2014. Connecting partners around emerging invasive species issue: from taskforces to the web-based i-MapInvasives. 22nd Annual Rural Landowner workshop. Yorkshire, NY.
11. Pérez-Fuentetaja, A. and F. Goodberry. 2013. Daphnia's challenge: survival and reproduction when calcium and food are limiting. International Society of Limnology. 32nd Congress, Budapest, Hungary. August 8, 2013.
12. Pérez-Fuentetaja, A., M. Clapsadl, C. Pennuto, and C. Mayer. 2014. Inter-annual dynamics of nutrients and plankton in Lake Erie. 57th Annual Conference on Great Lakes Research. May 26-30, 2014, Hamilton, Ontario, Canada.



GLC researchers and students at the 57th Annual Conference on Great Lakes Research (IAGLR) in Hamilton, Ontario, in May 2014..

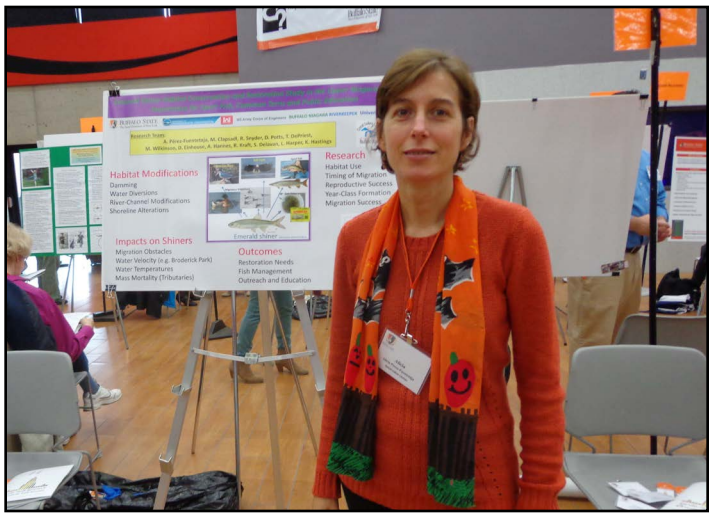

Lyubov Burlakova and Manuel Lopes-Lima (Portugal) at the World Congress of Malacology in Azores, July 2013.

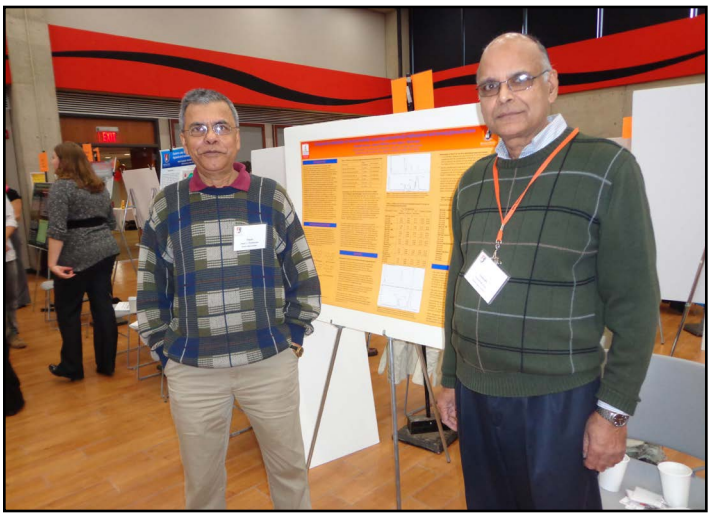
Invited Talks

1. Burlakova, L. E., and A. Y. Karatayev. Biogeography and conservation of freshwater mussels (Bivalvia: Unionidae): drivers of diversity and threats in Texas. February 4, 2014, Berry College Biology Seminar, Rome, Georgia.
2. Karatayev, A. Y., T. D. Miller, and L. E. Burlakova. Long-term changes in the distribution range and population size of endemic unionid bivalve *Popenaias popeii*. February 4, 2014 at Berry College Biology Seminar, Rome, Georgia.
3. Pérez-Fuentetaja, A. 2014. Invited talk. The changing ecology of the Great Lakes: Contaminants and sex in the aquatic world. Phi Beta Kappa. March 19, 2014.
4. Pérez-Fuentetaja, A. Emerald shiner habitat conservation and restoration study in the Upper Niagara River: Importance for sport fish, common terns and public education. Lake Erie–Upper Niagara River Angler Outreach Event. New York State Department of Environmental Conservation. Woodlawn Beach State Park Lodge. June 17, 2014.

