



# THE GREAT LAKES CENTER

Annual Report 2010-2011

<https://greatlakescenter.buffalostate.edu>

**Buffalo State**  
*State University of New York*





The Lake Erie  
Nearshore and Offshore  
Nutrient Study  
(LENONS)  
*June 2011*







## Conservation of Native Freshwater Mussel Refuges in Great Lakes Coast





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## MISSION

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

## HIGHLIGHTS

Over the last year, the Great Lakes Center saw sustained activity and productivity in research, education and service. The last year was especially successful in obtaining grant funding. We have increased the total number of funded projects from 10 in 2009-2010 to 17 in 2010-2011 and almost doubled the total amount of funded projects (from \$2,391,130 in 2009-2010 to \$4,556,387, including \$3,389,361 for Buffalo State in 2010-2011). 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 two letters of intent for new graduate programs in Great Lakes Environmental Science were submitted to SUNY.

- Our researchers have published **8** peer-reviewed papers, **3** papers were accepted and **12** papers were submitted for publications.
- Presented **39** talks, including: **23** at national/international/regional conferences, **8** invited talks, and **8** presentations in non-refereed venues.
- Submitted **10** grant proposals (total requested amount **\$2,678,261**, including **\$2,372,386** for Buffalo State).
- **Seventeen** projects for research and education (including multi-year grants) are currently funded in the GLC totaling **\$4,556,387**, including **\$3,389,361** for Buffalo State.
- Center personnel acted as advisers to graduate students, and taught **7** 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 a preliminary program for the renovation of our Field Station with the intent to create a signature building on the water for research but also to allow public interaction and education.
- We made significant progress in updating and replacing equipment and making facilities improvements at the Field Station.
- We have submitted two letters of intent for new graduate programs in the Master of Science in Great Lakes Environmental Science and the Master of Art in Great Lakes Environmental Science

# I. Staff

Our Research Fleet Manager & Ships Captain Caleb Basiliko left GLC in the summer of 2010. In 2011 Thomas Robert Hahn joined GLC as an adjunct professor and grant director. Thomas graduated from University of Vienna, Austria and received his doctoral degree in physics from University of California, San Diego in 1999.

## GLC Personnel

<i><b>Director:</b></i>	Alexander Karatayev
<i><b>Research Scientists:</b></i>	Subodh Kumar, Director of the Lab of Environmental Toxicology Lyubov Burlakova Mark Clapsadl Jagat Mukherjee Christopher Pennuto Alicia Pérez-Fuentetaja Charlotte Roehm Thomas Hahn
<i><b>Secretary:</b></i>	Cathleen Nasca
<i><b>Field Station Personnel:</b></i>	Field Station Director, Research Associate & Ships Captain Mark Clapsadl Research Fleet Manager & Ships Captain Caleb Basiliko Field Station Technician Kit Hastings
<i><b>Research Assistants:</b></i>	Christopher Janik (Buffalo State College) Brienne Tulumello (Buffalo State College) Paul Juetten (Buffalo State College) Allyse Fischer (Buffalo State College) Joel Harris (Buffalo State College) Cecilia Pershyn (Buffalo State College) Rory Pusateri (Buffalo State College) Fawn Goodberry (Buffalo State College) Vadim Karatayev (University at Buffalo) Nicole Germain (University at Buffalo)
<i><b>Work Study Students:</b></i>	James Webb

## 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
- 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
- Bill Edwards, Assistant Professor of Biology, Niagara University
- Paul Patrick, Senior Consultant, Senes Consulting, LTD
- Mike Goehle, Regional ANS Coordinator, US 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
- 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, Central Michigan University, Mount Pleasant, Michigan
- James Kitchell, Professor and Director of the Center for Limnology, University of Wisconsin, Madison
- 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
- Mara L. Alexander, Ecologist, U.S. Fish and Wildlife Service, San Marcos National Fish Hatchery and Technology Center, 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
- Dave Evers, Assistant Professor, Biology Department, University of Southern Maine
- Mark Green, Associate Professor, Biology Department, Saint Joseph's College of Maine
- Alan van Arsdale, Senior Ecologist, US EPA
- Joseph Conroy, Ohio State University, Columbus, Ohio

- 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
- Tom Bridgeman, University of Toledo, Toledo, Ohio.

### **International**

- Demetrio Boltovskoy, Professor, University of Buenos Aires, Argentina
- Sergei Olenin, Professor, Coastal Research and Planning Institute, Klaipeda University, Lithuania
- Sergey Mastitsky, Postdoc, Integrative Bioinformatics and Systems Biology (iBioS), German Cancer Research Center, Heidelberg University, Germany
- Charles Ramcharan, Associate Professor, Department of Biology, Laurentian University, Sudbury, Ontario, Canada
- Jan Ciborowski, Professor, Department of Biological Sciences, University of Windsor, Windsor, Ontario, Canada
- Frances Lucy, Associate Professor, Institute of Technology, Sligo, Ireland
- Jan Karlsson, Climate Impacts Research Centre (CIRC), Department of Ecology and Environmental Science, Umeå University, Sweden
- Reiner Giesler, Climate Impacts Research Centre (CIRC), Department of Ecology and Environmental Science, Umeå University, Sweden
- Richard Soare, Department of Geography and Planning, Concordia University, Montreal, Canada
- Norman Yan, Professor, York University, York, Ontario, Canada
- Alexander P. Ostapenya, College of Biology, Laboratory of Hydroecology, Belarusian State University, Minsk, Belarus
- Tamara A. Makarevich, Associate Professor, Department of General Ecology, College of Biology, Belarusian State University, Minsk, Belarus

## **Awards and Achievements**

Research paper “The invasive bivalves *Dreissena polymorpha* and *Limnoperna fortunei*: parallels, contrasts, potential spread and invasion impacts” by A. Y. Karatayev, D. Boltovskoy, D. K. Padilla, and L. E. Burlakova, published in the Journal of Shellfish Research in 2007 (volume 26, issue 1, pp. 205-213) was recognized as the third most cited article in the journal over the last three years.



## II. Research Activities

### Aquatic Ecology and Ecosystems Research

Most of the aquatic ecology/ecosystems research is carried out at the GLC Field Laboratory 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:



LENONS getting ready to sample benthos  
June 2011 Chris Pennuto, Allyse Fischer,  
Cecilia Pershyn, Vadim Karatayev



LENONS Plankton team: Alicia Perez,  
Rory Pusateri, and Mark Clapsadl

#### The nearshore and offshore Lake Erie 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  $^{18}\text{O}_p$  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.

#### 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.

#### Round goby-steelhead trout interactions in stream mesocosms.

This project will examine the interactions between invasive round gobies and stream-form steelhead trout. As gobies invade further inland in tributary rivers and streams, their aggressive behavior coupled with their wide diet breadth may result in direct and indirect impacts to other fishes with similar niches.

