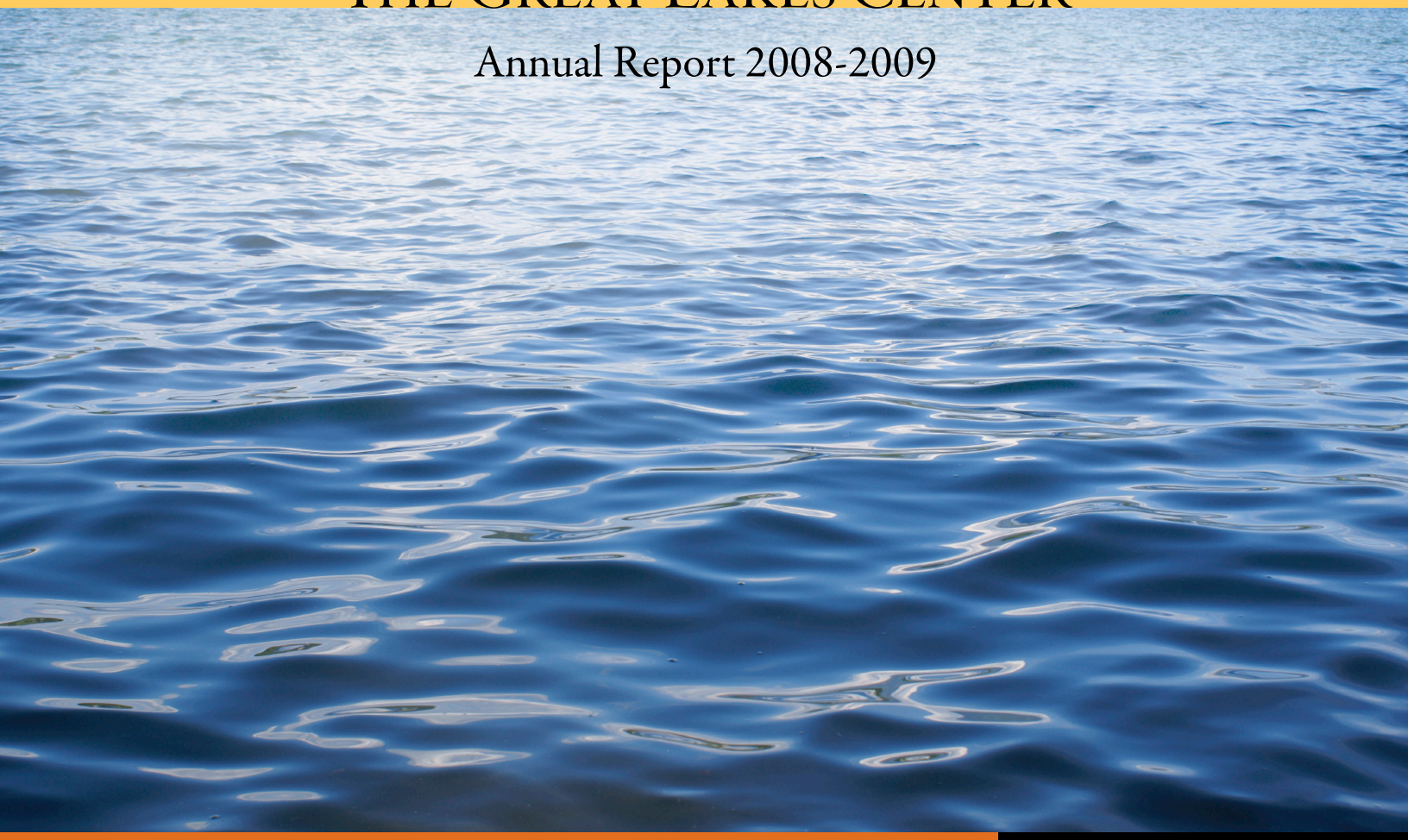
The Great Lakes Center

Annual Report 2008-2009



https://greatlakescenter.buffalostate.edu

Buffalo State
State University of New York

~ In memory of Captain John Freidhoff ~

Boat Christening Ceremony, May 2009

New Research Vessel purchased by Research Foundation

The Nearshore and Offshore Lake Erie Nutrient Study

Content

2008-2009 Annual Report
Great Lakes Center – Buffalo State College

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 all areas of our operations, including 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 universities in North America, Europe, and South America.

