The Great Lakes Center

Annual Report 2011-2012

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Buffalo State
State University of New York

The Lake Erie Nearshore and Offshore Nutrient Study (LENONS)

August 2011, June 2012

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 Buffalo State College, as well as other institutions in North America, Europe, and South America. Finally we made significant progress toward developing new graduate programs.

- Our researchers have published **5** peer-reviewed papers, **11** papers were accepted and **5** papers were submitted for publications.
- Presented **25** talks, including: **19** at national/international/regional conferences, **4** invited talks, and **2** presentations in non-refereed venues.
- Submitted **17** grant proposals (total requested amount **$6,521,391**).
- **Twelve** projects for research and education (including multi-year grants) are currently funded in the GLC totaling **$3,437,142**.
- Center personnel acted as advisers to graduate students, and taught **6** graduate and undergraduate courses.
- All of the Center resources, including vessels, sampling equipment, field station labs and the conference room, the environment toxicology lab, and the aquatic ecology lab were used extensively to train undergraduate and graduate students.
- We developed and launched a new GLC website that features a modern design, updated content, and new photo galleries and videos.
- We made significant progress in updating and replacing equipment and facilities improvements at the Field Station.
- We made significant progress toward developing two new graduate programs in the Professional Science Master and Master of Art in Great Lakes Ecosystem Science.

I. Staff

Dr. Charlotte L. Roehm left Buffalo State and moved to Colorado in the summer of 2011. Charlotte was on the split line in the Geography and Planning Department and the Great Lakes Center.

GLC Personnel

Director:	Alexander Karatayev
Research Scientists:	Subodh Kumar, Director of the Lab of Environmental Toxicology Lyubov Burlakova Mark Clapsadl Jagat Mukherjee Christopher Pennuto Alicia Pérez-Fuentetaja Thomas Hahn (part time)
Secretary:	Cathleen Nasca
Field Station Personnel:	Field Station Director & Research Associate Mark Clapsadl Field Station Technician Kit Hastings
Research Assistants:	Brianne Tulumello (Buffalo State College) Paul Juette (Buffalo State College) Allyse Fischer (Buffalo State College) Hilary McLaughlin (Buffalo State College) Melissa Miller (Buffalo State College) Anthony Cevaer (Buffalo State College) Steve Sliwinski (Buffalo State College) Vadim Karatayev (University at Buffalo)

GLC Affiliates (at Buffalo State College)

- Randal Snyder, Associate Professor, Biology Department
- Howard Riessen, Professor, Biology Department
- Gary Pettibone, Professor, Biology Department
- Kimberley Irvine, Professor, Geography and Planning Department
- Kelly Frothingham, Associate Professor, and Geography and Planning Department Chair
- Jill Singer, Professor, Earth Sciences and Science Education Department and Director of the Office of Undergraduate Research.
- Steve Vermette, Professor, Geography and Planning Department

Collaborators

At New York State

- Daniel Molloy, Associate Scientist and Director of the Field Research Laboratory New York State Museum
- Denise Mayer, Assistant Director and Research Scientist, New York State Museum Field Research Laboratory
- Dianna Padilla, Professor, Department of Ecology and Evolution, State University of New York, Stony Brook University
- Lars Rudstam, Professor and Director of the Cornell Biological Field Station, Cornell University
- Jim Watkins, Post-Doctoral Researcher, Cornell Biological Field Station, Cornell University
- Joseph Makarewicz, Distinguished Service Professor, Environmental Science and Biology, State University of New York in Brockport
- Joe Atkinson, Professor Environmental Engineering, State University of New York at Buffalo
- Howard Lasker, Professor, Director of Graduate Program in Evolution, Ecology & Behavior, Department of Geology, State University of New York at Buffalo
- Mary Alice Coffroth, Professor, Department of Geology & Graduate Program in Evolution, Ecology and Behavior, State University of New York at Buffalo
- Amy Mahar, Wildlife Diversity Biologist, New York State Department of Environmental Conservation, Avon, NY
- Jenny Landry, Wildlife Diversity Biologist, Region 8 Bureau of Wildlife , New York State Department of Environmental Conservation, Avon, NY
- Mike Goehle, Regional ANS Coordinator, US Fish and Wildlife Service
- Dimitry Gorsky, Fish Biologist, U.S. Fish and Wildlife Service
- Gregory Boyer, Director, Great Lakes Research Consortium, Professor of Biochemistry, State University of New York, College of Environmental Science and Forestry, Syracuse
- David Campbell, The Paleontological Research Institution, Ithaca, NY
- Robert Baier, Professor and Executive Director of the Industry/University Center for Biosurfaces, State University of New York at Buffalo
- Diana S. Aga, Associate Professor, Chemistry Department, State University of New York at Buffalo
- Katherine Alben, Senior Scientist, Wasdworth Institute, Albany

At Other US Institutions

- Walter Hoeh, Associate Professor, Evolutionary, Population, and Systematic Biology Group, Department of Biological Sciences, Kent State University, Kent, Ohio
- Jake Vander Zanden, Associate Professor, Center for Limnology, University of Wisconsin, Madison, Wisconsin
- David Zanatta, Assistant Professor, Biology Department, Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan
- Daelyn A. Woolnough, Assistant Professor, Biology Department, Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan
- Bob Krebs, Professor, Department of Biology, Geology, Environmental Science, Cleveland State University, Cleveland, Ohio
- Jonathan Bossenbroek, Assistant Professor of Ecology, Department of Environmental Sciences, University of Toledo
- Mary Walsh, Aquatic Ecologist, Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Pennsylvania
- Elizabeth Meyer, Aquatic Ecologist, Pennsylvania Natural Heritage Program, Pennsylvania
- Marsha May, Texas Nature Trackers, Wildlife Diversity Branch, Texas Parks and Wildlife Department, Austin, Texas
- Robert Gottfried, Administrator, Texas Natural Diversity Database, Texas Parks and Wildlife Department, Austin, Texas
- Thomas D. Miller, Director, Lamar Bruni

Vergara Environmental Science Center, Laredo Community College, Texas
- David J. Berg, Professor, Department of Zoology, Miami University, Ohio
- Brian Lang, Biologist, New Mexico Department of Game and Fish, New Mexico
- Charles Randklev, Research Associate, Texas Water Resources Institute, Texas A&M Institute of Renewable Natural Resources, San Antonio, Texas
- Michael R. Kidd, Assistant Professor, College of Arts and Sciences, Texas A&M International University, Laredo, Texas
- Yixin Zhang, Assistant Professor, Department of Biology, Texas State University - San Marcos, Texas
- Donald Jerina, Head, Laboratory of Bioorganic Chemistry NIDDK, National Institutes of Health, Bethesda, Maryland
- Kenneth Laali, Professor in Chemistry, 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, Chair, Department of Geological Sciences, Case Western Reserve University, Cleveland, Ohio
- Darren Bade, Kent State University, Kent, Ohio
- Christine Mayer, Associate Professor, 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, Associate Research Scientist, Cooperative Institute for Limnology and Ecosystems Research, University of Michigan, Ann Arbor, Michigan
- Tom Bridgeman, University of Toledo, Toledo, Ohio

International

- Demetrio Boltovskoy, Professor, University of Buenos Aires, Argentina
- Sergey Mastitsky, Postdoc, Integrative Bioinformatics and Systems Biology (iBioS), German Cancer Research Center, Heidelberg University, Germany
- Jan Ciborowski, Professor, Department of Biological Sciences, University of Windsor, Windsor, Ontario, Canada
- Frances Lucy, Associate Professor, Institute of Technology, Sligo, Ireland
- Richard Soare, Department of Geography and Planning, Concordia University, Montreal, Canada
- Norman Yan, Professor, York University, York, Ontario, Canada
- Tamara A. Makarevich, Associate Professor, Department of General Ecology, College of Biology, Belarusian State University, Minsk, Belarus

II. Research Activities

Aquatic Ecology and Ecosystems Research

Most of the aquatic ecology/ecosystems research is carried out at the GLC Field Station and focuses on the Great Lakes and their tributaries. However, Center personnel are also involved in numerous projects in other states, including Ohio, Pennsylvania, Michigan, and Texas, as well as in Canada and Europe. We maintain active international collaboration with world experts in invasion biology that allow us to be aware of future invaders, and concentrate our limited resources in order to minimize the negative effects of aquatic nuisance species.