#### Role of exotic invertebrates in Lake Erie.

This project examines the role of exotic invertebrates in Lake Erie benthos that increased dramatically during the last decades. Our 2009 and 2011 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.



Stream Mesocosms for round goby  
experiments Great Lakes center



Paul Juetter, Lyuba Burlakova, and Brianne Tulumello sorting benthic invertebrates on the shore of Lake Erie

### 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 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.

### 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 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



Alexander Karatayev examining dreissenids on boats in Lake Erie marina



Vadim Karatayev and Alexander Karatayev collecting exotic molluscs on Lake Oneida

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.

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. 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. We are currently working with TPWD personnel to prioritize sites for conservation based on species endemism and



Joe Skorupski, Matthew Johnson, Eric Tsakiris, Charles Randklev (Texas A&M Institute of Renewable Natural Resources), and Lyuba Burlakova surveying unionids in Colorado River, Colorado Bend State Park, in March 2011



diversity. 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.



Joint unionid survey by seven research teams from Michigan, New York, Ohio, and Pennsylvania in the Ottawa National Wildlife Refuge (Ohio) in June 2011.



Charles Randklev, Matthew Johnson (Texas A&M Institute of Renewable Natural Resources), and Lyuba Burlakova measuring shells collected in Colorado River, Texas.

### 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. We are going to sample unionids in refuges in the lower Great Lakes and examine their 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.

### 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 (priority 8) in both states under the federal Endangered Species Act (Federal Register 2008). Using an opportunity provided by US FWS for bilateral species conservation effort in New Mexico and Texas, we are 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.



Texas Hornshell Team: Yixin Zhang (Texas State University, San Marcos), Brian Lang (New Mexico Department of Game and Fish), David J. Berg and Kentaro Inoue (Miami University, OH), Thomas Miller (Environmental Science Center, Laredo Community College), and Trey Noble (Texas State University). Laredo, March 2011



Surveying *P. popeii* in Devils River, Texas, March 2011



Brian Lang (New Mexico Department of Game and Fish) and Kentaro Inoue (Miami University, OH) measuring *P. popeii* at the Rio Grande' La Bota mark-and-recapture site in Laredo, Texas, March 2011.

### 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.



Beryl Ankrah (Dr. Alicia Pérez-Fuentetaja's graduate student) performing goby stomach analyses.

### 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.

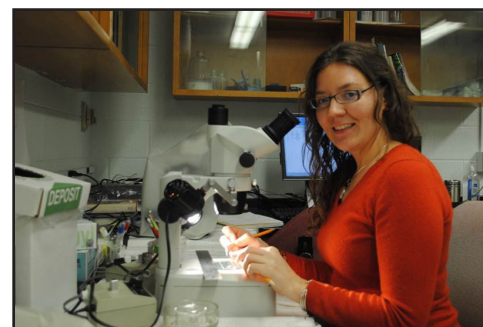
### Feeding ecology of the new Great Lakes invader *Hemimysis anomala*.

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



*Hemimysis anomala*, a new invasive mysid in the Great Lakes.

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.



Jessica Wuerstle, a graduate student of Dr. Alicia Pérez-Fuentetaja, studying diet of *Hemimysis anomala*.

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

The common cladoceran zooplankter *Daphnia* takes 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.

### Long Term Monitoring on Lake Erie.

The Lake Erie Lower Trophic Level Assessment is a multiagency effort organized by the Forage Task Group of the Great Lakes Fisheries Commission. The aim is to coordinate state and federal sampling efforts at locations around Lake Erie to build a database of biotic and abiotic information. Over ten years of data have already been collected, with three years of participation by the Great Lakes Center. Samples are collected bi-weekly from three sites in Eastern Lake Erie from May through October.



## Water Quality/Watershed Studies

### Current Projects:

#### 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 project PI (Dr. Roehm), co-PIs (Dr. Vermette and Ms. Perrelli – Department of Geography and Drs. Anderson and Beletsky – CILER University of Michigan) and collaborator (Dr. Singer – Department of Earth Sciences) have worked closely with engineering firms and other Buffalo groups to create a set of custom specific buoys. 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.



GLOS buoy in preparation for deployment.

#### Implementation of the Great Lakes Observing System.

In summer of 2011 we are going to deploy an automatic buoy provided by GLOS (Great Lakes Observation System) to Buffalo State College. The buoy will be maintained 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.

#### Hydrological characterization of Woodlawn Beach State Park: Implications for *E. coli*.

Woodlawn Beach State Park protects a 12 acre wetland that is listed on the park's master plan for preservation and enhancement. The project focuses on defining the hydrological flowpaths implicated in the transport and fate of *E. coli* and other contaminants within the Woodlawn Beach State Park. This status of the project is reaching its final stages, with a focus on data analysis and publications. We are currently working on the development of a combined hydrologic and biologic model that will be used to define the hydrologic dynamics required to maintain a healthy wetland ecosystem and one that is able to effectively abate *E. coli* concentrations and transport.

#### Impacts of climate change on Subarctic Lakes.

As part of a collaborative effort with Umeå University, Sweden, this ongoing three year collaborative project is looking at carbon and energy redistribution within watersheds affected by permafrost degradation and ultimately the impact on and fate in aquatic ecosystems.

#### Wetland remapping project.

In collaboration with NYSDEC, this project is reaching phase two of the wetland remapping of the distribution and boundaries within the Oswego/Oneida watershed. This year has seen the revision of a large sector of Oneida and Oswego maps and is being followed up by field ground truthing.

## 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:



Dr. Jagat Mukherjee and Jaquan Williams (student) are analyzing PAH carcinogens by high pressure liquid chromatography (HPLC).

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

Efforts are in progress to elucidate the signaling pathways involved in tumor promotion by tobacco smoke phenolic components. Role of protein kinase C (PKC) and p53 have been implicated in this regard. Ongoing studies include understanding of the role of PKC over-expression in chemo-prevention against tobacco smoke carcinogenesis using in vitro cell culture and in vivo animal models

#### 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.

#### Mechanism of synergistic interactions of active TSC phenolic component(s) with polynuclear aromatic hydrocarbons (PAHs) (present in the environment) toward potentiation of carcinogenicity.

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.



Dr. Subodh Kumar and graduate student Jaquan Williams analyzing the metabolites of the phenanthro[3,4-b]thiophene, a potential human carcinogen identified in diesel exhaust and cigarette smoke, by high pressure liquid chromatograph located at the Bioanalytical Laboratory (SCI-455) of the Environmental Toxicology and Chemistry Lab of GLC.