Conference Presentations (non-refereed)

1. Burlakova, L., A. Karatayev, S. Daniel, B. Tulumello, J. Fisher, K. Hastings, and K. Pawlowski. Great Lakes Center participates in EPA's Long-Term Biological Monitoring of Great Lakes. 14th Annual 2013 Faculty and Staff Research and Creativity Fall Forum, SUNY Buffalo State, October 31, 2013.
2. Gourgue, H. and A. Pérez-Fuentetaja. *Daphnia*'s nutrient allocation in soft water-high food conditions. 16th annual Student Research and Creativity Celebration, SUNY Buffalo State, April 28, 2014.
3. Kumar, S., J. Williams, and J. J. Mukherjee, Comparative metabolism of environmentally occurring phenanthro[3,4-b]thiophene and benzo[c]phenanthrene. 14th Annual 2013 Faculty and Staff Research and Creativity Fall Forum, SUNY Buffalo State, October 31, 2013.
4. Pawlowski, K., L. E. Burlakova, and A. Y. Karatayev. Do quagga mussels (*Dreissena rostriformis bugensis*) found in shallow and deep environments differ in their wet to dry weight ratios? 16th annual Student Research and Creativity Celebration, SUNY Buffalo State, April 28, 2014.
5. Pérez-Fuentetaja, A. Emerald Shiner habitat conservation and restoration study in the Upper Niagara River: Importance for sport fish, common terns and public education. The 14th Annual Faculty and Staff Research and Creativity Fall Forum. Thursday, October 31, 2014
6. Thomas, M., Z. Beisinger, J. Deller, M. Hosack, P. Kocovsky, T. MacDougall, J. Markham, A. Pérez-Fuentetaja, E. Weimer, and L. Witzel. 2014. Report of the Lake Erie Forage Task Group. March 2013. Presented to: Standing Technical Committee, Lake Erie Committee, Great Lakes Fishery Commission.





Alicia Pérez-Fuentetaja, Jagat Mukherjee, and Subodh Kumar at the 14th Annual Faculty and Staff Research and Creativity Fall Forum at SUNY Buffalo State.

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 (GLES), 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.

Graduate Programs

Students enrolled in Great Lakes Ecosystem Science programs Administered by the GLC:

Fall 2013
Zachary S. Adams, MS
Michael Borrelli, MA
Scott G. Ketch, MS
Jerome A. Krajna, MS
Heather M. Lewis, MS
Jacquelyn R. O'Mara, MSED
Keith Pawlowski, MS

Spring 2014
Zachary S. Adams, MS
Michael Borelli, MA
Heather M. Lewis, MS
Jacquelyn R. O'Mara, MSED
Keith Pawlowski, MS
Andrew M. Lenox, MA
John R. Grabowski, MS
Eric L. Bruestle, MA
Ashley S. Perez, MS
Sean R. Ryan, Continuing Education
(Non-matriculated)
Jiazhen Zhang, UG International

Integrative Graduate Education and Research Traineeship Ph.D. Program at SUNY Buffalo:

Student:	**Advisor:**
Isabel Porto Hannes	Burlakova, L.

Sara Mochrie, project manager with Ecology and Environment, presents for graduate students in GLC 600, Great Lakes Seminar.