Current Projects

The Lake Erie Nearshore and Offshore Nutrient Study (LENONS)

Even though nutrient input target levels in Lake Erie have been reached, significant issues like the central basin 'dead-zone,' extensive *Cladophora* growth in the eastern basin and *Lyngbya* in the west, and repeated outbreaks of nuisance algae continue to occur. The role of nearshore and offshore dreissenid mussel populations and the flux and sequestration of nutrients within mussel beds and sediments remain a priority consideration to understanding the nearshore shunt hypothesis, and to explaining the Lake Erie trophic paradox.

The proposed work will quantify all the major biotic and abiotic nutrient pools, flux rates, and trophic pathways in the nearshore and offshore regions of Lake Erie. We will directly measure nutrient levels in these compartments and flux rates in the most rapidly cycling pools. Additionally, we will couple our data with hydrodynamic models of particle transport and phosphate source tracking using $^{18}O_P$ to assess whether the pools of nutrients in the nearshore and offshore regions follow the predicted patterns of lake mixing models and the nearshore shunt hypothesis. Photos in front cover.

LENONS: Kit Hastings and Steve Sliwinski collecting water samples. June 2012.

Students helping in LENONS project: Paul Juette, Rory Pusateri, Allyse Fischer, Cecilia Pershyn, Vadim Karatayev, and Brianne Tulumello.

Seasonal stoichiometric changes in river seston and *Dreissena* populations

This project will determine the seasonal changes in the C:N:P ratios of river seston and the invasive quagga mussel, *Dreissena bugensis rostriformis*. Understanding the plasticity of body tissue elemental composition can shed light on a species ability to survive under varying food quality regimes, which might aid invasion of new habitats.

Students collecting quagga mussels in the Buffalo River: Cecilia Pershyn, Vanessa Pereira, and Allyse Fischer.

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 will assess 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 will be the first application of community respiration profiling to assess a possible cascade effect on microbes in a stream ecosystem.

Leaf packs in Ellicott Creek for research into how microbial carbon utilization varies in the presence and absence of the round goby in stream reaches.

Invasion paradox: who is the better invader – *Dreissena rostriformis bugensis* or *Dreissena polymorpha*?

Dreissena polymorpha (zebra mussel) and *D. r. bugensis* (quagga mussel) are both invaders, co-occur in their native habitat, and have very different histories of invasion. We compared the rates of spread of *D. polymorpha* and *D. r. bugensis* at different spatial scales and contrasted differences in their ecological and population characteristics to determine the relative importance of these traits on the success and patterns of invasion for these two species. In recent years, *Dreissena r. bugensis* has been become the dominant species of dreissenids in the lower Great Lakes. However, we found that in glaring contrast to the ratios of the dreissenid species in the Great Lakes, *D. polymorpha* was found to obtain similar or larger sizes and density than *D. r. bugensis* on examined boats - the main vectors of spread for the two species. Therefore, lakes Erie and Ontario are still important sources for *D. polymorpha* secondary spread in North America.

Role of exotic invertebrates in Lake Erie

This project examines the role of exotic invertebrates in Lake Erie benthos that increased dramatically during last decades. Our 2009, 2011, and 2012 benthic survey of Lake Erie has shown that benthic invaders currently constitute 40% of total benthic density, and over 95% of the total wet biomass. Benthic community structure and dominance has changed significantly since 1979, and the community is currently dominated by exotic species, resulting in dramatic changes in the food web dynamics of the whole lake.

Chris Pennuto, Lyuba Burlakova, Brianne Tulumello, Vadim Karatayev, Allyse Fisher (on left) and Alexander Karatayev (on right) sorting benthic invertebrates on the shore of Lake Erie.

Exotic molluscs host epizootically important parasites

Exotic species may serve as vectors of introduction for their specific parasites, including highly pathogenic ones, and may also become hosts for aboriginal disease agents. This can result in catastrophic outbreaks of the parasitic diseases that would otherwise not have existed in the introduced areas. We found that many exotic molluscs that were believed to be free of parasites have already acquired trematodes native to North America. Some of

the exotic molluscs hosted exotic trematodes that are highly pathogenic to their vertebrate hosts. In six of the 12 waterbodies studied, exotic molluscs had a prevalence of trematode infection high enough to pose medium to high risk of parasite transmission to their subsequent vertebrate hosts. We suggest that parasitological assessment should be an integral part of the assessment of the ecological and economic risks these species pose.

Diversity, distribution and long-term changes in freshwater Unionidae in Texas

Freshwater Unionidae is the most rapidly declining faunal group in the US, including Texas. Among the 52 species known in Texas, there are at least 26 species that require special attention, including six endemic and one federally listed endangered species. Currently we are funded by the U.S. Fish and Wildlife Service and Texas Parks and Wildlife Department (State Wildlife Grants, 2004 - 2012) to conduct statewide surveys of the rare and the most valuable Unionidae populations in Texas. As a result of our surveys, of the 46 Unionidae species currently present in Texas, 65% were classified as rare and very rare, including all state and regional endemics (Burlakova et al. 2011).

Estimation of populations of endemic species in the San Saba River, July 2011.

In July 2011, using State Wildlife Grants funding, we surveyed sites on the Colorado, Frio, Guadalupe, Llano, Neches, Nueces, San Marcos, San Saba, Rio Grande, and Trinity rivers to update the status of unionid species of greatest conservation need: threatened False spike (*Quincuncina mitchelli*), Texas fatmucket (*Lampsilis bracteata*), Texas pimpleback (*Quadrula petrina*), smooth pimpleback (*Quadrula houstonensis*) and Mexican fawnsfoot (*Truncilla cognata*). We found abundant and diverse unionid assemblages, including rare endemic species, in lower San Saba River, in the Nueces, San Marcos, Neches and Trinity rivers. All collected data soon will be a part of the Texas Natural Diversity Database, making the data readily available for conservation, monitoring and decision making.

San Saba River mussels: *Quadrula verrucosa* (pistolgrip) and endemic *Quadrula houstonensis* (smoth pimpleback).

Fifteen rare freshwater mussel species were recently added to the state's list of threatened species, and 11 of those are currently under consideration for federal listing by the U. S. Fish and Wildlife Service. Taxonomic identification of species based on shell morphology is challenging and complicates conservation efforts, therefore we are currently working on molecular taxonomic identification of the most problematic Texas endemic species.

Survey of Texas Hornshell Populations in Texas

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 assessing the current distribution and habitat requirements of *P. popeii* in Texas, evaluating existing populations and their trends, and studying species' biology to develop the recovery plan and management options for *P. popeii* in Texas. In 2011 and 2012 we surveyed the Devils River and the Rio Grande

Devils River survey team: H. Nichols and T. Nobles (Texas State University, San Marcos), P. Douglas and K. Stubbs (Expedition Outfitters), T. Miller (Environmental Science Center, Laredo Community College), T. Vaughan (Texas International A&M University in Laredo), and L. Burlakova (photo: A. Karatayev).

Texas hornshell survey on the Rio Grande (D. Barclay, S. Barclay, A. Karatayev, and T. Miller) (photo: L. Burlakova).