- Our researchers have published 11 manuscripts, 10 were accepted for publication, and 10 were submitted to peer-reviewed journals. In addition, 3 manuscripts were published in non-refereed venues.
- Presented 37 talks, including: 23 at national/international conferences, 7 invited talks, and 7 presentations in non-refereed venues.
- Submitted 15 grant proposals (total requested amount $4,170,183).
- Ten projects for research and education (including multi-year grants) are currently funded in the GLC totaling $1,724,514.
- Request for additional funding for the Great Lakes Center for $1,050,000 was submitted to New York Senate.
- Center personnel acted as advisers to graduate students, and taught 9 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.
- A new 27 foot research vessel, the John J. Friedhoff was purchased by the Research Foundation for the GLC.
- Our strategic plan for 2009 – 2014 was reviewed and approved by the school of Natural and Social Sciences, Dean's Council, and the Vice President's Council.
- We made a substantial progress toward development of a Master of Science program in the Great Lakes Ecosystem.

I. Staff

In December 2008 Sheila Christopher accepted a Senior Research Scientist position in Virginia Water Resources Research Center and left GLC. In August of 2008 Sergey E. Mastitsky joined GLC as a research scientist on Research Foundation line. Sergey graduated from Belarusian State University and got his doctoral degree in Hydrobiology from the Belarusian Academy of Science in 2004. He is an expert in the spread, ecology, and parasites of aquatic exotic species.

GLC Personnel

Director: Alexander Y. Karatayev

Research Scientists: Subodh Kumar, Director of the Laboratory of Environmental Toxicology
Lyubov Burlakova
Mark Clapsadl
Sergey Mastitsky
Jagat Mukherjee
Christopher Pennuto
Alicia Pérez-Fuentetaja
Charlotte Roehm

Secretary: Cathleen Nasca

Field Station Director, Research Associate & Ships: Captain Mark Clapsadl

Research Fleet Manager & Ships: Captain Caleb P. Basiliko

Field Station Technician: Kit Hastings

Research Assistants: Christopher Janik

Work Study: Jocelyn Helta
Ama Achempong

GLC Affiliates

Randal Snyder, Associate Professor, Buffalo State College

Howard Riessen, Professor, Biology Department, Buffalo State College

Gary Pettibone, Professor, Biology Department, Buffalo State College

Kimberley Irvine, Professor, Geography and Planning Department, Buffalo State College

Kelly Frothingham, Associate Professor and Chair, Geography and Planning Department, Buffalo State College

Jill Singer, Professor, Earth Sciences and Science Education Department and Director of the Buffalo State Office of Undergraduate Research.

Collaborators

At New York State:

- Daniel Molloy, Associate Scientist, New York State Museum;
- Denis Meyer, Research Scientist, New York State Museum;
- Dianna Padilla, Professor, Department of Ecology and Evolution, State University of New York at Stony Brook
- Edward Mills, Professor and Director of the Cornell Biological Field Station, Cornell University
- Dawn Dittman, Ecologist, USGS Great Lakes Science Center, Tunison Laboratory of Aquatic Science, Cortland, NY
- Joseph Makarewicz, Distinguished Service Professor Environmental Science and Biology, State University of New York, Brockport, NY
- Joe Atkinson, Professor Environmental Engineering, 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, USFWS
- Gregory Boyer, Director, Great Lakes Research Consortium, Professor of Biochemistry, State University of New York, College of Environmental Science and Forestry, Syracuse, NY
- Robert Baier, Professor and Executive Director of the Industry/University Center for Biosurfaces, University at Buffalo
- Diana S. Aga, Associate Professor, Chemistry Department, University at Buffalo.
- Katherine Alben, Senior Scientist, Wasdworth Institute, Albany, NY