Advising Undergraduate and Graduate Students

- Lyubov Burlakova was the major professor for one student in Integrative Graduate Education and Research Traineeship Ph.D. Program at SUNY Buffalo (Isabel Porto Hannes) and a faculty mentor/ advisor for Keith Pawlowski, M.S. student, Great Lakes Ecosystem Science. She was also a member of Graduate Committee for Paul Juette, M.A. student of the Biology Department, and Wendy Paterson, M.S. student from Central Michigan University.
- Alexander Karatayev was the advisor of a graduate student from the Biology Department (Paul Juette). He was also a member of Graduate Committee for a Ph.D. student at SUNY Buffalo (Isabel Porto Hannes).
- Subodh Kumar was the major professor of one graduate student (M. Williams) from the Forensic Science program. He also supervised and trained two work-study students.
- Chris Pennuto was the advisor of four graduate students from the Biology Department (Allyse Fischer, Hilary McNaughton, Stephen Sliwinski, Stephen Tentinger) and one from the Great Lakes Ecosystems Science program (Mike Borelli). He also was MA thesis committee member for six students (Julie Boerner, Eric Bruestle, Jeromy Henderson, Paul Juette, Brian Hass and Sierra Anseeuw).
- Alicia Pérez-Fuentetaja was the research advisor of one undergraduate student (Hulgrid Gourgue).

Seminars

In order to facilitate collaboration between the GLC personnel and leading experts in aquatic ecology and related sciences and increase visibility of the Center in 2013-2014 we invited eight speakers to present talks on our seminar, including:

1. Sarah Delavan, University at Buffalo. "Predator avoidance behavior? Patterns in clam excurrent siphon velocity according to external environmental cues." November 14, 2013.
2. Jason D. Fridley, Syracuse University. "The modern invasive species problem: a world Darwin envisioned?" November 22, 2013.
3. Knut Mehler, Desert Research Institute, Las Vegas. "Understanding effects of changes in land use, environmental parameters, and habitat characteristics on the benthic macroinvertebrates in the Walker River, Nevada." December 4, 2013.
4. Dimitry Gorsky, U.S. Fish and Wildlife Service. "Restoring lake sturgeon in the Great Lakes: a U.S Fish and Wildlife Perspective." February 27, 2014.
5. Ronald Griffiths, Oregon State University. "Benthos powers lake dynamics." February 27, 2014.
6. Martin A. Stapanian, U.S. Geological Survey, Lake Erie Biological Station. "Soil and vegetation indices for wetland quality: a predictive modeling approach." April 10, 2014.

Invasive species workshop presented by Dr. Frances Lucy, Institute of Technology, Sligo, Ireland, for WNY PRISM in June 2014.

7. Zy Biesinger, "Habitat effects on the space use and growth of reef-oriented fish in the Gulf of Mexico." March 20, 2014.
8. Frances Lucy, Centre for Environment Research Innovation and Sustainability (CERIS), Department of Environmental Science, Institute of Technology, Sligo, Ireland. "Freshwater invasives networking for strategy." June 3, 2014.

Other Educational Activities

Subodh Kumar continued organization and coordination of DEC mandated precertification courses for waste water treatment plant operators of New York State. These training courses comprised of Basic Laboratory, Basic Operation, Activated Sludge, Grade 3 supervision and Grade 4 Management. The number of trainees attended these courses were 7, 6, 4, 0, and 4, respectively, in the fall semester of 2013, and 11, 14, 13, 0, and 0, respectively, in the spring semester of 2014.

Students in Dr. Standora's BIO 315 Ecology class aboard the Privateer at the GLC Field Station. Kit Hastings and Josh Fisher led field sampling demostrations where students learned how to use equipment like the plankton net, right.

IV. Service Activities

Members of the GLC have been active in service to the profession, to the College, and to the community.

Lyubov Burlakova:

- Coordinator of the Great Lakes Center and Biology Department Seminar Series.
- Coordinator of the Great Lakes Center's "Benthic Ecology" Seminar Series.
- Assisted in preparation of the Great Lakes Center 2012-2013 Annual Report (November 2013).
- Assisted in preparation of the Great Lakes Center 2013 Open House (December 2013).
- Participated in a meeting with USFWS to discuss collaborative long-term monitoring of the invasive species in the lower Great Lakes (March 17, 2014).
- Represented GLC at Science and Mathematics Day at Buffalo State; guided tours of the GLC laboratories and described GLC activities (May 19, 2014).
- Assisted in preparation of the Field Station Open House (May 2014).
- Adjunct associate professor, Department of Geology, and a member of the graduate committee for the Ecosystem Restoration through Interdisciplinary Exchange (ERIE) IGERT Program, State University of New York at Buffalo.
- Graduate faculty and graduate committee member at Central Michigan University.
- Participated in a Mollusc Species Assessment meeting for the revision of NY's Species of Greatest Conservation Need. NY DEC, November 18-19, Montezuma Audubon Center, Savannah, NY.
- Member of search committee to hire a manager for the Western New York Partnerships for Regional Invasive Species Management (WNY PRISM).
- Participated in Western NY PRISM Aquatic Invasive Species Workshop (June 3, 2014).
- Member of the International Association of the Great Lakes Research and the Freshwater Mollusc Conservation Society.
- Reviewed manuscripts for *Aquatic Conservation*, *Journal of Great Lakes Research* (multiple), *PLOS One*, *Biological Invasions*, *Marine and Freshwater Research*, *Management of Biological Invasions*, and *Turkish Journal of Fisheries and Aquatic Sciences*.