River near Laredo and found the largest known population of *P. popeii* between Laredo and Eagle Pass, which is healthy and reproducing. However, probably due to pollution, the species has not been found downstream from Laredo. We analyzed all historical data and documented long-term changes in the distribution of *P. popeii* in Texas including range fragmentation and local extirpations. We are currently working on estimation of *P. popeii* population and life-history parameters (e.g., individual growth, survival, size structure, recruitment) and trends by monitoring selected population in Laredo using mark-recapture methods, and are planning to initiate a fish-host study at the site.

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. Although these have existed with the ongoing threat of dreissenid mussels in nearby offshore waters for over 20 years, the long-term survival of unionids in these habitats remains in question.

In 2011, within this large collaborative project funded by the U.S. Fish and Wildlife Service, we surveyed a total of 117 sites at 41 locations in bays, coastal wetlands, and drowned rivermouths on the U.S. side of Lake Erie and Lake St. Clair and collected 1778 individuals belonging to 23 unionid 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.

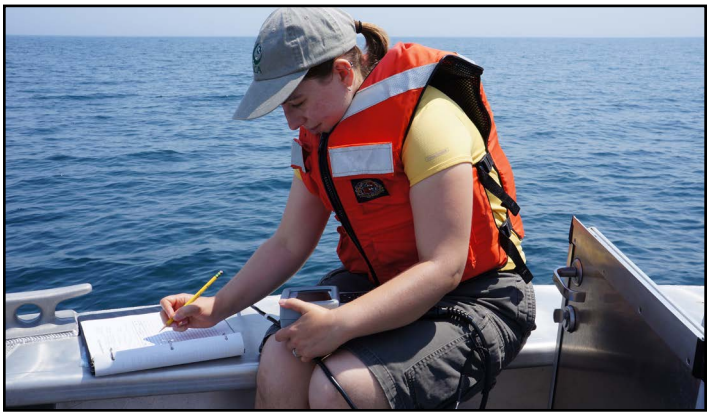
Our continuing research will attempt to develop models based on unionid presence/absence and habitat characteristics in unionid refuges to identify addition refuge locations. In summer 2012 we are planning to survey the U.S. part of Lake Ontario. We will examine unionid genetic diversity/isolation to determine if there is gene flow between coastal refuges and nearby riverine habitats. This information will help managers develop conservation strategies to sustain existing populations in these refuges. We will also make management recommendations to agencies responsible for conservation of coastal zones and recovery of listed (Endangered and Threatened) species. Finally, this expansive project will also train undergraduate and graduate students, thereby creating a cadre of future scientists and managers who will work to protect this imperiled resource. For more information please check the Great Lakes Unionid Refuge Project. Photos in inside back cover.

Food web-mediated transport and bioaccumulation of flame retardants (PBDE) in sport fish from eastern Lake Erie

We are sampling sport fish (walleye, lake trout, steelhead trout, smallmouth bass) and their forage fish (gobies, emerald shiners, yellow perch, smelt), and forage invertebrates (dreissenids, amphipods and zooplankton), water and sediment, to determine PBDE congener load at all these trophic levels. Stable isotopic determination of organisms will help us determine their position in the food web and bioaccumulation coefficients for these chemicals of concern.

Long Term Monitoring on Lake Erie

Since 2008, the Great Lakes Center has monitored two sites in eastern Lake Erie for the Lower Trophic Level Assessment, a multiagency effort begun in 1999 by the Forage Task Group of the Great Lakes Fisheries Commission. This long-term project is aimed at building a database of biotic and abiotic information from sampling stations throughout Lake Erie to describe annual trophic conditions. From May through October, we collect physical limnology data, water samples, and plankton samples biweekly, and benthos monthly.



Kit Hastings takes a vertical profile of the water column with a YSI sonde.

Mark Clapsadl collects water samples, with other sampling equipment.

Botulism type E in the Great Lakes

We have ten years of research experience in the new and ongoing botulism outbreaks in the Great Lakes basin. Our current role in this topic is to act as a resource for information for federal (EPA) and state agencies (DEC, NY-F&WS) as well as the Great Lakes Research Consortium and to the greater research community. Our expertise includes sources of type E botulism in the Great Lakes and food web transmission.

Feeding ecology of the new Great Lakes invader *Hemimysis anomala*

A new invasive species in Lake Erie and other Great Lakes that is also making its way into the Finger Lakes region, *H. anomala* is the first mysid to become established in Lake Erie. H. anomala's feeding selectivity carries the potential for trophic cascade effects as their predation may limit the number of important grazer species. However, their adaptive omnivorous diet may allow them to shift their diet to include a larger portion of algae, occupying an intermediate feeding niche. We are examining diet selectivity of this species in laboratory and field experiments.

Effects of Calcium decline and food levels on *Daphnia* development and reproduction

The common cladoceran zooplankter *Daphnia* takes the calcium to form their carapace from the surrounding water. They also are an important link at the base of many aquatic food webs. Declining levels of calcium in the Canadian Shield lakes threaten to disrupt trophic interactions and lead to significant changes in ecosystem functioning. We are investigating the interaction between food availability and calcium on growth, reproduction, and survivorship of *Daphnia*.

Comparison of growth and condition of invasive round gobies in Lake Erie and Ellicott Creek, a tributary stream

The round goby has invaded tributary streams of Lake Erie. As a result, goby diets have adapted to the foods available in the stream. We investigate how this change in diet affects their development and whether the ontogenetic shift observed in gobies with lake diets also occurs in stream gobies.

Water Quality/Watershed Studies

Observing Systems and Monitoring in Lake Erie

This project is an EPA Great Lakes Restoration Initiative funded project that aims at deploying 3 buoys in the Western and Eastern parts of Lake Erie. The near-real time data collected by the buoys is being complemented by the use of an Automated Underwater Vehicle (AUV) that increases the spatial resolution of mapping along the nearshore regions of Lake Erie. A website detailing the equipment and the data will allow stakeholders to access data concerning the state of health of the lake and help improve management decisions.

EPA buoy deployed outside Buffalo, NY.

Implementation of the Great Lakes Observing System

In summer of 2011 and 2012, we deployed an automatic buoy provided by GLOS (Great Lakes Observation System) to Buffalo State College. The buoy is maintain and run through the Great Lakes Center as a part of a regionally distributed network of 19 fixed monitoring buoys that are located throughout the five Great Lakes. The buoy is one of six new standard GLOS buoys and the only one located in the Eastern basin of Lake Erie.

Kit Hastings and Mark Clapsadl with the GLOS buoy, deployed outside Dunkirk, NY.

Environmental Toxicology

The Environmental Toxicology Laboratory of the Great Lakes Center maintains state of the art facilities on the campus of Buffalo State College. The scientists at this laboratory study the mechanism by which various environmental pollutants present in the Great Lakes induce their adverse effects on human health and the health of other species in order to assess the risk associated with these chemicals, and also to develop preventive measures for minimizing or eradicating various adverse health effects associated with human exposure to these contaminants.

Current Projects

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.

Jagat Mukherjee with different cell lines (including cancer cell lines) that are being incubated at controlled temperature and an atmosphere of 5% carbon dioxide.

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.

Identification of chemo-preventive targets in tumor promotion by tobacco smoke phenolic components

Efforts are in progress to identify the phenolic components in tobacco smoke phenolic fraction (TSCPhFr) having tumor promoting activity in PAH-initiated cells. Identification of the phenolic component will help development of chemo-preventive strategy through elimination of the respective phenolic component from tobacco leaf by genetic engineering.

Subodh Kumar using a Liquid Scintillation Counter to measure the radioactivity of different PAH metabolites and signaling intermediates.