#### 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 \$4,556,387, including \$3,389,361 for Buffalo State)

1. Burlakova, L., A. Karatayev, 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.
2. 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.
3. Burlakova, L. E., A. Y. Karatayev, M. E. May, and B. Lang. U.S. Fish and Wildlife Service, and Texas Parks and Wildlife Department, Traditional Section 6, Bilateral species conservation effort in New Mexico and Texas. \$35,000. 2011.
4. Hahn, T. and A. Y. Karatayev. Effects of Multiple Acoustic Scattering from Realistic Oceanic Bubble and Fish Assemblages. \$75,734. 2011.
5. Karatayev, A. Y. and M. Clapsadl. Implementation of the Great Lakes Observing System. US Department of Commerce. \$35,000. 2011.
6. Karlsson, J., C. Roehm, T. Christensen, N. T. Roulet. Greenhouse Gas Emissions from Lakes in Northern Permafrost Areas: Quantitative Importance and Climate Impacts. Swedish Research Council. \$490,950 (not to BSC). 2009-2012.
7. Lange, C., B. Martinez-Hackert, J. Carbonara, J. S. Sabato, C.L. Roehm, K. Huffner, J. Zawicki, T. Tang, K. Williams, B. Tomaselli, D. Henry, D. MacIsaac. NASA-NSPIRES, STUDIES (Students and Teachers Using Data from Investigations in Earth Systems). \$654,250. 2010-2013.
8. Mukherjee, J. J. Phenolic component of tobacco smoke as tumor promoter. National Institutes of Health. \$214,500. 2008-2011
9. 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. 2007-2011.
10. Pennuto, C. M., A. Y. Karatayev, A. Pérez-Fuentetaja, L. E. Burlakova, D. Bade, G. Matisoff, J. Kramer, C. Mayer. The Lake Erie Nearshore and Offshore Nutrient Study (LENONS). U.S. EPA Great Lakes Restoration Initiative 2010. \$615,813 (365,101 for BS). 2010-2013.
11. Pérez-Fuentetaja, A., M. Clapsadl, D. Aga, M. Alae. 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.

12. Roehm, C. L., S. Vermette, M. Janis. Hydrological characterization of Woodlawn Beach State Park: Implications for E. Coli, NYS Water Resource Institute, USGS National Institutes for Water Resources (NIWR). \$55,517. 2010-2011.
13. Roehm, C. L., S. Vermette, D. Beletsky, E. Anderson. Observing Systems and Monitoring in Nearshore Lake Erie, EPA Great Lakes Restoration Initiative 2010. \$962,583 (\$793,528 for BSC). 2010-2012.
14. Roehm, C. L. Freshwater Wetland Remapping, EPA/NYSDEC, \$100,000. 2009-2011.
15. Snyder, R. J., L. E. Burlakova, D. B. MacNeill, 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.
16. Vermette, S., K. Irvine, C. L. Roehm. Pre-Restoration Wetland Characterization and Chemical Mass Balance Study: Woodlawn Beach State Park, New York, New York Great Lakes Research Consortium (GLRC), \$9,940. 2010-2011.
17. Zanatta, D., L. Burlakova, A. Karatayev, R. Krebs, M. Hoggarth, F. de Szalay, J. Bossenbroek, E. Meyer, 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.
- restoration, and sustainability. Proposal submitted to the U.S. Department of the Interior, Bureau of Reclamation, Policy and Administration Call "WaterSMART (Sustaining and Manage America's Resources for Tomorrow)". 2011-2013. \$159,491 (\$20,030 for BSC). (Pending).
3. Karatayev, A. Y., Burlakova, L. E., and D. K. Padilla (Stony Brook University). Reduce ecological and economic damage posed by parasites of exotic species introduced to the Great Lakes and their tributaries. Invited Proposal submitted to the NY Sea Grant Core Research Call for 2011. 2011 - 2013. \$149,000 (\$107,346 for BSC). (Not funded).
4. Kumar, S., J. J. Mukherjee, and S. Amin. Involvement of sulfoxidation pathway in thia-PAH-induced carcinogenesis, National Institutes of Health. \$871,710 (\$822,664 for BSC). 2011-2014. (Pending).
5. Kumar, S. Development of novel MMP-9 inhibitors for the potential treatment of prostate cancer bone metastasis (Pre-application). Department of the Army- USAMRAA. (Not funded).
6. Lange, C., L. E. Burlakova, and L. Hill Rao. Using indicator species and environmental data to explore climate change in and around the Great Lakes. Pre-Proposal submitted to the NOAA Office of Education. 2011- 2013. \$322,763. (Not funded).
7. Lysenko, V. S. and L. E. Burlakova. Development of technologies to evaluate ecological and operational risks for freshwater ecosystems due to exotic species. Ministry of Education and Sciences, Russian Federation. \$135,714 (\$60,000 for BSC). 2011-2012. (Not funded).
8. Mukherjee, J. J. and S. Kumar. Chemopreventive potential of fatty acids against tobacco smoke carcinogenesis. (Resubmission) National Institutes of Health. \$367,000. 2011-2013 (Not funded).
9. Mukherjee, J. J. and S. Kumar. Chemopreventive potential of fatty acids against tobacco smoke carcinogenesis. (Resubmission) National Institutes of Health. \$367,000. 2011-2014. (Pending).
10. Mukherjee, J. J. and S. Kumar. Fatty acids' role in PAH-induced cellular protective response - a new dimension. National Institutes of Health. \$404,251. 2011-2014. (Pending).

**Submitted in 2010-2011 (Total \$2,678,261, including \$2,372,386 for Buffalo State)**

1. Burlakova, L. E., A. Y. Karatayev, M. L. Alexander, M. E. May, and Y. Zhang. Biological assessment of threatened freshwater mussels (Bivalvia: Unionidae) in Texas. U.S. Fish and Wildlife Service, and Texas Parks and Wildlife Department, Traditional Section 6. 2011-2014. \$268,332. (Pending).
2. Henderickson, D. A., and S. Sarkar (PIs, University of Texas Austin), L. E. Burlakova, A. Y. Karatayev (collaborators). A decision support framework for freshwater conservation,



## 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. Eight manuscripts were published, another 3 were accepted for publication and/or published online, 12 were submitted to peer-reviewed journals. A total of 39 presentations were made by the GLC researchers, including: 23 presentations at national/international/regional conferences, 8 invited talks, and 8 presentations were made in non-refereed venues.