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
- Stanley Dodson, Professor, Department of Zoology, University of Wisconsin, Madison, Wisconsin
- Richard Lathrop, Wisconsin Department of Natural Resources, University of Wisconsin, Madison, Wisconsin
- 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
- Tom Miller, Director, Lamar Bruni Vergara Environmental Science Center, Laredo Community College, Laredo, Texas
- Heidi Bunk, Lake Biologist, Southern Region, Wisconsin Department of Natural Resources, Waukesha, Wisconsin
- 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 DeMarini, 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

- Jack Kramer, National Center for Water Quality Research, Heidelberg University, Tiffin, Ohio
- Gerald Matisoff, Dept of Geological Sciences Department Chair, Case Western Reserve University, Cleveland, Ohio
- Darren Bade, Kent State University, Kent, Ohio

International:

- Demetrio Boltovskoy, Professor, University of Buenos Aires, Argentina.
- Sergei Olenin, Professor, Coastal Research and Planning Institute, Klaipeda University, Lithuania.
- Francisco Sylvester, Postdoctoral Fellow, University of Windsor, Canada.
- 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.
- Tamara Makarevich, Associate Professor, Belarusian State University, Minsk, Belarus.
- Vadim Panov, Adjunct Professor, St.-Petersburg State University, St.-Petersburg, Russia.
- 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.

Professional Development Activities

Caleb Basiliko:

- Obtained FCC marine radio operators license.
- Completed training for Master Diver certification.
- Attended and passed 200 tons upgrade class for captain's license.
- Began training for Dive Control Specialist.
- Attended training for vessel operators in Traverse City Michigan.
- Attended Coast Guard Industry Day for new rules updates.

Lyubov Burlakova:

- Attended a workshop "How to Get Your Proposal Funded" sponsored by The Research Foundation of State University of New York and the University Faculty Senate, October 6, 2008.
- Attended a workshop "The NSF Course, Curriculum and Laboratory Improvement Program". Presenter: Jill Singer, Program Director, NSF Division of Undergraduate Education at the NSF. The Research Foundation of SUNY at Buffalo State College. April 13, 2009.
- Attended the National Science Foundation Day at Binghamton, NY. January 15, 2009.
- Participated in the United States Conference On Teaching Statistics (USCOTS 2009), Ohio State University, Columbus, OH, June 25th - 27th (Funded by Title III grant from the US Department of Education to improve the quantitative/ mathematical performance of students).

Mark Clapsadl:

- Attended Bio-acoustics workshop at Cornell University June 1, 2009
- Attended week long CTD training Seattle Washington Feb. 8-13
- Received 50 ton USCG masters License December 2008.

Alexander Karatayev:

- Attended a workshop "How to Get Your Proposal Funded" sponsored by The Research Foundation of State University of New York and the University Faculty Senate, October 6, 2008.
- Attended a workshop "The NSF Course, Curriculum and Laboratory Improvement (CCLI) Program". Presenter: Jill Singer, Program Director, NSF Division of Undergraduate Education at the NSF. The Research Foundation of SUNY at Buffalo State College. April 13, 2009.
- Attended the National Science Foundation Day at Binghamton, NY. January 15, 2009.

Subodh Kumar:

- Attended the National Science Foundation Day at Binghamton, NY. January 15, 2009.

Sergey Mastitsky:

- Attended a workshop "How to Get Your Proposal Funded" sponsored by The Research Foundation of State University of New York and the University Faculty Senate, October 6, 2008
- Attended a workshop "The NSF Course, Curriculum and Laboratory Improvement (CCLI) Program". Presenter: Jill Singer, Program Director, NSF Division of Undergraduate Education at the NSF. The Research Foundation of SUNY at Buffalo State College. April 13, 2009.
- Attended the National Science Foundation Day at Binghamton, NY. January 15, 2009.