Participants of the NYSDEC Species Assessment Meeting for the revision of NY's Mollusk Species of Greatest Conservation Need, Montezuma Audubon Center, Savannah, NY, November 2013.

Mark Clapsadl:

- Participated in and supervised the Lake Erie Long Term Lower Trophic Level Monitoring Project.
- Served as science advisor on the environmental committee of the Niagara Musky Association.
- Provided significant support to numerous GLC research projects, as well as support to outside agencies and organizations.
- Hosted the Field Station Open House.

Susan Daniel

- Designed several Great Lakes Center posters.

- Assisted in taxonomic training of new employees.
- Member of the International Association of the Great Lakes Research and the Geological Society of America.

Joshua Fisher

- Participated in the Lake Erie Long Term Lower Trophic Level Monitoring Project.
- Participated in the Texas hornshell mark and recapture study in Laredo, TX.
- Participated in long-term monitoring studies aboard the USEPA Research Vessel *Lake Guardian*.
- Participated in electrofishing on the Upper Niagara River as a part of the Emerald Shiner Habitat Restoration and Conservation Study.
- Participated in benthic sampling on the Lower Niagara River as part of a study on Lake Sturgeon habitat use, feeding ecology, and benthic resource availability.
- Assisted in coordination of field station boats, vehicles, and buildings between the GLC and collaborating agencies, organizations, and universities.
- Provided instructional support on field sampling procedures for several Buffalo State classes.
- Assisted Buffalo State faculty, researchers, and staff in planning and implementing various field studies.
- Attended American Fisheries Society workshop and received certificate in identification of larval fish.
- Volunteer crew leader for Buffalo Niagara Riverkeeper Riverwatch program and Spring shoreline sweep.
- Provided field station tours and presentations on past, current, and future GLC projects to 75 people from the Adirondack Mountain Club.

Kit Hastings:

- Participated in field collection and laboratory studies in multiple projects conducted at the Field Station, including coordinating and implementing all aspects of the Lake Erie Long Term Lower Trophic Level Monitoring Project.
- Played a key role in developing GLC Newsletters (editor) and revamping the GLC website.
- Designed and assisted in preparation of the Great Lakes Center 2012-2013 Annual Report for publication.
- Assisted in lab work associated with the Great Lakes Long-term Biological Monitoring Program.
- Provided instructional support on field sampling procedures for multiple Buffalo State classes.
- Member of the Buffalo State Sustainability Council. As part of the website committee, helped draft and implement the Buffalo State Sustainability webpage.
- Participated in planning and preliminary field work for the Emerald Shiner Habitat Restoration and Conservation Study.
- Represented the Great Lakes Center at the grand opening of the Bird Island Pier on 8/13/13, where the Field Station was recognized for facilitating the project.
- Member of NYS GIS Association and the WNY GIS User Group.

Alexander Karatayev:

- Organized Great Lakes Center Open House (December 2013).
- Published Great Lakes Center 2012-2013 Annual Report (November 2013).
- Wrote multiple articles for GLC Newsletter series.
- Participated in Graduate School meeting (February 7, 2014).
- Represented GLC at Distinctive Graduate Programs Information Session (March 13, 2014).
- Organized meeting with USFWS to discuss collaborative long-term monitoring of the invasive species in the

lower Great Lakes (March 17, 2014).

- Represented GLC at Science and Mathematics Day at Buffalo State; guided tours of the GLC laboratories and described GLC activities (May 19, 2014).
- Organized Field Station Open House (May15 , 2014).
- Campus representative for the Great Lakes Research Consortium.
- Member of the Biology Department Personnel Committee.