Identification of gene products modulated by benzopyrene (an environmentally present carcinogenic PAH) by cutting age microarray technique and in vitro analyses of the role of the particular gene in BP-induced signaling with a view to the development of biomarkers

We already have the microarray data of benzo[a]pyrene-induced gene expression in mouse epidermal JB6 cell line performed in Roswell Park Cancer Research institute. The data include expression level of 50,000 genes. We are now analyzing the data with the objective of identifying the biomarkers modulated in response to BP, an environmental carcinogen.

Studies on polynuclear aromatic hydrocarbons, polynuclear sulfur heterocycles, and their metabolites

In our continuing effort to understand the mechanism by which environmental occurring polynuclear aromatic hydrocarbons and their heterocyclic analogs induce cancer, we are currently studying the metabolism of phenanthro[3,4-b]thiophene to its mutagenic/carcinogenic metabolites by liver and lung microsomes from various animal species as well as human in order to have a better understanding of the carcinogenic potential of this and related carcinogens in various animal.

Studies on developing selenium incorporated chalcones as potential chemopreventive and chemotherapeutic agents of next generation

Because of the ability of natural occurring chalcones and various organoselenium compounds to prevent or reverse carcinogenesis or kill cancer cells with high selectivity without showing any genotoxicity and drug resistance, we initiated a pilot study that has been directed toward developing organoselenium compounds containing chalcone scaffold. We believe that such natural product-driven studies may provide important leads to develop an effective anti-cancer drug that has potential to supplement or replace current anti-cancer drugs which are known to produce adverse side effects, mutations leading to cancer and/or drug resistance.

Grants and Funding

Ongoing Grants (Total $3,437,142)

1. Burlakova, L. E., A. Y. Karatayev, M. E. May, M. D. Warriner, and B. Gottfried. Survey of threatened freshwater mussels (Bivalvia: Unionidae) in Texas. State Wildlife Grant Program, U.S. Fish and Wildlife Service, and Texas Parks and Wildlife Department. **$38,000**. 2011-2012.
2. 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**. 2011-213.
3. Burlakova, L. E, A. Y. Karatayev, and M. Goehle. Preliminary Risk Assessment of the Parasites of Aquatic Exotic Invertebrates in the Great Lakes Region. Great Lakes Research Consortium, NYGLPF Small Grants Program. **$9,473**. 2010-2011.
4. Hahn, T. and A. Y. Karatayev. Effects of Multiple Acoustic Scattering from Realistic Oceanic Bubble and Fish Assemblages. 2011-2013. **$151,468**.
5. Karatayev, A. Y. and M. Clapsadl. Implementation of the Great Lakes Observing System. US Department of Commerce. **$42,678**. 2011-2012.
6. Mukherjee, J. J. Phenolic component of tobacco smoke as tumor promoter. National Institutes of Health. (2008-2011; extension to 2012). **$214,500**.
7. 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 BSC)**. 2010-2013.
8. Pérez-Fuentetaja, A., M. Clapsadl, D. Aga, and M. Alaee. Food web–mediated transport and bioaccumulation of flame retardants (PBDE) in sport fish from eastern Lake Erie. New York Great Lakes Protection Fund. Large Grants Program. **$100,000**. 2009-2011.
9. Snyder, R. J., L. E. Burlakova, D. B. MacNeill, and A. Y. Karatayev. Evaluating Ponto-Caspian Fishes for Risk of Great Lakes Invasion. U.S. EPA Great Lakes Restoration Initiative 2010. **$111,264**. 2010-2011.
10. Vermette, S., C. L. Roehm, S. D. Beletsky, and E. Anderson. Observing Systems and Monitoring in Nearshore Lake Erie, EPA Great Lakes Restoration Initiative 2010. **$962,583 ($793,528 for BSC)**. 2010-2012.
11. 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, 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 BSC)**. 2010-2013.
12. Pennuto, C. URM: The watershed as a model for training minority undergraduate Biology majors for graduate careers. National Science Foundation, Division of Biological Infrastructure. **$721,000**. 2007-2012. Application for NCE under review.

Submitted in 2011-2012 (Total $6,468,209)

1. Burlakova, L. E., A. Y. Karatayev, D. Woolnough, D. Zanatta, I. Hannes, A. Hillman, L. Holst, and M. Janis. Restoration of native freshwater mussels in the Niagara River Area of Concern. Pre-proposal submitted to the Great Lakes Fish and Wildlife Restoration Act FY 2012. **$199,301**. 2013-2016. **Not funded**.
2. Burlakova, L. E., A. Y. Karatayev, D. Gorsky, and D. W. Schloesser. Status of the Niagara River benthic community: effects of water fluctuations, contamination, and long-term trends. Conceptual Pre-Proposal submitted to the Habitat Enhancement and Restoration Fund, New York Power Authority. 2012–2015. **$1,008,043**. **Pending**.
3. Burlakova, L. E., A. Y. Karatayev, and M. E. May. Biological assessment of threatened freshwater mussels (Bivalvia: Unionidae) in Texas. Proposal submitted to the U.S. Fish and Wildlife Service, and Texas Parks

and Wildlife Department, Traditional Section 6. **$270,992**. 2012-2015. **Pending**.

4. Karatayev, A. Y., L. E. Burlakova, and M. Stapanian. Workshop on Collaborative Research on Lakes in the Former Soviet Republics. 2011-2012. **$76,556**. Proposal submitted to the U.S. Agency for International Development. **Pending**.
5. Karatayev, A. Y., L. E. Burlakova, T. Hahn, and D. Gorsky. Niagara River Observatory. Pre-Proposal submitted to the Niagara River Greenway Commission. 2012–2015. **$1,509,137**. **Determined as consistent and recommended for submission of full proposal**.
6. Kumar, S., and J. J. Mukherjee. Involvement of sulfoxidation pathway in thia-PAH-induced carcinogenesis. National Institutes of Health. **$871,710**. **Not Funded**.
7. Kumar, S., and J. J. Mukherjee. Pilot studies on developing selenium derivatives of chalcones as anticancer drugs. National Institutes of Health. **$147,000**. **Pending**.
8. Kumar, S., and J. J. Mukherjee. Involvement of sulfoxidation pathway in thia-PAH-induced carcinogenesis (Resubmission). National Institutes of Health (RO1). **$958,509**. **Not Funded**.
9. Mukherjee, J. J., and S. Kumar. PAH-induced cellular protective response of apoptosis: role of fatty acids (New). National Institutes of Health. **$367,500**. **Pending**.
10. Mukherjee, J. J., and S. Kumar. Alcohol and PAH-induced carcinogenesis. National Institutes of Health. 2012-2014. **$147,000**. **Pending**.
11. Mukherjee, J. J., and S. Kumar. Phenolic component of tobacco smoke as tumor promoter (Renewal). National Institutes of Health. **$367,000**. **Pending**.
12. Mukherjee, J. J., and S. Kumar. Chemopreventive potential of fatty acids against tobacco smoke carcinogenesis (Resubmission). National Institutes of Health. **$367,000**. **Not Funded**.
13. Mukherjee, J. J., and S. Kumar. Fatty acids' role in PAH-induced cellular protective response - a new dimension. National Institutes of Health. **Not Funded**.
14. Pennuto, C. M., and D. Gorsky. Assessing split-beam echosounding to identify Lake sturgeon in the lower Niagara River ecosystem. 2012. **$48,705**. Proposal submitted to the Great Lakes Fishery Commission. **Not funded**.
15. Pérez-Fuentetaja, A. Fish and Wildlife Restoration Act. 2012. Predation Risk of Great Lakes Fish Eggs and Larvae by a Spreading Invader, *Hemimysis anomala* (Mysidaceae). **$53,182**. **Not Funded**.
16. Snyder, R. J., L. E. Burlakova, D. B. MacNeill, and A. Y. Karatayev. Enhanced Early Detection of Invasive Ponto-Caspian Fishes in the GL. U.S. EPA Great Lakes Restoration Initiative 2012. **$99,756**. 2012-2013. **Pending**.
17. Walsh, M., E. Meyer, and L. E. Burlakova. Species status surveys for clubshell, northern riffleshell, rayed bean, and snuffbox in the upper Allegheny basin in New York and Pennsylvania. Pre-proposal submitted to the U.S. Fish and Wildlife Service, New York Department of Environmental Conservation, Buffalo State College, Pennsylvania Fish and Boat Commission, and Pennsylvania Natural Heritage Program, Western Pennsylvania Conservancy, Traditional Section 6, Bilateral species conservation effort in New York and Pennsylvania. 2012-2013. **$30,000**. **Not funded**.