### Refereed Journal Publications (Published):

1. Burlakova, L. E., Karatayev, A. Y., Karatayev, V. A., M. E. May, Bennett, D. L., and Cook, M. J. 2011. Endemic species: contribution to community uniqueness, effect of habitat alteration, and conservation priorities. *Biological Conservation* 144: 155–165.
2. Burlakova, L. E., A. Y. Karatayev, V. A. Karatayev, M. E. May, D. L. Bennett, and M. J. Cook. 2011. Biogeography and conservation of freshwater mussels (Bivalvia: Unionidae) in Texas: Patterns of diversity and threats. *Diversity and Distributions* 17: 303-407.
3. Karatayev, A.Y., L. E. Burlakova, and D. K. Padilla. 2010. *Dreissena polymorpha* in Belarus: history of spread, population biology, and ecosystem impacts. Chapter 9 in G. van der Velde, S. Rajagopal and A. bij de Vaate (eds), The Zebra Mussel in Europe. Backhuys Publishers, Leiden/ Margraf Publishers, Weikersheim. p. 101-112.
4. Karatayev, A. Y., Burlakova, L. E., Karatayev, V. A., and D. Boltovskoy. 2010. *Limnoperna fortunei* vs. *Dreissena polymorpha*: Population densities and benthic community impacts of two invasive freshwater bivalves. *Journal of Shellfish Research* 29(4): 975-985.
5. Mastitsky, S. E., A. Y. Karatayev, L. E. Burlakova, and D. P. Molloy. 2010. Parasites of exotic species in invaded areas: does lower diversity mean lower epizootic impact? *Diversity and Distributions* 16: 798–803.
6. Molloy, D. P., L. Giamberini, L. E. Burlakova, A. Y. Karatayev, J. R. Cryan, S. L. Trajanovski, and S. P. Trajanovska. 2010. Investigation of the endosymbionts of *Dreissena stankovici* with morphological and molecular confirmation. Chapter 23 in G. van der Velde, S. Rajagopal and A. bij de Vaate (eds), The Zebra Mussel in Europe. Backhuys Publishers, Leiden/Margraf Publishers, Weikersheim. p. 227-238.
7. Mukherjee J. J., S. Kumar, R. Gocinski, and J. Williams. 2011. Phenolic fraction of tobacco smoke inhibits BPDE-induced apoptosis response and potentiates cell transformation: Role of attenuation of p53 response. *Chemical Research in Toxicology* 24: 698–705
8. Pérez-Fuentetaja, A., S. Lupton, M. Clapsadl, F. Samara, L. Gatto, R. Biniakewitz, and D. S. Aga. 2010. PCB and PBDE levels in wild common carp (*Cyprinus carpio*) from Eastern Lake Erie. *Chemosphere* 81: 541-547.

### Refereed Journal Publications (in press):

1. Burlakova, L. E., Karatayev, A. Y., and Karatayev, V. A. Invasive mussels induce community changes by increasing habitat complexity. *Hydrobiologia*.
2. Karatayev, A. Y., S. E. Mastitsky, D. K. Padilla, L. E. Burlakova, and M. M. Hajduk. Differences in growth and survivorship of zebra and quagga mussels: size matters. *Hydrobiologia*. Published on-line DOI: 10.1007/s10750-010-0533-z.

3. Pérez-Fuentetaja, A., M. Clapsadl, R. G. Getchell, P. R. Bowser and W. T. Lee. *Clostridium botulinum* Type E in Lake Erie: Inter-annual differences and role of benthic invertebrates. *Journal of Great Lakes Research* 37(2).

### Refereed Journal Publications Submitted (in Review):

1. Higgins, S. E., C. M. Pennuto, J. C. Makarewicz, T. E. Howell. Watershed land-use and impacts on *Cladophora* abundance in Lake Ontario. Submitted to *Journal of Great Lakes Research*.
2. Karatayev, A. Y., Burlakova, L. E., Mastitsky, S. E., Padilla, D. K., and E. L. Mills. Contrasting rates of spread of two congeners, *Dreissena polymorpha* and *Dreissena rostriformis bugensis*, at different spatial scales. Submitted to *Hydrobiologia*.
3. Karatayev, A. Y., Burlakova, L. E., and Padilla, D. K. Spread, population dynamics, and life history of zebra mussels versus quagga mussels: what we know and what we do not. Submitted to: "Quagga and Zebra Mussels: Biology, Impacts, and Control", Second Edition. Eds. Nalepa, T. F., and D. Schloesser.
4. Karatayev, A. Y., L. E. Burlakova, M. J. Vander Zaden, R. C. Lathrop and D. K. Padilla. A century of change in a lake benthic community: evidence for multiple community states. Submitted to *Limnology and Oceanography*.
5. Kothawala, D. N., Roehm, C. L., Blodau, C. and T. R. Moore. Selective adsorption of dissolved organic matter to mineral soils. Submitted *Environmental Science and Technology*.
6. Lucy, F. E., L. E. Burlakova, A. Y. Karatayev, S. E. Mastitsky, and D. T. Zanatta. *Dreissena* impacts on Unionida: A synthesis of trends in North America and Europe. Submitted to: "Quagga and Zebra Mussels: Biology, Impacts, and Control", Second Edition. Eds. Nalepa, T. F., and D. Schloesser.
7. Makarewicz, J. C., T. W. Lewis, C. M. Pennuto, J. Atkinson, W. J. Edwards, G. L. Boyer, and T. Howell. Physical and chemical characteristics of the nearshore zone of Lake Ontario. Submitted to *Journal of Great Lakes Research*.
8. Mukherjee, J. J., S. Kumar, R. Gocinski, and J. Williams. Phenolic fraction of tobacco smoke inhibits BPDE-induced apoptosis response and potentiates cell transformation: Role of attenuation of p53 response. Submitted to *Chemical Research in Toxicology*.
9. Pavlac, M. M., T. T. Smith, S. P. Thomas, J. C. Makarewicz, W. J. Edwards, C. M. Pennuto, and G. L. Boyer. Assessment of phytoplankton distribution in the nearshore zone using continuous in situ fluorometry. Submitted to *Journal of Great Lakes Research*.
10. Pennuto, C. M., T. Howell, J. C. Makarewicz, W. J. Edwards, G. L. Boyer, and J. Atkinson. Round goby size and abundance in nearshore Lake Ontario. Submitted to *Journal of Great Lakes Research*.
11. Pennuto, C. M., T. Howell, J. C. Makarewicz, and T. W. Lewis. Size and abundance patterns of dreissenid mussels in the Lake Ontario nearshore environment. Submitted to *Journal of Great Lakes Research*.
12. Pérez-Fuentetaja, A., M. Clapsadl, and W. T. Lee. Are dreissenid mussels a key link for type E botulism transmission in the Great Lakes? Submitted to: "Quagga and Zebra Mussels: Biology, Impacts, and Control", Second Edition. Eds. Nalepa, T. F., and D. Schloesser. Lewis Publishers.

### International/National/Regional Conference Presentations:

1. Bade, D., J. Conroy, C., Pennuto C., L. Burlakova, A. Karatayev, A. Pérez-Fuentetaja, D. Kane, D. Culver, J. Kramer, W. Edwards. 2011. Biological Phosphorus uptake from streams to offshore L. Erie. 54th Annual Conference on Great Lakes Research. The International Association for Great



Lakes Research, May 30 – June 3, Duluth, Minnesota.