Field Station Open House, May 15, 2014.

- Member of the GLC Graduate Committee.
- Member of the Ph.D. Committee for Isabel Porto Hannes in the Ecosystem Restoration through Interdisciplinary Exchange (ERIE) IGERT Program, State University of New York at Buffalo.
- Supervised a graduate student from the Biology Department.
- Invited Dr. F. Lucy from the Institute of Technology, Sligo, Ireland to present a workshop and to continue collaboration between Buffalo State and Institute of Technology.
- Organized a meeting with Timothy Boling, CEO of Cradle Beach, and Michael Kearns, NYS Assemblyman for the 142nd District to discuss how Buffalo State can help in developing grade level curriculum in the field of science focused on the Great Lakes (September 4, 2013).
- Advisory Board member of the *International Journal of Aquatic Invasions*.
- Participated in a Mollusc Species Assessment meeting for the revision of NY's Species of Greatest Conservation Need. NY DEC, November 18-19. Montezuma Audubon Center, Savannah, NY.
- Participated in Western NY PRISM Aquatic Invasive Species Workshop (June 3, 2014).
- Presented results of GLC activity at the PSM advisory board meeting (January 14, 2014).
- Multiple interviews for various mass media.
- Member of the American Society of Limnology and Oceanography, the International Association of the Great Lakes Research, the Freshwater Mollusc Conservation Society.
- Reviewed manuscripts for *BioInvasions Records*, *Aquatic Invasions*, *Journal of Great Lakes Research*, and *Aquatic Conservation: Marine and Freshwater Ecosystems*.

Subodh Kumar:

- Radiation Safety Committee member.
- Chemical Hygiene Committee member.
- Helped and advised individuals of our local communities for their concern related to contamination with potentially toxic spills.
- Organization and coordination of DEC-mandated precertification courses for waste water treatment plant operators of New York State.
- Reviewed manuscripts for *Biomed Research International*, *Chemical Research in Toxicology*, *ARKIVOC* (also serves in Editorial Board), and *ACS Combinatorial Science*.

Cathy Nasca:

- Assisted in preparation of the Great Lakes Center Annual Report for publication.
- Assisted in publication of Great Lakes Center posters.

- Organized Great Lakes Center Open House.
- Organized Great Lakes Center Field Station Open House.
- Assisted in preparation of the Great Lakes Center and Biology Department Seminar Series.

Christopher Pennuto:

- Presenter, Science & Math Day (May 19, 2014).
- Graduate Advisory Council member and Chair.
- Dean Review Committee member.
- Graduation Ceremony seating Marshal.
- Aquatic Biology Concentration Committee Chair.
- Panelist, Research & Creativity Council 2014 Spring forum. "Digging for funding: Finding fertile ground."
- Biology representative, recruitment visit to China (March 8-16, 2014).
- Major Professor of five graduate students.
- Member of Graduate Committee of six graduate students.
- Guest Editor for special issue on Lake Erie nutrients, *Journal of Great Lakes Research*.
- Student judge: Annual Conference International Association for Great Lakes Research, Hamilton, ON.
- Workshop presenter for WNY PRISM; Chautauqua County Master Gardener's invasive species forum and Erie/Niagara County Master Gardener's invasive species forum (November 2013).
- Reviewed manuscripts for *Journal of Great Lakes Research*, *North American Journal of Fishery Management*, *Middle States Geographer*, *Diversity and Distributions*, *Fundamental and Applied Limnology*.

Alicia Pérez-Fuentetaja:

- Chair SNSS Personnel Committee. Evaluated 10 applications for promotion.
- Member of the Biology Advisement Committee and Personnel Committee. Helped organize Biology Open House.
- Member of Search Committee to hire a manager for the Western New York Partnerships for Regional Invasive Species Management (WNY PRISM).
- Advisor Graduate Comprehensive Exam students in Biology.
- Invited to lead a discussion roundtable for the Research and Creativity Council, 2014 Spring Forum, "Digging for funding: finding fertile ground," Research Foundation (April 11, 2014).
- Reviewed articles for *Journal of Wildlife Diseases* and *Journal of Great Lakes Research*.
- Research Advisor to the Lake Erie Forage Task Group. This international multi-agency group reviews fisheries data on the lower food web organisms in Lake Erie and reports to the Great Lakes Fishery Commission. A written report is published every year.
- Outreach for NY Department of Environmental Conservation Angler Event (June 17, 2014).
- Member of the graduate committee of three graduate students.
- She has been working to create a network of agencies and public interested in the ecology of the Niagara River and educate them about the importance for conservation and improvement of this global treasure.
- Developed tools and support for outreach and education for ecological conservation.