Publications and Presentations

Last year the researchers of the GLC were very active in publishing papers and presenting their results at international and national meetings and conferences. Five manuscripts were published, another 11 were accepted for publication and/or published online, and 5 were submitted to peer-reviewed journals. A total of 25 presentations were made by the GLC researches, including: 19 presentations at national/international/regional conferences, 4 invited talks, and 2 presentations were made in non-refereed venues.

Refereed Journal Publications (published)

1. Burlakova, L. E., A. Y. Karatayev, and V. A. Karatayev. 2012. Invasive mussels induce community changes by increasing habitat complexity. *Hydrobiologia* 685(1): 121-134.
2. Karatayev, A. Y., S. E. Mastitsky, D. K. Padilla, L. E. Burlakova, and M. M. Hajduk. 2011. Differences in growth and survivorship of zebra and quagga mussels: size matters. *Hydrobiologia* 668(1):183-194.
3. Karatayev, A. Y., L. E. Burlakova, S. E. Mastitsky, D. K. Padilla, and E. L. Mills. 2011. Contrasting rates of spread of two congeners, *Dreissena polymorpha* and *Dreissena rostriformis bugensis*, at different spatial scales. *Journal of Shellfish Research* 30(3): 1–9.
4. Karatayev, A. Y., R. Claudi, and F. E. Lucy. 2012. History of *Dreissena* research and the ICAIS gateway to aquatic invasion science. *Aquatic Invasions* 7: 1-5.
5. Karatayev, A. Y., T. D. Miller, and L. E. Burlakova. 2012. Long-term changes in unionid assemblages in the Rio Grande, one of the World's top 10 rivers at risk. *Aquatic Conservation: Marine and Freshwater Ecosystems*. 22: 206-219.

Refereed Journal Publications (accepted/in press)

1. Burlakova, L. E., D. Campbell, A. Y. Karatayev, and D. Barclay. Accepted. Distribution, genetic analysis and conservation priorities for rare Texas freshwater molluscs in the genera *Fusconaia* and *Pleurobema* (Bivalvia: Unionidae). *Aquatic Biosystems*.
2. Higgins, S. E., C. M. Pennuto, J. C. Makarewicz, T. E. Howell. 2012. Watershed land-use and impacts on *Cladophora* abundance in Lake Ontario. *Journal of Great Lakes Research*.
3. Karatayev, A. Y., L. E. Burlakova, and D. K. Padilla. Accepted. Spread, population dynamics, and ecosystem impacts of zebra mussels versus quagga mussels: what we know and what we do not. Invited book chapter in "Zebra Mussels: Biology, Impacts and Control," T. F. Nalepa and D. W. Schloesser (eds.). Second Ed. Lewis Publishers.
4. Karatayev, A. Y., L. E. Burlakova, J. Vander Zanden, R. C. Lathrop, and D. K. Padilla. Accepted. A century of change in a lake benthic community: Evidence for multiple community states. *Hydrobiologia*.
5. Karatayev, A. Y., S. E. Mastitsky, L. E. Burlakova, V. A. Karatayev, M. M. Hajduk, and D. B. Conn. Exotic molluscs in Great Lakes host epizootically important trematodes. Submitted to *Journal of Shellfish Research*.
6. Lucy, F. E., L. E. Burlakova, A. Y. Karatayev, S. E. Mastitsky, and D. T. Zanatta. Accepted. *Dreissena* impacts on Unionida: A comparison of trends in North America and Europe. Invited book chapter in "Zebra Mussels: Biology, Impacts and Control," T. F. Nalepa and D.W. Schloesser (eds.). Second Ed. Lewis Publishers.
7. Makarewicz, J. C., T. W. Lewis, C. M. Pennuto, J. Atkinson, W. J. Edwards, G. L. Boyer, and T. Howell. 2012. Physical and chemical characteristics of the nearshore zone of Lake Ontario. *Journal of Great Lakes Research*.
8. Pavlac, M., C. M. Pennuto, and G. L. Boyer. 2012. Nearshore phytoplankton assemblages in Lake Ontario. *Journal of Great Lakes Research*.
9. Pennuto, C. M., T. Howell, J. C. Makarewicz, W. J. Edwards, G. L. Boyer, and J. Atkinson. 2012. Round goby size and abundance in nearshore Lake Ontario. *Journal of Great Lakes Research*.

10. Pennuto, C. M., T. Howell, T. E. Lewis, J. C. Makarewicz. 2012. Status of *Dreissena* mussels in the Lake Ontario nearshore environment. *Journal of Great Lakes Research*.
11. Pérez-Fuentetaja, A., M. D. Clapsadl, and W. T. Lee. 2012. Comparative Role of Dreissenids and Other Benthic Invertebrates as links for Type-E Botulism Transmission in the Great Lakes. Invited book chapter in "Zebra Mussels: Biology, Impacts and Control," T. F. Nalepa and D.W. Schloesser (eds.). Second Ed. Lewis Publishers.

Refereed Journal Publications Submitted (in review)

1. Karatayev, V. A., A. Y. Karatayev, and L. E. Burlakova. Lakewide dominance does not predict dreissenid spread potential. Submitted to *Journal of Great Lakes Research*.
2. Lucy, F. E., A. Y. Karatayev, and L. E. Burlakova. Predictions for the spread, population density, and impacts of *Corbicula fluminea* in Ireland. Submitted to *Aquatic Invasions*.
3. Mackintosh, S. A., L. R. Zimmerman, G. Pacepavicius, M. Clapsadl, A. Pérez-Fuentetaja, M. Alaee, D. S. Aga. Analytical Performance of a Triple Quadrupole Mass Spectrometer Compared to a High Resolution Mass Spectrometer for the Analysis of Polybrominated Diphenyl Ethers in Fish. Submitted to *Analytica Chimica Acta*.
4. Molloy, D. P., D. A. Mayer, M. J. Gaylo, J. T. Morse, K. T. Presti, P. M. Sawyko, A. Y. Karatayev, L. E. Burlakova, F. Laruelle, K. C. Nishikawa, and B. H. Griffin. *Pseudomonas fluorescens* strain CL145A – A biopesticide for the control of zebra and quagga mussels (Bivalvia: Dreissenidae). Submitted to the *Journal of Invertebrate Pathology*.
5. Pennuto, C. M., and N. Dong. Effects of prior experience and age on learned predator avoidance by the crayfish, *Orconectes propinquus*. *Marine and Freshwater Behavior and Physiology.*

Non-Refereed Publications

1. Markham, J., M. Hosack, J. Deller, P. Kocovsky, T. MacDougall, A. Pérez-Fuentetaja, E. Trometer, E. Weimer, and L. Witzel. 2012. Report of the Lake Erie Forage Task Group. March 2012. Presented to: Standing Technical Committee, Lake Erie Committee, Great Lakes Fishery Commission.