2. Ankrah B., A. Pérez-Fuentetaja. 2011. Differences in Diet and Condition of Round Gobies from Eastern Lake Erie and a Tributary Stream. Great Lakes Research Consortium. Syracuse, NY. March 19, 2011.
3. Burlakova, L. E., A. Y. Karatayev, V. A. Karatayev, M. E. May, D. L. Bennett, and M. J. Cook. Biogeography and conservation of freshwater mussels (Bivalvia: Unionidae): drivers of diversity and threats. 7th Biennial Symposium of the Freshwater Mollusk Conservation Society, Louisville, Kentucky, April 11-15, 2011.
4. Burlakova, L. E., A. Y. Karatayev, and C. M. Pennuto. Exotic invertebrates alter benthic community in the Lake Erie. 17th International Conference on Aquatic Nuisance Species. August 29-September 2, 2010, San Diego, CA.
5. Burlakova, L. E., F. Lucy, A.Y. Karatayev, S. E. Mastitsky, and D. T. Zanatta. *Dreissena* impacts on Unionidae: General trends in North America and Europe. 54th Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 30 – June 3, Duluth, Minnesota.
6. Cudney, K., C. M. Pennuto, and C. E. Janik. 2011. The effect of the invasive round goby (*Neogobius melanostomus*, Pallas 1814) on leaf breakdown in a Lake Erie tributary stream. Great Lakes Research Consortium Student/Faculty Conference. March 19-20, Syracuse, NY.
7. Cudney, K., C. M. Pennuto, and C. E. Janik. 2011. The effect of the invasive round goby (*Neogobius melanostomus*, Pallas 1814) on leaf breakdown in a Lake Erie tributary stream. International Association of Great Lakes Research (IAGLR). June 1-3, Duluth, MN.
8. Goodberry, F., A. Pérez-Fuentetaja, and H. Riessen. 2011. Effects of calcium decline and food levels on *Daphnia pulex* neonate production. Great Lakes Research Consortium. Syracuse, NY. March 18-19, 2011.
9. Janik, C. E., C. M. Pennuto, and K. Cudney. 2011. Invasive round gobies alter primary production in Great Lakes watershed lotic systems. Great Lakes Research Consortium Student/Faculty Conference. March 19-20, Syracuse, NY.
10. Janik, C. E., C.M. Pennuto, and K. Cudney. 2011. Invasive round gobies alter primary production in Great Lakes watershed lotic systems. International Association of Great Lakes Research (IAGLR). Duluth, MN.
11. Karatayev, A. Y., L. E. Burlakova, S. E. Mastitsky, D. K. Padilla, and E. L. Mills. 2010. Invasion paradox: why *Dreissena rostriformis bugensis*, being less invasive, outcompete *D. polymorpha*? 17th International Conference on Aquatic Nuisance Species. August 29-September 2, 2010, San Diego, CA.
12. Karatayev, A. Y., S. E. Mastitsky, L. E. Burlakova, V. A. Karatayev, D. B. Conn, and M. M. Hadjuk. 2011. Exotic molluscs in the Great Lakes Region host pathogenic trematodes. 54th Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 30 – June 3, 2011, Duluth, Minnesota.
13. Karatayev, V. A., A. Y. Karatayev, and L. E. Burlakova. 2011. Lakewide dominance does not predict the invader species for Dreissenids. 54th Annual Conference on Great Lakes Research. The International Association for Great Lakes Research. May 30 – June 3, 2011, Duluth, Minnesota.
14. Mukherjee, J. J. and S. Kumar. 2011. Potentiation of PAH-induced cell transformation by phenolic fraction of tobacco smoke: a mechanistic insight. American Association for Cancer Research meeting,

April 2-6, 2011, Orlando, FL.

15. Pennuto, C. M., A. Pérez-Fuentetaja, A. Karatayev, L. Burlakova, J. Conroy, J. Kramer, D. Bade, G. Matisoff. 2011. Biological production and nutrient fate in nearshore and offshore Lake Erie. Ohio Sea Grant Symposium, March 28, 2011, Toledo, OH.
16. Pennuto, C. M. 2011. Status of the round goby in the lower Great Lakes. State of the Lake (ERIE) annual meeting, May 12, 2011, Hamburg, NY.
17. Pennuto, C. M., Basiliko, C., Fischer, A., Makarewicz, J. C., Lewis, T. E., Howell, E. T. 2011. Round goby abundance and size correlate with habitat conditions in nearshore Lake Ontario. International Association of Great Lakes Research (IAGLR). June 1-3, Duluth, MN.
18. Pérez-Fuentetaja, A., J. Wuerstle. 2011. Feeding preferences of a new Great Lakes invader, *Hemimysis anomala*, the bloody red shrimp. International Association of Great Lakes Research (IAGLR). June 1-3, 2011, Duluth, MN.
19. Roehm, C. L. Great Lakes Restoration Initiative: Year one, Great Lakes Research Consortium Conference, March 18-19th, 2011, Syracuse, NY.
20. Roehm, C. L. Observing Systems and Monitoring in Nearshore Lake Erie. 54th Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 30 – June 3, 2011, Duluth, MN.
21. Roehm, C. L. Hydrodynamics in Nearshore Lake Erie; An insight. 54th Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 30 – June 3, 2011, Duluth, MN.
22. Wuerstle, J., A. Pérez-Fuentetaja. 2010. Prey size selection in *Hemimysis anomala*. Finger Lakes Research Conference, December 4, 2010, Geneva, NY. Best Presentation Award.
23. Wuerstle, J., A. Pérez-Fuentetaja. 2011. Prey size selection in *Hemimysis anomala*. Great Lakes Research Consortium, March 19, 2011, Syracuse, NY. Best Presentation Award.

### Invited Talks:

1. Burlakova, L. E. Endemic freshwater mussels (Bivalvia: Unionidae): contribution to community uniqueness, effect of habitat alteration, and conservation priorities in Texas. Invited Seminar. Evolution, Ecology and Behavior Graduate Program, University at Buffalo. September 17, 2010.
2. Burlakova, L. E. A century of change in a lake benthic community (Lake Mendota, Wisconsin). Invited Seminar at NOAA-GLERL. Ann Arbor, MI, November 12, 2010.
3. Burlakova, L. E., A. Y. Karatayev. Texas Hornshell Project update. Presentation at the Texas Parks and Wildlife Department, March 22, 2011.
4. Karatayev, A. Y. Invasive bivalves as ecosystem engineers. Invited Seminar at NOAA-GLERL. Ann Arbor, MI, November 12, 2010.
5. Karatayev, A. Y. A review of the research and teaching activities over the last 10 years. Belarusian State University, School of Biology. February 2011.
6. Pérez-Fuentetaja, A. 2010. Type E botulism in the Great Lakes: A widespread concern. Department of Molecular and Cellular Biology, Roswell Park Cancer Institute, Buffalo, NY, December 9, 2010.
7. Pérez-Fuentetaja, A. 2011. Great Lakes: food webs and persistent organic pollutants. Chemistry Department, Graduate Student Group, University at Buffalo, April 8, 2011.