V. Professional Development Activities

Lyubov Burlakova:

- Was promoted to Senior Research Scientist in the fall of 2013 and became Chief of the Benthic Ecology Group.
- Established seminar series for the Benthic Ecology Group members and graduate students.
- Has been directing five research grants totaling $2,644,609.

Susan Daniel:

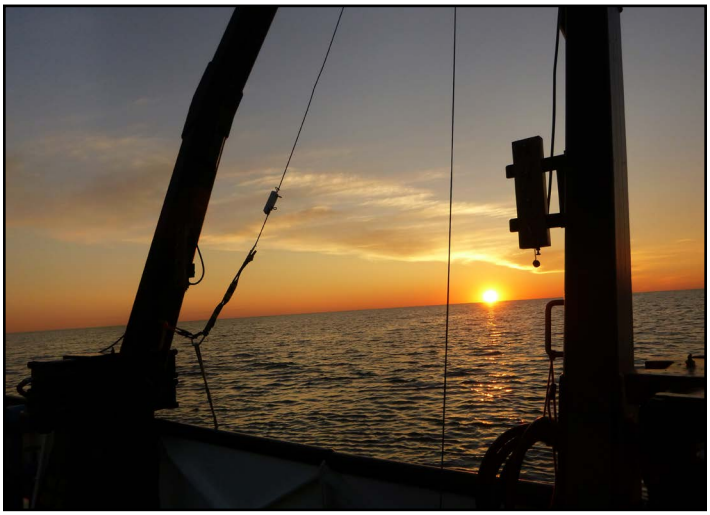
- Accepted into Great Lakes Ecosystem Science (MA) program and will start taking graduate level courses in fall 2014.
- Completed training in CPR and First Aid, SUNY Buffalo State College (June 9, 2014).

Joshua Fisher:

- Attended American Fisheries Society workshop and received certificate in identification of larval fish.
- Completed BIO 612 Freshwater Macroinvertebrate Ecology at Buffalo State.

Kit Hastings:

- Attended several workshops related to website and multimedia content: Intro to Academic Blogging webinar 7/10/13; Locating and Streaming Video Resources 8/14/13; Information Architecture webinar 11/13.
- Attended "Sharpen Your GIS Skills" seminar from ESRI in Rochester, NY (October 17, 2013).



Susan Daniel, Annie Scofield (Cornell), and James Watkins (Cornell) collecting zooplankton samples aboard the R/V *Lake Guardian*. There were many opportunities to view spectacular sunrises and sunsets during the month long cruise.