International/National/Regional Conference Presentations

1. Alben, K. T., M. M. Sobiechowska, M. Bridoux, and A. Pérez-Fuentetaja. Use of algal pigments to trace food-web relationships between invertebrates and fish in the Great Lakes. International Association of Great Lakes Research. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
2. Burlakova, L. E. and A. Y. Karatayev. Biogeography and conservation of freshwater mussels (Bivalvia: Unionidae) in Texas. IV International Scientific Conference "Lake Ecosystems: Biological Processes, Anthropogenic Transformation, Water Quality," 12-17 September 2011, Naroch-Minsk, Belarus.
3. Burlakova, L. E., B. L. Tulumello, A. Y. Karatayev, and D. T. Zanatta. *Dreissena* Impacts on Unionidae: Recent Trends in Lake Erie. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
4. Hahn, T., and O. Diachok. Acoustic Cross Sections and Resonance Frequencies of Large Fish Schools, 162nd Meeting of the Acoustical Society of America, San Diego.
5. Hahn, T., and X. Chen. The Effects of Multiple Scattering on Fisch and Bubble Acoustic Cross Sections; 2nd Pan American/Iberian Meeting on Acoustics, Cancun, Mexico.
6. Hahn, T. Acoustic Remote Sensing of Fish Schools. International Association of Great Lakes Research. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
7. Hannes, I. P., H. R. Lasker, and L. E. Burlakova. Proposed study of unionid community below and above escarpments from Lake Ontario and Lake Erie tributaries. 55th Annual Conference on Great Lakes

Research. May 13-17, Cornwell, Ontario, Canada.

8. Juette, P. M., A. Y. Karatayev, and L. E. Burlakova. Reconstruction of dreissenid biomass dynamics in Lake Erie. 22nd Annual Great Lakes Research Consortium Conference in SUNY-Oswego. March 30-31, 2012, Oswego, NY. Poster.
9. Karatayev, A. Y., L. E. Burlakova, and D. K. Padilla. Distribution, population dynamics and ecosystem impacts of *Dreissena polymorpha* and *Dreissena rostriformis bugensis*. IV International Conference "Lake Ecosystems: Biological Processes, Anthropogenic Transformation, Water Quality." September 12-17, 2011. Naroch-Minsk, Belarus.
10. Karatayev, A. Y., L. E. Burlakova, and S. E. Mastitsky. Predicting the zebra mussels spread: what can we learn from 200 years of continuous invasion. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
11. Karatayev, V. A., A. Y. Karatayev, L. G. Rudstam, and L. E. Burlakova. A century of change in molluscan community in Lake Oneida: Evidence of recovery? 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
12. Mackintosh, S. M., A. Pérez-Fuentetaja, L. R. Zimmerman, G. Pacepavicius, M. Clapsadl, M. Alaee, and D. S. Aga. 2012. Analysis of Brominated Flame Retardants in the Lake Erie Food Web: Levels, Bioaccumulation, and Trophic Transfer. International Association of Great Lakes Research. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
13. Pennuto, C. M., L. E. Burlakova, A. Y. Karatayev, A. Perez-Fuentetaja, J. Kramer, G. Matisoff, D. L. Bade, C. Mayer, and T. Bridgeman. Benthos and water column correlations in nearshore Lake Erie. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
14. Pennuto, C. M., C. J. Janik, and K. A. Cudney. 2012. The invasive round goby alters CPOM decomposition and primary production in a heterotrophic stream. Society of Freshwater Science. Louisville, KY.
15. Pérez-Fuentetaja, A., and B. Ankrah. 2012. Feeding Ecology of the Round Goby in Lake Erie and in an Invaded Stream. International Association of Great Lakes Research. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
16. Snyder, R. J., L. E. Burlakova, A. Y. Karatayev, and D. B. MacNeill. Evaluating Ponto-Caspian fishes for risk of Great Lakes invasion. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.

Great Lakes Center team presenting at the 55th Annual Conference on Great Lakes Research in Cornwell, Ontario, May 2012: A. Karatayev, S. Mackintosh, A. Pérez-Fuentetaja, V. Karatayev, L. Burlakova, R. Snyder, B. Tulumello.

17. Tulumello, B. L., L. E. Burlakova, and A. Y. Karatayev. Estimating the change in weight of *Dreissena polymorpha* and *Dreissena r. bugensis* fixed in ethanol. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada. Poster.
18. Tulumello, B. L., L. E. Burlakova, and A. Y. Karatayev. Estimating the change in weight of *Dreissena polymorpha* and *Dreissena r. bugensis* fixed in ethanol. 22nd Annual Great Lakes Research Consortium Conference in SUNY-Oswego. March 30-31, 2012, Oswego, NY. Poster.
19. Zanatta, D. T., J. Bateman, J. L. Bergner, J. Bossenbroek, L. E. Burlakova, T. Crail, F. de Szalay, T. Griffith, M. Hickin, D. Kapusinski, A. Y. Karatayev, L. Kolich, R. A. Krebs, G. Longton, E. Meyer, W. Paterson, T. Prescott, M. T. Rowe, D. W. Schloesser, M. Scott, M. Shackelford, K. Shreve, M. Walsh. Survey and reassessment of Unionidae in Lake Erie and Lake St. Clair, 25 years after the dreissenid invasion. 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.

Invited Talks

1. Burlakova, L. E. *Dreissena* impacts on Unionidae: general trends in North America and Europe and recent findings from Lake Erie and St. Clair. Cornell University Biological Field Station, Bridgeport, NY. June 20, 2012.
2. Karatayev, A. Y. Invasive bivalves as ecosystem engineers. Invited Seminar at Ecology and Evolutionary Biology Seminar, SUNY Albany. February 3, 2012.
3. Karatayev, A. Y. Parasites of exotic species in invaded areas: does lower diversity mean lower epizootic impact? Cornell University Biological Field Station, Bridgeport, NY. June 20, 2012.
4. Pérez-Fuentetaja, A. 2012. Waking the Dragon: Type E Botulism in the Great Lakes. SUNY College at Brockport, NY. April 3, 2012.

Conference Presentations (non-refereed)

1. Karatayev, A. Y., T. D. Miller, and L. E. Burlakova. Long-term changes in unionid assemblages in the Rio Grande, one of the World's top 10 rivers at risk. 12th Annual 2011 Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 27, 2011.
2. Mukherjee, J. J., and S. Kumar. Potentiation of PAH-induced cell transformation by phenolic fraction of tobacco smoke: a mechanism insight. 12th Annual 2011 Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 27, 2011.

Great Lakes Center faculty and URM students at the 22nd Annual Great Lakes Research Consortium Conference in SUNY-Oswego, March 2012: Vanessa Pereira, Brianne Tulumello, Carla Lanze, Cecilia Pershyn, Paul Juette, Alexander Karatayev, Chris Pennuto.

III. Education

The GLC fulfills its educational mission directly through the classes its researchers teach, through its graduate program, 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.

Classes Taught

- BIO 300 Biostatistics / BIO 590 Biological Data Analysis – L. Burlakova
- BSC 101 Foundations of Inquiry: "The Oceans and Us" – A. Pérez-Fuentetaja
- BIO 104 Environmental Biology – C. Pennuto
- BIO 361/362 Biology/URM seminar – C. Pennuto
- BIO 635 Great Lakes Ecology – A. Pérez-Fuentetaja
- BIO 617 Research Seminar – A. Pérez-Fuentetaja

Graduate Programs

Multi-Disciplinary Masters Degree Program Administered by the GLC:

Student:	**Advisor:**
Jessica Bakert	Irvine, K.
Kimly Reth	Irvine, K.
Jameieka Price	Irvine, K.
Alyssa Russell	Irvine, K.
Michael Draganac	Frothingham, K.
Heather Lewis	Frothingham, K.
Jerome Krajna	Frothingham, K.
Joseph Petre	Vermette, S.
Lim Sereyrath	Murphy
Eric Snyder	Tang, T.
Heidi Childs	Potts, D.
Robbyn Drake	Burlakova, L.