8. Roehm, C. L. 2011. Great Lakes Restoration Initiative: Year one. Great Lakes Research Consortium Conference, Syracuse, NY, March 18-19th, 2011.

### Conference Presentations (Non-Refereed)

1. Burlakova, L. E., Karatayev, A. Y., Karatayev, V. A., May, M. Conservation of freshwater molluscs in Texas. 11th Annual 2010 Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 2010. Poster.
2. Drake, R., Burlakova, L. E., Karatayev, A. Y. Benthic macroinvertebrate bioassessment of Scajaquada Creek (Buffalo, NY). 11th Annual 2010 Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 2010. Poster.
3. Karatayev, V. A., Karatayev, A. Y., Burlakova, L. E. In spite of *Dreissena rostriformis bugensis* dominance, *D. polymorpha* retains a strong potential to invade from the Great Lakes. 11th Annual 2010 Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 2010. Poster.
4. Karatayev, V. A., Karatayev, A. Y., Burlakova, L. E. Dominance within a lake does not represent invasion potential. University Honors College. SUNY University at Buffalo. Spring Open House. March 26, 2011. Poster.
5. Kumar, S. and J. J. Mukherjee. Mechanism of carcinogenesis of benzo[b]phenanthro[2,3-d]thiophene (a thia-PAH) is potentially different from widely studied benzo[a]pyrene. 11th Annual 2010 Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 2010. Poster.
6. MacKintosh, S., L. R. Zimmerman, G. Pacepavicious, M. Clapsadl, A. Pérez-Fuentetaja, M. Alae, D. S. Aga. 2011. Poster. Catch of the day: Brominated flame retardants in the food web of Lake Erie. Best Poster Award NSF-IGERT 2011 Poster Competition. <http://www.igert.org/posters2011/posters/117>
7. Mukherjee, J. J., S. Kumar, R. Gocinski, and J. Williams. Cell transformation ability of phenolic fraction of tobacco smoke condensate: Role of p53 and nuclear factor kappa B transcription factors. 11th Annual 2010 Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 2010. Poster.
8. Weimer, E., M. Hosack, J. Deller, P. Kocovsky, T. MacDougall, J. Markham, A. Pérez-Fuentetaja, E. Trometer and L. Witzel. 2011. Report of the Lake Erie Forage Task Group. March 2011. Presented to: Standing Technical Committee, Lake Erie Committee, Great Lakes Fishery Commission.



Poster presentation by the Lab of Environmental Toxicology at the 11th Annual Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, 2010 (students Ronald Gocinski and Jaquan Williams and Dr. Jagat J. Mukherjee).

### 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 (2010-2011)

- BIO 612-02 Trophic Interactions – *A. Pérez-Fuentetaja*
- BIO 430/630 Stream Ecology – *C. Pennuto*
- BIO 361/362 Biology/URM Seminar – *C. Pennuto (two semesters)*
- BIO 612, Freshwater Macroinvertebrate Ecology – *C. Pennuto*
- BIO 429/629 Fisheries Biology/Advanced Fisheries Biology – *A. Pérez-Fuentetaja*
- GEG365/565 Soil Science and Management – *C. Roehm*

#### Graduate Program

##### Multi-Disciplinary Masters Degree Program Administered by the GLC:

Student:	Advisor:
Vileno, Codie	Roehm, C. L.
Reeverts, Tom	Roehm, C. L.
Bakert, Jessica	Irvine, K.
Price, Jameieka	Irvine, K.
Draganac, Michael	Frothingham, K.
Lewis, Heather	Frothingham, K.
Petre, Joseph	Vermette, S.
Childs, Heidi	Potts, D
Drake, Robbyn	Burlakova, L.

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

**Student:** Isabel Porto Hannes

**Advisor:** Burlakova, L.



## Advising Undergraduate and Graduate Students

- Chris Pennuto was the advisor of four graduate students from the Biology Department (Bryan Young, Shannon Rupprecht, Christopher Janik and Kevin Cudney), and one undergraduate URM student (Shana Chapman). He also was MA thesis committee member for four students (Lynn Soscha, Beryl Ankrah, Jessica Wuerstle, and Nicole Woods).
- Charlotte Roehm supervised two graduate students (Codie Vilen and Tom Reeverts) and was co-advisor/committee member for two Masters student Jameieka Price and Joseph Petre.
- Lyuba Burlakova was the major professor for one graduate student (Robbyn Drake), one URM student (Brianne Tulumello) and was a member of Graduate Committee for Biology graduate student Jessica Wuerstle.
- Alicia Pérez-Fuentetaja was the major professor for three graduate students (Fawn Goodberry, Jessica Wuerstle and Beryl Ankrah) and supervised research in her lab by URM student Rory Pusateri. She also was MA thesis committee member for two students (Chris Janik, Kevin Cudney).
- 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. Two undergraduate students got authorships in peer reviewed journals which will help their future career development.

## 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. The number of trainees attended these courses were 10, 5, 5, 5, and 1, respectively, in the fall semester of 2010.
- Kit Hastings provided instructional support on field sampling procedures and the LTM protocol for Dr. Standora's class, Fall 2010; gave field station tours and support on bomb calorimeter use for Dr. Standora's classes, Spring 2011; and provided boat support for Dr. Pérez-Fuentetaja's Fisheries class, Spring 2011



Kit Hastings supervising students from Dr. Standora's class

## 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 of the GLC Graduate Committee.
- Co-chair of Aquatic Invasive Species Session, 54th Annual Conference on Great Lakes Research. May 30 – June 3, 2011, Duluth, Minnesota.
- Advised Texas Parks and Wildlife Department, Colorado River Authority, Guadalupe-Blanco River Authority, 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 listing of six rare Texas mussels under the Endangered Species Act, and for the 90-Day Finding on a Petition to List the Southern Hickorynut Mussel (*Obovaria jacksoniana*) as Endangered or Threatened.
- Assisted Texas Parks and Wildlife Department by providing information on distribution of invasive applesnail *Pomacea insularum* in Texas for the Texas Rapid Assessment Team survey in Galveston Bay in June 2011.
- Member of the American Society of Limnology and Oceanography.
- Member of the Freshwater Mollusc Conservation Society.
- Member of United States Conference On Teaching Statistics (USCOTS) NSF Post-Intro Statistics Cluster.
- Reviewed manuscripts submitted to: *Biological Conservation*, *The Journal of Experimental Biology*, *Parasitology*, *Journal of the North American Benthological Society*, *The American Midland Naturalist*, and *Aquatic Invasions*.