Kit Hastings:

- Attended Buffalo State Van Driver Safety Course
- Received NYS Boating Safety Certification
- Attended Field Station Boating Safety Course
- Heartsaver First Aid Certification (AED/CPR trained)
- Attended a workshop "Maritime Meteorology" sponsored by the Buffalo State College Maritime Center, May 2, 2009
- Enrolled in the Random drug Testing program

Charlotte Roehm:

- Attended a workshop "How to Get Your Proposal Funded" sponsored by The Research Foundation of State University of New York and the University Faculty Senate, October 6, 2008
- Attended a workshop "The NSF Course, Curriculum and Laboratory Improvement (CCLI) Program" Presenter: Jill Singer, Program Director, NSF Division of Undergraduate Education at the NSF. The Research Foundation of SUNY at Buffalo State College. April 13, 2009
- Attended and completed the Community Emergency Response Training (CERT) course Dec, 2008

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 (e.g. 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 nearshore and offshore Lake Erie nutrient study (NOLENS).

Although the nutrient abatement strategies implemented in the Lake Erie watershed have reduced nutrient inputs to target levels, not all of the anticipated responses have been realized. The central basin hypoxia event (the 'dead-zone'), extensive *Cladophora* growth in the eastern basin, and repeated outbreaks of nuisance algae in the western basin have all occurred since the reduction in nutrient inputs. This project documented the quantity of nutrients present in all biotic and abiotic compartments of the nearshore and offshore pelagic and benthic habitats and pathways for trophic transfer. We measured directly flux rates in the most rapidly cycling pools and use published, scientifically peer-reviewed nutrient flux rates for the remaining biota in the system, coupled with published hydrodynamic models of particle transport, to assess whether the pools of nutrients in the nearshore and offshore regions follow the predicted patterns of early lake mixing models. This project is in collaboration with National Center for Water Quality Research in Heidelberg University, Kent State University, Ohio State University, and Case Western Reserve University.

Lake Ontario Nearshore Nutrient Assessment.

This is a multi-institutional, binational effort that is aimed at understanding the dynamics of a lake changing in response to impacts of climate change, non-indigenous species, and anthropogenic factors. This project is in collaboration with SUNY Brockport, SUNY Buffalo, SUNY ESF, Niagara University, and University of Rochester.

Senes.

This project will determine biomass and coverage of benthic algae to field-verify satellite imagery on color spectra from nearshore Lake Ontario near the FitzPatrick nuclear power facility.

Goby Barriers.

This project will determine the interaction between water velocity, substrate composition, and streambed slope on round goby swimming performance. Ultimately, these data may assist in barrier design to reduce upstream passage or allow us to predict which streams are most at risk to further invasion.

Amphipod intraguild predation.

This project will assess intraguild predation as a mechanism promoting successful invasion of non-native benthic amphipod species.

Crayfish predator avoidance.

This project will assess the importance of learning in predator avoidance by native and invasive crayfish.

Predict the characteristics and spread of aquatic invertebrate invaders.

Long-term experience of studying exotic species has allowed us to bring together an international team currently working on a project to predict future invaders. For 98 freshwater, marine, and brackish species, we collected data on a wide range of biological and ecological parameters. Using this database, we will be able to employ a quantitative approach to address many important problems in invasion biology, and to predict a set of future scenarios that determine invasion success.

Predict the potential effects of zebra mussels on benthic community and lake ecosystems of Madison lakes.

The objectives of this study are to: provide pre-invasion information on the community composition, density, biomass and production of benthic habitats in the Madison lakes; predict the effect of zebra mussel invasion on benthic communities in the Madison lakes through comparisons with data obtained in southeastern Wisconsin lakes and an extensive long-term database from Eastern European lakes; and to estimate the potential effect of zebra mussels on benthic and pelagic communities and associated fisheries in the Madison lakes.

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

Lyubov Burlakova and Sergey Mastitsky set up an experiment to study growth and mortality of zebra and quagga mussels under different thermal regimes.