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

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

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), one student in Multi-Disciplinary Master Degree Program (Robbyn Drake), and one undergraduate URM student (Brianne Tulumello). She was also a member of Graduate Committee for Paul Juette, M.A. student of the Biology Department, and Wendy Paterson, M.S. student at Central Michigan University.
- Alexander Karatayev was the advisor of a graduate student from the Biology Department (Paul Juette).
- Chris Pennuto was the advisor of three graduate students from the Biology Department (Joel Harris, Allyse Fischer, and Hilary McNaughton), and two undergraduate URM student (Cecilia Pershyn and Vanessa Pereira). He also was MA thesis committee member for four students (Jessica Weurstle, Nicole Woods, Lynn Socha, and Paul Juette).
- Alicia Pérez-Fuentetaja was the major professor of two graduate students from the Biology Department (Fawn Goodberry and Beryl Ankrah). She also was MA thesis committee member for a graduate student from the Biology Department (Joel Harris).
- Subodh Kumar was the major professor of one graduate student (M. Williams) from the Forensic Science program.
- Jagat Mukherjee assisted undergraduate students in their independent research endeavors. He also encouraged undergraduate students in ongoing research activities.

Other Educational Activities

- Subodh Kumar continues 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 4 Management and Grade 3 Supervision.
- Kit Hastings provided instructional support on field sampling procedures for Dr. Standora's and Dr. Bergslien's classes.

Dr. Bergslien's students get a sampling demonstration at the Field Station.

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.
- Member Great Lakes Ecosystem Science Master Program Committee: Creation and implementation of a new M.A. and a new M.S. course for the Great Lakes Center.
- Co-chair of Aquatic Invasive Species Session, 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
- Graduate Faculty and Graduate Committee Member at Central Michigan University.
- Advised Texas Parks and Wildlife Department, Texas Commission on Water Quality, and other organizations on distribution and abundance of rare unionid mussels in Texas.
- Provided information required for conservation of Unionidae in Texas for U.S. Fish and Wildlife Service for rare Texas mussels under the Endangered Species Act, and for a Petition to List Texas endemic species as Endangered or Threatened.
- Member of the Great Lakes Research Consortium.
- Member of the Freshwater Mollusc Conservation Society.
- Member of United States Conference On Teaching Statistics (USCOTS) NSF Post-Intro Statistics Cluster.
- Reviewer: *Aquatic Invasions*, *Biological Conservation*, *Journal of North American Benthological Society*, *The Journal of Experimental Biology*, *The Southwestern Naturalist*.

Mark Clapsadl:

- Participated in and supervised the Lake Erie Long Term Lower Trophic Level Monitoring Project.
- Participated in the Lake Erie Nearshore Offshore Nutrient Study, providing logistical support essential to the project as well as actually collecting a large percentage of all the field samples taken from Lake Erie.
- Assisted Dr. Tao Tang in conducting extensive LIDAR (laser mapping) surveys of Lake Erie and the Buffalo River as part of an international scholar exchange program.
- Provided laboratory technical support to Dr. Randy Snyder with his Alewife Fatty Acids research.
- Gave lectures/field trips for multiple BSC classes.
- Participated in the bi-annual Limnology Field trip to Pymatuning, PA along with Dr. Riessen, the Ecology Field trip with Dr. Standora, and the GES 460 field trip with Dr. Bergslien.
- Assisted with development of the Great Lakes Center Webpage.
- Presented Field Station Activities at GLC Annual Open House.
- Committee Member of the Niagara River Corridor Task Group
- Member of Field Station Renovation Committee
- On Oct. 31, 2011, transported a safe containing heroin, automatic weapons, and ammunition down the Black Rock Canal (as a service to the Buffalo Police Department).

Kit Hastings:

- Participated in field collection and laboratory studies in multiple projects conducted at the Field Station, including the Lake Erie Long Term Lower Trophic Level Monitoring Project.
- Played a key role in developing and launching a new GLC website.
- Participated in the Lake Erie Nearshore Offshore Nutrient Study.
- Participated in upgrade of computer systems at the Field Station.
- Volunteered with Buffalo State College Sustainability Council to help plan for and set up the North Wing Courtyard pollinator and rain garden.
- Participated in Elmwood Village Cleanup on 4/21/12.

Alexander Karatayev:

- Organized Great Lakes Center Open House (November 2011).
- Published Great Lakes Center 2010–2011 Annual Report (November 2011).
- Campus representative for the Great Lakes Research Consortium.
- Member of the Biology Department Personnel Committee.
- Member Great Lakes Ecosystem Science Master program committee: Creation and implementation of a new M.A and a new M.S. for the Great Lakes Center.
- Supervised a graduate student from the Biology Department.
- Member of the Field Station Renovation Committee.
- Member of the New Science Building Renovation Committee.
- Co-chair of Aquatic Invasive Species Session, 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
- Reviewed a tenure package of Dr. David Zanatta at the Central Michigan University.
- Reviewed a doctoral thesis of Sergey Afanasyev, Institute of Hydrobiology National Academy of Sciences of Ukraine.
- Advisory Board member of the International Journal of Aquatic Invasions.
- Editor of the Special Issue of the International Journal of Aquatic Invasions.
- Multiple interviews for various mass media.
- Member of the American Society of Limnology and Oceanography.
- Member of the International Association of the Great Lakes Research.
- Reviewer: *Journal of Aquatic Invasions*, *Biological Invasions*, *Biofouling*, and *Hydrobiologia*.

Subodh Kumar:

- Radiation Safety Committee member.
- Chemical Hygiene Committee member.
- Supervised a graduate student in Forensic Science.
- 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.
- Member of American Chemical Society.

- Member of American Association for the Advancement of Science.
- Member of American Association for Cancer Research.
- Member of Environmental Mutagen Society.
- Member of Sigma Xi.
- Reviewer: *Journal of Medicinal Chemistry*, *Chemical Research in Toxicology*, *ARKIVOC* (also serves in Editorial Board), *Bioorganic and Medicinal Chemistry Letters*, *Bioorganic and Medicinal Chemistry*, *Polycyclic Aromatic Compounds*, *ACS Combinatorial Science*, *Journal of Heterocyclic Chemistry*, and *Archiv der Pharmazie*.

Jagat Mukherjee:

- Invited reviewer of the grant proposals submitted to the Bankhead-Coley Cancer Research Program managed by the Florida Department of Health.
- Assisted undergraduate students in their independent research endeavors.
- Reviewer: *Chemical Research in Toxicology*, *Cell Biochemistry and Function*, *Journal of National Cancer Institute*.

Cathy Nasca:

- Assisted in preparation of the Great Lakes Center Annual Report for publication.
- Organized Great Lakes Center Open House.
- Assisted in preparation of the Great Lakes Center and Biology Department Seminar Series.

Christopher Pennuto:

- Faculty co-advisor, Biology Club.
- Chair of the Great Lakes Ecosystem Science Master Program Committee: Creation and implementation of a new M.A and a new M.S. for the Great Lakes Center.
- Chair of the GLC Evaluation Committee and GLC Director Evaluation Committee: Review and evaluation of GLC and Director performance in the last five years.
- Graduate Advisory Council member, Subcommittee on Continuous Enrollment Policy.
- Distinguished Professor Committee member.
- Dive Safety Officer.
- Member of the Biology Department Personnel Committee.
- Major Professor of three graduate students.
- Member of Graduate Committee of four graduate student.
- Reviewer: *Diversity and Distributions*, *Journal of Great Lakes Research*.