### **Mark Clapsadl:**

- Chair of the Field Station Renovation Committee.
- Served on McKinley High School Science Curriculum Advisory Committee.
- Gave lectures for Tapestry Charter School, Springville Middle School.
- Dive Control Board member and an assistant of the Dive Safety Officer.
- Gave lectures/field trips for multiple BSC classes.
- Interviews for Buffalo Spree magazine.
- Assisted the NYS DEC with Lake Erie trawl surveys.
- Presentation of Field Station Activities at GLC annual Open House.
- Provided access for Anthropology class to build a primitive kiln on FS grounds for firing pots.

### **Kit Hastings:**

- Participated in field collection and laboratory studies in multiple projects conducted at the Field Station.
- Made substantial progress in updating GLC website.
- Contributed to Buffalo State College Sustainability Council planning in fall 2010.
- Attended several Final Friday discussions about LGBT issues on campus and a webinar on SafeZone.

**Alexander Karatayev:**

- Organized Great Lakes Center Open House (April 2011).
- Published Great Lakes Center 2009 – 2010 report (April 2011).
- Campus representative for the Great Lakes Research Consortium.
- Member of the Biology Department Personnel Committee.
- Member of the GLC Graduate Committee.
- Member of the Field Station Renovation Committee.
- New Science Building Renovation Committee member.
- Dive Control Board member.
- Co-chair of Aquatic Invasive Species Session, 54th Annual Conference on Great Lakes Research. The International Association for Great Lakes Research. May 30 – June 3, 2011, Duluth, Minnesota.
- Associate Editor 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.
- Reviewed manuscripts for the *Journal of Aquatic Invasions*, *Biological invasions*, *Freshwater Biology*, *Transactions of the American Fisheries Society*, *Biofouling*, and *Hydrobiologia*.

**Subodh Kumar:**

- Radiation Safety Committee member.
- New Science Building Renovation 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 *Journal of Medicinal Chemistry*, *Chemical Research in Toxicology*, ARKIVOC (Also Serves in Editorial Board), *Bioorganic and Medicinal Chemistry Letters*, and *Bioorganic and Medicinal Chemistry*.

**Jagat Mukherjee:**

- Invited reviewer of the grant proposals submitted to the Bankhead-Coley Cancer Research Program managed by the Florida Department of Health.

**Cathy Nasca:**

- Assisted in preparation of the Great Lakes Center Annual Report for publication.
- Organized Great Lakes Center Open House.



**Christopher Pennuto:**

- Faculty co-advisor, Biology Club.
- Chair of the Great Lakes Center Graduate Program Committee. Serving on the Committee for the Graduate Masters Program to establish a new multidisciplinary Masters program (2008-current).
- Graduate Advisory Council member, Subcommittee on Continuous Enrollment Policy.
- FNSS Dean's Review committee, Dec 2010-Apr 2011.
- Instruction and Research Committee, Sep 2010-present.
- Advisement Committee, Convener.
- Assessment Committee member.
- Dive Safety Officer.
- Field Station Renovation Committee member.
- Session organizer IAGLR 2011 with Dr. Lynda Corkum, U of Windsor, Gobies in the Great Lakes. 54th Annual Conference on Great Lakes Research. The International Association for Great Lakes Research. May 30 – June 3, 2011, Duluth, Minnesota.
- Reviewer: *Canadian Journal Fisheries & Aquatic Sciences*, *Journal of Great Lakes Research* (2 ms), *Marine and Freshwater Research*, Minnesota Sea Grant proposal

**Alicia Pérez-Fuentetaja:**

- Chair of the Biology Department Graduate Committee.
- Member of the GLC Graduate Committee.
- Advisor Graduate Comprehensive Exam students.
- Member of the Biology Department Personnel Committee.
- Member SNSS Personnel Committee.
- Member Assessment Committee.
- Hosted a table for Biology at the Graduate Education Programs Information Session. Feb.10, 2011.
- Research Advisor to the Lake Erie Forage Task Group.
- Judge student poster presentations at the International Association of Great Lakes Research (IAGLR). 54th Conference, Duluth, Minnesota. May 30 - June 3, 2011.
- Reviewer: *Canadian Journal of Fisheries and Aquatic Sciences* and *Journal of Great Lakes Research* (3 ms).

**Charlotte Roehm**

- Responsible for the maintenance and running of the Point Peter Brook Watershed.
- Continued partnership with the National Weather Service for improving forecasting models.
- Continued partnership with engineering firms for the integration of research equipment.
- Formed partnership with University of Colorado researchers.
- Reviewed manuscripts submitted to: *Environmental Science and Technology*, *Journal of Geophysical Research - Biogeosciences*, *Limnology and Oceanography-Methods*, and *Global Change Biology*.

# V. Professional Development Activities

## **Lyubov Burlakova:**

- Received a status of an Adjunct Associate Professor, Department of Geology, Evolution, Ecology & Behavior Graduate Program.

## **Mark Clapsadl:**

- Continued to learn the requirements to maintain an appropriate Dive Control Policy.
- Learned Nexsens software.

## **Alexander Karatayev:**

- Received a status of an Adjunct Associate Professor, Department of Geology, Evolution, Ecology & Behavior Graduate Program.

## **Kit Hastings:**

- Attended “Workplace Violence and Domestic Violence Prevention Training,” presented by the Human Resource Management Office, Buffalo State College, November 4, 2010.
- Attended a webinar “Making Better Turbidity Measurements in Ambient Water” presented by YSI Inc., November 4, 2010.
- Attended American Heart Association Heartsaver First Aid class that she helped organize for the School of Natural and Social Sciences, November 12, 2010.
- Received training on using Ingeniux Web Template System on December 21, 2010, and attended “Windows Terminal Server for Ingeniux Users” on February 1, 2011, for training on how to access and update the GLC website.

- Attended a YSI workshop sonde calibration and maintenance, presented by YSI Inc at the GLC Field Station, January 25, 2011, to improve my methods.
- Completed the following classes: CIS 151 Introduction to Information Processing I, Fall 2010; GEG 325 Remote Sensing and Mapping, Spring 2011.

## **Charlotte Roehm:**

- Participated in *Transborder Research University Network (TRUN)* Meeting on Transborder Water, Centre for Environment, Wayne State University, November 19th, 2010
- Participated in *Transborder Research University Network (TRUN)* Meeting on Transborder Water, Centre for Environment, University of Toronto, September 13th, 2010

## VI. Field Laboratory Activities

The bulk of the ecosystems/fisheries research is carried out at the GLC Field Laboratory. The Field Laboratory is located at the head of the Niagara River on Lake Erie that 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 both macro and micro-visualization equipment, including a multi-chamber tank for digitizing and analyzing foraging, habitat selection, and predator-prey interactions. Over the past three years we have been working to repair, replace or upgrade equipment and systems in the field station and have made significant progress towards this goal as well as efforts to better utilize space to maximize opportunity for research.