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. Although in many waterbodies *D. r. bugensis* have been reported to outcompete *D. polymorpha,* local competition may be much more dependent upon local environmental conditions and will determine which dreissenid species will become dominant in a given waterbody, and thus likely to attach to boats and spread. To assess which biological traits allowed different dreissenid species to dominate under different environment conditions, we studied reproduction dynamics, growth rate and larval settlement of zebra and quagga mussels in Lake Erie.

Parasites of aquatic exotic species: an underestimated threat to invaded ecosystems.

Collecting molluscs in Ontario watershed to study parasites of exotic species. Sergey Mastitsky, Lyubov Burlakova, and Alexander Karatayev

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. A clear understanding of the mechanisms and patterns of the spread of exotic species and their associated parasites is therefore required to predict and prevent such outbreaks. We are assembling a database of parasites of aquatic invaders and conducting field study to determine the prevalence and intensity of infection of aquatic exotic invertebrates by parasites in their native and invaded ranges.

Estimating the size of the single existing population of endemic Quadrula petrina in Concho River, August 2008

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 - 2009) to conduct statewide surveys of the rare and the most valuable Unionidae populations in Texas. We are assembling a database that will include, along with our own data, all published data on unionid diversity and abundance in Texas. This comprehensive dataset will be used to analyze the current status and long-term dynamics of unionid diversity across the whole state.

Discovery of Texas endemics Quadrula houstonensis and Truncilla macrodon in Colorado River, May 2009

South American channeled applesnail *(Pomacea insularum).*

This snail is of special concern for the USA coastal ecosystems and rice industry. The goals of our research are to determine *Pomacea insularum* current distribution, and to estimate the rate, patterns and vectors of applesnail spread in Texas. These data will allow prediction of their potential spread in Texas, and the US. With our four years of research experience in the biology and ecology of this invader, we are acting as a resource for information for agencies in other states.

Limnoperna research in South America.

Limnoperna fortunei, a bivalve mollusc native to China, is now rapidly spreading in South America. As with *Dreissena* (the zebra mussels), *Limnoperna* has rapidly become a major nuisance for many industries and power plants, and its impact on the environment may be even stronger than that of *Dreissena*. Together with colleagues from Argentina, we conducted the first quantitative survey of *Limnoperna* in Rio Tercero Reservoir, analyzed mussel coverage on different substrate types, estimated the overall population size, and studied their effect on the benthic community. Our data will help us to predict the potential effect of *Limnoperna* on aquatic ecosystems in the US.

Endocrine-disrupting effects of persistent organic pollutants in fish populations from eastern Lake Erie.

We have sampled steelhead trout, common carp, and largemouth bass from eastern Lake Erie to determine levels of the endocrine disrupting pollutants PCB and PBDE, which have estrogenic effects on exposed populations of fish. We assess the impacts to reproduction of these chemicals by measuring in male fish the levels of a unique female protein synthesized for egg production. The effects of these pollutants on fish include the alteration of their sexual characteristics and reproductive fitness.

Lisa Zimmerman (University at Buffalo), Alicia Pérez-Fuentetaja, and students Beryl Ankrah and Jessica Wuerstle collecting tissue samples to determine PBDE concentration in Steelhead Trout.

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

Graduate students Beryl Ankrah and Jessica Wuerstle taking samples of trout stomach contents for PBDE analysis.

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.

Workshop on writing a proposal to study Botulism E in Great Lakes, June 2009. Alicia Pérez-Fuentetaja, Lyubov Burlakova, Denise Mayer (NYS Museum), Mark Clapsadl, Daniel Molloy (NYS Museum), Sergey Mastitsky, and Kimi Nishikawa (NYS Museum).

Botulism type E in the Great Lakes.

We have seven 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.

The role of the zooplankton *Bosmina freyi* in acidifying lake ecosystems.