Alicia Pérez-Fuentetaja:

- Chair of the Search Committee to hire a new Plant Biologist.
- Member Great Lakes Ecosystem Science Master Program Committee: Creation and implementation of a new M.A. and a new M.S. for the Great Lakes Center.
- Member of the GLC Evaluation Committee and GLC Director Evaluation Committee: Review and evaluation of GLC and Director performance in the last five years.
- Member of the Biology Department Personnel Committee and the SNSS Personnel Committee.

- Major Professor of two graduate students. Member of Graduate Committee of one graduate student.
- Advisor Graduate Comprehensive Exam students. Administered comprehensive exams for students Todd Duval and Stephanie Kroneiss.
- Research Advisor to the Lake Erie Forage Task Group.
- Chair of Native and Non-Native Invertebrates: Biology, Ecology and Food Webs Session, 55th Annual Conference on Great Lakes Research. May 13-17, Cornwell, Ontario, Canada.
- Judge student poster presentations at the International Association of Great Lakes Research. 55th Conference, Cornwall, Ontario. May 13-17, 2012.
- Reviewer: *Journal of Great Lakes Research*.

V. Professional Development Activities

Mark Clapsadl:

- Participated in the Annual Great Lakes Observing System meeting March 21-22 in Cleveland Ohio.
- Participated in the Niagara River Partnership Huron-Erie Corridor Initiative Information Exchange Lewiston, New York June 21-22.

Kit Hastings:

- Received training for: Safe Zone on 10/12/11; QPR on 1/12/12; Workplace Violence Prevention on 6/27/12.
- Completed the following classes: BIO 418 Limnology, GEG 429 Advanced Topics in GIS.

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. We continue to update and maintain our research support systems.

Research Vessels

The new 28' Privateer boat has been added to our collection of research vessels. This boat enables us to take groups of students out onto the water for classes and research. Also, we have finished rebuilding and repairing the vessels in need of work that are worth repairing. This is likely the first time in decades that all of the boats have been in good repair.

The new Privateer has a large open deck that makes it ideal for anything requiring extra room.

Instructional Support

- Kit Hastings developed a Field Station orientation guide. This guide provides practical information regarding safety, policies and procedures for students new to using the GLC facilities.
- GLC staff provided boat time and class assistance with the Limnology field trip to Pymatuning, PA.
- Dr. Standora's Ecology class was given a limnology equipment demonstration and lecture in the fall; Dr. Bergslien's class was given a limnology equipment demonstration and lecture in the spring.
- Facilities were provided for Lisa Anselmi's Anthropology class experiments.

Students learning field sampling procedures on Conneaut Lake for the Limnology field trip.

Research Activities

- Installed and operated the GLOS (Great lakes Observing System) buoy in Lake Erie off Dunkirk, NY.
- Provided research vessel and logistical assistance for the Lake Erie Nearshore Offshore Nutrient Study (LENONS) project.
- Continued Long Term sampling of the eastern basin of Lake Erie for the Lower Trophic Level Assessment, adding to over ten years of data.
- Assisted Jill Singer with logistics for her Buffalo River current sonar modeling project.
- Provided support and facilities for Geography and Planning department training for the new autonomous underwater vehicle (AUV).
- Allowed access to the boat launch for NYS DEC and US Fish & Wildlife Service.
- Provided support to SUNY ESF with muskellunge spawning research.
- Interviewed for several campus news articles.

VII. New Initiatives

Great Lakes Center M.S. Programs

In conjunction with the Departments of Geography & Planning, Earth Sciences, Biology, and the Dean's Office, we have made significant progress toward developing two new graduate programs in the Professional Science Master and Master of Science in Great Lakes Ecosystem Science. These degrees build upon an effort begun nearly a decade ago to create a Great Lakes-focused, graduate research degree. These programs will be able to accommodate a range of students and faculty outside the Center, but it will still lean toward our core interests. The location and facilities of Buffalo State College provide a unique opportunity to study the effects of the interactions of physical and biological processes with the social, economic and civil activities of humans living on one of the world's most precious resources - fresh water. The Great Lakes region holds approximately 20% of the world's store of fresh water. The entire Great Lakes basin drains through Lake Erie and the Niagara River and thus directly past the Field Station on the Niagara River. This is a prime site for students who wish to study how humans both create and resolve environmental problems, especially those related to the aquatic environment. Students will become professionals who will provide critical insight and interventions for future planning and management of the world's water supplies.

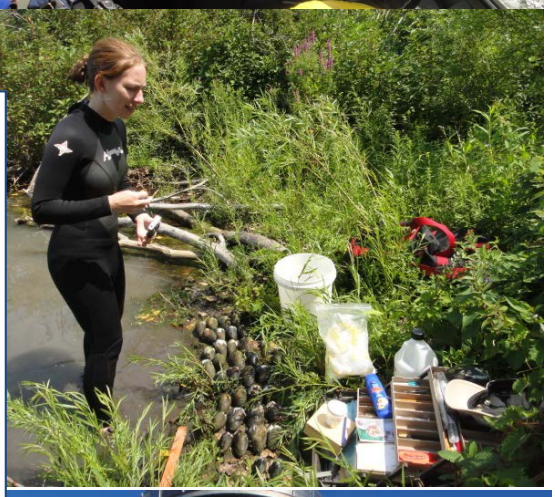
Great Lakes Center Website

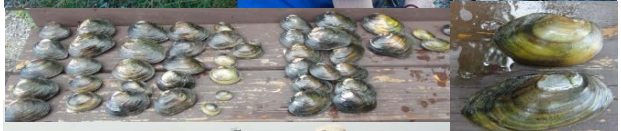
One focus this year was updating the GLC website, since it was out of date and no longer reflected the Great Lakes Center as it is today. With help from College Relations, we developed and launched a new GLC website that features a modern design, updated content, and new photo galleries and videos. The new format is much easier to update, so new content is added regularly.

Seminars

In order to facilitate collaboration between the GLC and leading experts in aquatic ecology and related sciences and to increase our visibility in 2011–2012, we invited seven speakers to present talks, including:

1. David Zanatta, Biology Department, Central Michigan University, Mount Pleasant, MI. "Patterns of post-glacial colonization for freshwater mussels in the Great Lakes." October 27, 2011.
2. Daelyn Woolnough, Biology Department, Central Michigan University, Mount Pleasant, MI. "Determining the spatial linkages between hosts and parasites: Can we use fish to predict the condition of freshwater mussel communities?" October 27, 2011.
3. Daniel P. Molloy, Department of Biological Sciences, University at Albany. "Unraveling the Mystery of Rotifer Deaths at a Remote Adirondack Lake." November 17, 2011.
4. Martha Patricia Celis-Salgado, Post-Doctoral Fellow, Faculty of Science and Engineering, York University, Ontario. "The biological recovery of Sudbury lakes from historical metal damage: Evaluation, trends and emerging stressors." December 2, 2011.
5. Don W. Schloesser, USGS, Great Lakes Science Center, Ann Arbor, MI, USA. "Restoration of burrowing mayflies (*Hexagenia* spp.) in the Laurentian Great Lakes." December 8, 2011.
6. Martin A. Stapanian, U.S. Geological Survey, Lake Erie Biological Station. "Evidence for predatory control of the invasive round goby by burbot." January 26, 2012.
7. Irina Feniova, Institute of Ecology and Evolution, Russian Academy of Sciences, Fulbright Scholar at Oklahoma State University. "The effects of temperature on the species composition and biomass of cladoceran communities." April 26, 2012.





Conservation of Native Freshwater Mussel Refuges in the lower Great Lakes

June - August 2011