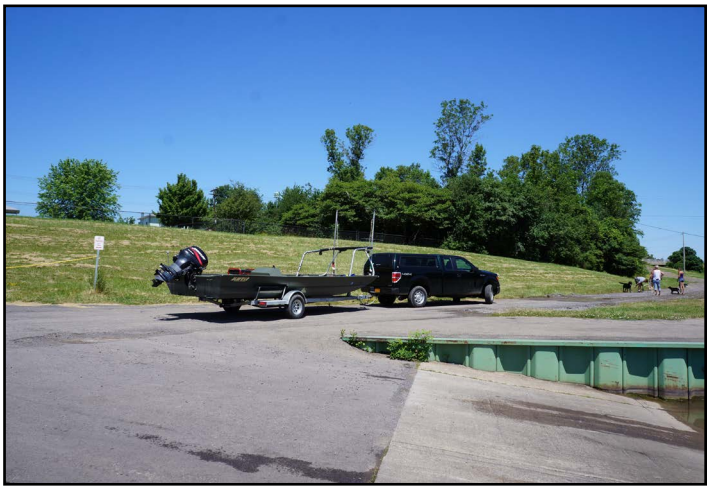
VI. Field Station Activities

The bulk of the ecosystems/fisheries research is carried out at the GLC Field Station. The Field Station is located at the head of the Niagara River on Lake Erie and is capable of supporting high-level research in a variety of disciplines. It houses a fully-automated aquaculture system, a variety of data loggers and automated sampling equipment, and microscopes. We continue to update and maintain our research support systems. During the last year Mark Clapsadl and William Benfanti were able to make contacts through the US Naval Supply Center to the office of Senator Mark Grisanti that have led to an announcement by Governor Coumo's office of a grant to Buffalo State for $150,00 for a boat ramp improvement project. This boat ramp improvement would eliminate the problems experienced launching our larger vessels due to low water conditions in Lake Erie. Additionally, the GLC Field Station now houses the Western New York Partnership in Regional Invasive Species Management (WNY PRISM) office headed by Andrea Locke.

Research Vessels

The addition of a boat storage facility has greatly improved our ability to protect the boats from the elements while not in use and to provide a space for maintenance and repairs. The vessels are all in good working order and are being used regularly. This spring we retired the electrofishing boat hull and replaced it with a new larger 21' Allweld jon-boat. We were able to recycle the electrofishing equipment for a significant cost savings. This new boat has already been used extensively for research.

Instructional Support



Our new electrofishing boat.

- Mark Clapsadl provided support for the Pymatuning limnology field trip for Dr Reissen (Biology).
- Dr. Standora's Ecology class was given a calorimetry equipment demonstration and lecture in the fall.
- Dr. Bergslien's class was given a limnology equipment demonstration and lecture in the spring.
- Dr. Standora's biology class was given a calorimetry equipment demonstration in the spring.
- Facilities were provided for Dr. Anselmi's Anthropology class experiments.

Research Activities

- Provided vessel and technician support for "Investigating Lake Sturgeon habitat use, feeding ecology, and benthic resource availability in the lower Niagara River."
- Installed and operated the Great Lakes Observing System (GLOS) buoy in Lake Erie off Dunkirk, NY.
- Continued long-term sampling of the eastern basin of Lake Erie for the Lower Trophic Level Assessment, adding to over ten years of data.
- Provided support to SUNY ESF with muskellunge spawning research.
- Assisted Jill Singer with logistics for her Buffalo River current sonar modeling project.

- Facilitated access to the boat launch for NYS DEC and US Fish & Wildlife Service.

Outreach

- Hosted multiple Buffalo Niagara Riverkeeper kayaking touring events for public education.
- Provided access to facilities and assistance with logistics for the Bird Island breakwall repairs.
- Provided access and assistance to the US EPA with Buffalo River sediment analysis projects.
- Provided access and support to the NYS DEC with multiple fisheries and common tern projects.
- Provided field station access and support to the US Army Corps of Engineers.
- Provided access and support to the US Navy Supply Center.

A Buffalo Niagara River Keeper kayak tour for educating refugees about our local waterways. Right, WNY PRISM seasonals Patrick Gormley, Jerry Krajna, Andrew Stadler, Angela Driscoll, who monitored for invasive species and worked at many education and outreach events throughout Western New York.

VII. New Initiatives

Great Lakes Center M.S. and M.A. Programs

Two new graduate programs in Great Lakes Ecosystem Science (GLES) have been administered through the Great Lakes Center starting in the fall of 2013. In addition to GLC faculty, members the Geography and Planning, Biology, Chemistry, and Earth Sciences and Science Education Departments are involved in the GLES programs.

The GLES programs provide an opportunity for students to pursue graduate studies through two different interdisciplinary applied environmental science programs, a thesis-based Master of Arts (M.A.) and an internship-based professional Master of Science (M.S.). Both programs provide graduates with the opportunity to attain a broad understanding of the physical, chemical, biological, and social factors that comprise the Great Lakes ecosystems, while at the same time offering graduates the depth they need in a particular discipline to prepare them for entry either into a Ph.D. program or into the workforce.

The GLES M.A program provides a strong foundation in environmental science and allows students to approach problems from a purely scientific perspective. Graduates will be trained to deal effectively with a broad range of problems and issues related to ecosystem structure and function within the Great Lakes and surrounding watersheds, which will prepare them for advanced research, professional employment, or study at the Ph.D. level.