This organism plays a vital role in the future of lakes that are exposed to acid rain and deforestation and, therefore, have declining calcium levels. Bosmina is small zooplankton species that has low Ca requirements and, therefore, can potentially replace the common grazer Daphnia in many of the thousands of lakes that are part of the Canadian Granitic Shield, altering permanently the structure of the food webs. We are working with researchers at York University, Ontario, to compare in a highly replicated experiment the competitive and environmental advantages of Bosmina in lakes suffering from decalcification and Climate Change.

Long Term Monitoring on Lake Erie.

This multiagency effort aimed at building a database of biotic and abiotic information from multiple sites on Lake Erie was recently picked up from the USFW. Samples are collected bi-weekly from two sites in Eastern Lake Erie from May through October. An additional monitoring site was added in 2009 for the GLC database, and more extensive benthic sampling has been initiated.

Monitoring Program. Mark Clapsadl and Kit Hastings collecting plankton samples and recording water quality.

Water Quality/Watershed Studies

Current Projects:

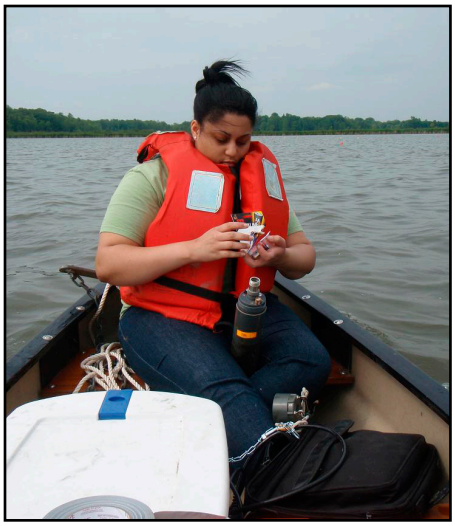
Point Peterbrooke and Cattaraugus Creek Watershed dynamics.

The Great Lakes Center has made a substantial commitment to the study of the impact of the contributing watersheds on the Great Lakes. We have continued the development of our model watershed in Point Peter Brook watershed in Cattaraugus County, where we have installed weirs with water level gauges and automated samplers along the trunk stream and several tributaries, piezometers, rain gauges, and a meteorological station. The initial goal for this project was to identify Variable Source Area (VSA) controls on the exports of nitrogen (N) and dissolved organic carbon (DOC) during storm events. We have expanded our watershed monitoring program, with funding from the USACE, USEPA, and NYS DEC as part of an effort to identify critical sources of sediment and nutrients to the Cattaraugus Creek, a major contributing watershed to Lake Erie. Part of the goal of the Cattaraugus Creek project is to assess how land use and climate change will affect sediment and nutrient loading, via model predictions. The model can then be used 1) as input to a lake-wide model and 2) for managers and stakeholders to make informed decisions about nutrient management such as developing remediation plans to reduce future excessive loading. The model is currently in finalization stages. The monitoring of the Point Peterbrooke watershed is continuing and this summer will incorporate additional measurement parameters to include the contribution of carbon loads.

Charlotte Roehm sampling stream water chemistry and biologic parameters in high alpine Arctic watershed

Impacts of Climate Change on Subarctic Lakes.

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



Undergraduate URE student of Charlotte Roehm, Monique Wilson is sampling water quality parameters in a coastal wetland pond

Algal Blooms in coastal wetlands of the Great Lakes.

This project aims to identify physical and biological parameters that cause the initiation of algal blooms within coastal wetlands. Wetlands are often considered traps for excess nutrients and contaminants. However, should the threshold of accumulation be exceeded, these ecosystems may contribute to the formation of blooms, which can be hydrologically transported into the Great Lakes during periods of high flow. This study aims to understand the complex dynamics of algal bloom formation and contribution within coastal wetlands through a combination of field observations and laboratory bioassays.

Undergraduate student Codie Vileno sampling a vernal pool at Tift Nature Preserve

Wetland remapping Project.

In collaboration with NYSDEC, an initiative is taking place this summer focusing on remapping wetland distribution and boundaries within the Oswego/Oneida watershed. This project involves the digitization of current NWI maps into the GIS databases and field verification of wetland boundaries in order to improve current wetland distribution maps.