### Improvements to the Infrastructure

Our boat ramp was widened and a jersey wall was added to one side to increase stability of the bank and keep the edges of the ramp neat. More stone was also spread at the end of the ramp to replace some that had settled or washed away.



Kit Hastings disassembling old fish tanks

We are working on replacing 8 large tanks in the fish lab with insulated tanks that match the 8 other tanks in the room. When complete, this will improve the number of replicates since tank insulation will not be a variable.

Two new microscopes were purchased to augment our microscope lab. We also acquired a digital camera which

can be attached to these scopes to record digital images or videos of specimens. The new microscopes are more portable than our high-end microscopes but of better quality than some of our older ones.



Mark Clapsdl installing new fish tanks

We installed two webcams, a stationary camera and one that can be controlled. We also replaced non-functioning weather stations with a new one with a rain gauge. The electrical supply to the tower was improved and made more weather resistant.

We have added a new spectrophotometer to our laboratory equipment here at the FS. This instrument will be useful for analysis of samples collected from the LTM project and is compatible with the spectrophotometers that other GLC staff members are using. We now have all of the equipment necessary to process chlorophyll samples onsite in the middle of the season, rather than having to utilize labs on campus later in the year.

Our efforts to clean and organize the field station have continued, and we have made a lot of progress. This year we are closer to completing this goal. Truckloads of obsolete or useless materials such as old computers, obsolete electronics, scrap metal, and used bottles have been either recycled or discarded. The garage /workshop space has been re-arranged and this year it provided an open bay for working on our small boats. We also made progress in cleaning and organizing our indoor and outdoor storage areas.



## Research Vessels

We have purchased a 20' Polar-kraft that can be used in both rivers and the lakes. We completed engine break-in and looked into setting it up as an electro-fishing boat. Two Boston whalers were upgraded. One had its hull refinished and painted and had a console installed. The other received a new engine, bench, and steering. The old electro-fishing boat was rewired and refurbished so it could be used this spring. Although it hasn't arrived yet, we commissioned a new Privateer. This 28' boat is mostly just open deck with a console and a t-top. It will be a good platform for lake work, while still being small enough to transport by trailer to remote locations.



The new Polar-kraft boat



Upgraded Boston whaler



Electrofishing (above left) & Setting nets (above) during Dr. Pérez-Fuentetaja Fisheries Biology class (spring 2011)



A student from Dr. Standora's class using a water sampler



Students from Dr. Standora's class examine benthic sample

## Instructional Support

Alicia Pérez-Fuentetaja's fisheries class was given a demonstration of net equipment deployment and an electro-fishing demonstration in the Black Rock canal.

Dr. Standora's class was given limnology equipment demonstration and lecture in the fall; in the spring, his class used our wet chemistry lab for a bomb calorimetry demonstration.

Facilities were provided for Lisa Anselmi's Anthropology class experiments.

We provided tours of the facilities and brief lectures for several local schools.

## Research Activities

- Provided research support and assistance with the PBDE project.
- 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.
- Provided facilities for Chris Pennuto's students for a mesocosm stream study, as well as providing support for a few other GLC graduate student projects.
- 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 and Wildlife Service.
- Provided support to SUNY ESF with muskellunge spawning research.
- Provided facilities for Dave Bleursch's project (UB) and Dr. Kukulka's heat exchange project
- Interviewed for several campus news articles, as well as for a piece in Buffalo Spree.

## VII. New Initiatives

### Great Lakes Center MS Program in Great Lakes Environmental Science

GLC in conjunction with the Departments of Geography & Planning, Earth Sciences, Biology, and the Dean's Office have submitted two letters of intent for new graduate programs in the Master of Science in Great Lakes Environmental Science and the Master of Art in Great Lakes Environmental Science Ecosystem Science to SUNY. These degrees build upon an effort begun nearly a decade ago to create a Great Lakes-focused, graduate research degree. Multiple meetings were held throughout 2009-2011, resulting in a selection of new and existing coursework and degree expectations. These programs will be able to accommodate a range of students and faculty outside GLC, but it would still lean toward our core interests. The locale and facilities of Buffalo State College provide a unique opportunity to study the effects of 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 Buffalo State's Great Lakes Center 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 started with an update to our photo gallery. This spring, over 50 new photos with captions were added to the photo gallery while about 50 new smaller photos were uploaded for use throughout the website. The research section was updated with projects from within the last three years; all other projects were moved to an archive. News and events were similarly archived and have been kept up-to-date as the semester progressed. Content on the Field Station was updated and simplified. We also created a map with directions to the Field Station from campus which can be easily accessed by students or visiting scientists.

### Academic Collaboration



To promote international collaboration, Alexander Karatayev and Lyubov Burlakova meet with the President of the Irish Institute of Technology in Sligo Terri Scott and researcher and Ecology Lecturer Frances Lucy to develop a memorandum of understanding. The Institute of Technology in Sligo has been recently named as Ireland's second-ranking Institute of Technology. The Memorandum was signed in July 2011.

In May of 2011 Buffalo State SUNY and the Institute of technology, Sligo, signed an Agreement for academic Collaboration to strengthen mutual understanding, foster friendly cooperation, and promote academic excellence, collaboration and exchange. GLC scientists Lyubov Burlakova and Alexander Karatayev in May of 2011 were invited to Ireland to develop a prediction of the spread of new invasive aquatic mollusc Asian clam in Ireland in collaboration with Irish scientist Frances Lucy. In the coming year Irish scientists are going to visit Buffalo State.

## **Publication of GLC Annual Reports**

In order to increase the visibility of the GLC, more effectively disseminate information about our activities, and to receive feedback from the college, scientists, and community, in the spring of 2011, we published GLC 2009-2010 annual report. The report was presented at our traditional Spring Open House and is available both as a hard copy and electronically at the GLC website. We will continue to publish and disseminate our annual reports.

## **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 2010-2011 we invited four speakers to present talks on our seminar, including:

1. Dr. Martin A. Stapanian, U.S. Geological Survey, Lake Erie Biological Station. "Change in diel catchability of young-of-year yellow perch associated with establishment of dreissenid mussels." September 23, 2010.
2. Dr. Ernest Khurshut, Institute of Zoology, Academy of Sciences of the Republic of Uzbekistan, Tashkent, Uzbekistan. "Aral Sea Ecological Crisis and Invasive Fishes in the Aral Sea Basin, Arid Central Asia." September 29, 2010.
3. Dr. Katya Kovalenko, University of Windsor and Mississippi State University. "Indirect effects of invasive species and the role of habitat complexity." December 9, 2010.
4. Dr. David Bruce Conn, Berry College, Museum of Comparative Zoology, Harvard University, and U.S. Office of International Health & Biodefense. "A Hitchhiker's Guide to the Planet: Parasites and Invasive Species on the Move." April 22, 2011.