The GLES M.S. combines coursework in environmental science with business communication and project management classes and an internship experience. The M.S. program was designed to meet the needs of industry, consulting firms, non-governmental organizations (NGOs), and governmental agencies with graduates prepared to provide a leadership role as they address a wide range of problems and issues related to the management of resources within the Great Lakes and surrounding watersheds.

Great Lakes Center Newsletter

The Great Lakes Center is pleased to announce the two new issues of our semiannual newsletters. The main goal of these newsletters is to give an update on our activities for the past 6 months to our friends, colleagues, and anyone else who's interested in what we do. While our Annual Report is business-oriented, mainly intended for reporting our productivity, newsletters have a more informal format for short articles on the progress of our research projects, conferences we attend, and other achievements; to feature student research; and to provide more pictures. Having a digital newsletter allow us to post it on our website, letting visitors know just what it is that we do. Newsletters link directly to longer articles and additional content posted throughout our website. It's also paperless, but still printer-friendly.

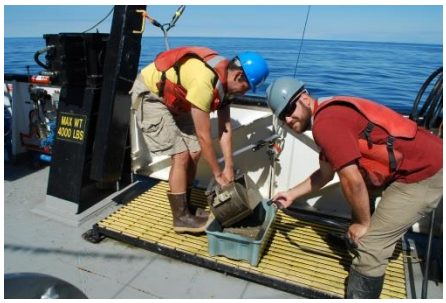
Benthic Ecology Seminars

Last year we established a seminar series "Benthic Ecology" to discuss questions related to current projects conducted by the benthic ecology group, graduate projects, and the most relevant papers in this field. We already had three speakers present their research including:

- Susan Daniel, Great Lakes Center. "The Oligochaeta of profundal Lake Erie and dreissenids impact," April 25, 2014.
- Wendy Paterson, Great Lakes Center. "An evaluation of the mussel populations in Lake Erie and its tributaries using the genetic structure of mapleleaf mussels," May 15, 2014.
- Frank Collas, Radboud University, Netherlands. "Mechanisms and environmental factors determining detachment of invasive dreissenid mussels," June 25, 2014.

Benthic Lab Seminar Series established in Spring 2014. Susan Daniel is presenting her graduate research proposal, May 2014.


LAKE GUARDIAN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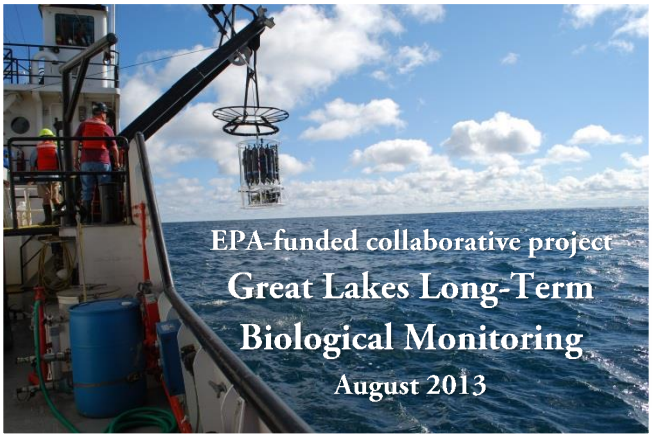
EPA-funded collaborative project
Great Lakes Long-Term
Biological Monitoring
August 2013


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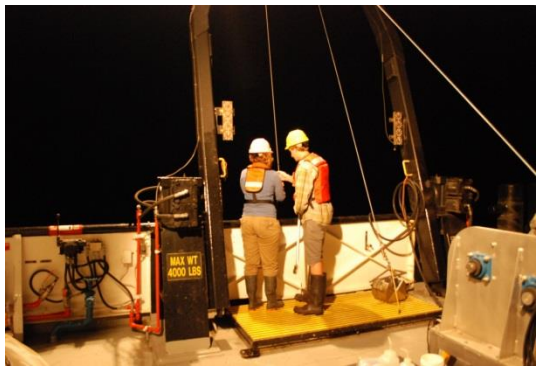
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