Environmental Toxicology

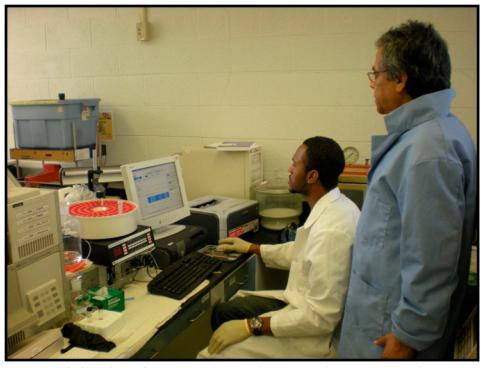
The Environmental Toxicology Laboratory of the Great Lakes Center maintains state of the art facilities on the campus of Buffalo State College. The scientists at this laboratory study the mechanism by which various environmental pollutants present in the Great Lakes induce their adverse effects on human 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:

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

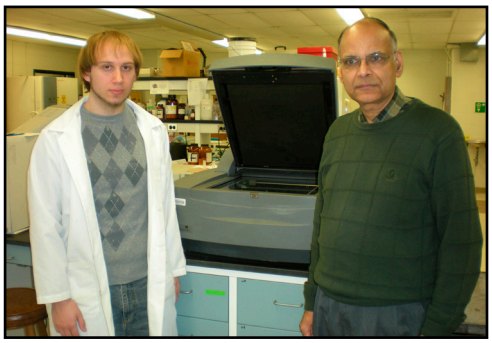
In our continuing effort to understand the mechanism by which environmental occurring polynuclear aromatic hydrocarbons and their heterocyclic analogs induce cancer, we completed a new and improved synthesis of the highly potent carcinogen dibenzo[a,l]pyrene and its carcinogenic metabolites. This study has been accepted for publication in Polycyclic Aromatic Compounds. In addition, we also finalized and published part of our ongoing research on phenanthro[3,4-b]thiophene, a highly mutagenic compound found in the environment. This study was conducted in collaboration with cancer researchers at the Environmental Protection Agency, RTP, NC. Based on the outcome of these studies, a new proposal is currently being developed for submitting to National Institutes of Health in near future.

Studies of the hydroxylated derivatives of polybrominated diphenyl ethers:



Jagat Mukherjee and undergraduate student Jacqan Williams are using HPLC instrument to separate different organic compounds.

Recently we studied the metabolism and disposition of PBDEs in trouts under a grant funded by New York Sea Grant. PBDEs are emerging contaminants in Great Lakes Nation's other water ways. There is now increasing evidence that many of these chemicals cause endocrine disruption in aquatic and wildlife species. Our studies indicated that these compounds are bioaccumulated significantly in edible portion of trout muscle. Recently our laboratory is interested in studying the mechanism of by which two widely distributed PBDEs, namely, BDE-47 and BDE-99, induce their biological effects. Our effort was primarily focused on developing a proposal for identifying phenolic metabolites that are potentially involved in the endocrine disruption activities of the parent compounds using fish and mammalian models. A proposal related to these studies was submitted to National Institutes of Health.



Subodh Kumar and the undergraduate student Ronald Gocinski calibrating the Phosphoimager machine to analyze the protein bands.

Development of mechanism-based MMP inhibitors:

This study was undertaken to develop a project in the area of chemoprevention. We are currently interested in developing strategy to prevent tumor metastasis which is the most common cause for cancer death. It is now growing evidence that the environmental pollutants including those found in Great Lakes are involved in this process of carcinogenesis. Our initial effort is to develop small organic molecules which are highly specific in inhibiting matrix metalloproteinase-9 (MMP-9) which appears to be specifically involved in the metastasis of prostate cancer. Our effort was basically directed to develop synthesis of some key intermediates needed to synthesize the potential inhibitors of MMP-9 in order to develop preliminary data to support grants which we submitted to National Institutes of Health, and Prostate Cancer Foundation.

Mechanism-based CYP2A6 inhibitors as smoking cessation agents:

Nicotine addiction is the primary cause for cigarette smoking which leads to high incidence of lung cancer and other diseases. CYP2A6 has been identified a principal cytochrome P-450 which is predominantly involved in the metabolism of nicotine to inactive products, thereby, removing active nicotine from body circulation. The smokers with high CYP2A6 in liver are prone to higher level of smoking to maintain the desired level of nicotine in the body. Thus CYP2A6 appears to be an excellent target for developing therapeutic agents for preventing cigarette smoking. We initiated a new proposal for developing mechanism-based CYP2A6 inactivator as potential smoking cessation agent. This proposal has been submitted to National Institutes of Health for potential funding to carry out the proposed research.

Effect of heavy metals on PAH-induced genotoxicity:

Studies directed to understand the mechanism(s) underlying the potentiating effect of cadmium, nickel and other heavy metals designated as environmental pollutants on the genotoxicity of PAH's, and thereby presents the carcinogenic risk to humans. We studied the effect of above metal pollutants on the protective signaling events (p53- dependent or independent cell cycle arrest and apoptosis) induced in response to genotoxic stress by PAHs with a view to determine the biomarker(s) involved in metal toxicity.

Identification of phenolic component(s) present in the environment as well as in tobacco smoke condensate (TSC) as tumor promoter:

We observed that the weakly acidic TSC phenolic fraction is a tumor promoter and increased the number of colonies of cells on soft agar (anchorage-independent cell growth). It possesses hundreds of phenolic components as determined by high pressure liquid chromatography (HPLC). The HPLC separated fractions as well as the crude TSC phenolic fraction are tested individually to examine their effect on anchorage-independent cell growth.We are in the process of determining the particular phenolic fraction(s) responsible for tumor promoting activity.

Mechanism of tumor promotion by TSC phenolic fraction:

Attempts are pursued to understand the mechanism of synergistic interactions of active TSC phenolic component(s) with polynuclear aromatic hydrocarbons (PAHs) (present in the environment) toward potentiation of carcinogenicity. We determined the interference of TSC phenolic fraction with PAH-induced p53 response which is known to trigger the cellular protective machinery thereby justifying the possibility of p53's role in this regard. We are in a process to examine the role of p53 downstream signaling events e.g. NFkappaB and MAP kinases with a view to understand the underlying mechanism of tumor promotion by TSC phenolic fraction.

Gene expression in benzopyrene treated cells:

We determined in vitro effect of the PAH benzopyrene on the cellular expression of several thousands of genes by cutting age Microarray technique. We observed up-regulation and down-regulation of many genes by benzopyrene. We are analyzing these thousands of gene expression data to sort out the role of particular gene product(s) in benzopyerene-induced celluar responses (both protective and tumorigenic) with a view to the development of biomarkers.

Grants and Funding

Proposals Funded (Total $1,724,514):

1. Burlakova, L. E. and A. Y Karatayev. State-Wide Assessment of Unionid Diversity in Texas in 2009. State Wildlife Grants, U.S. Fish and Wildlife Service. Texas Parks and Wildlife Department. **$67,514.** 2008–2009.
2. Karatayev, A. Y., Boyer, G. Funding request for the automatic buoy for GLC Buffalo State to joint Global Observatory System. **$30,000**.
3. Mukherjee, J. Phenolic component of tobacco smoke as tumor promoter. National Institutes of Health. **$214,500.** 2008-2011**.**
4. Pennuto, C. Lake Ontario Nearshore Nutrient Assessment (L.O.N.N.). US EPA. Co-investigator with SUNY Brockport, SUNY ESF, RIT, Niagara University, and UB. NY DEC. (Supplemental funding received November 2008 as a sub-award from SUNY Brockport). **$7,200.** 2008.
5. Pennuto C. Assessing barriers to round goby migration into Great Lake tributary streams. NY Sea Grant. **$89,300.** 2007-2009.
6. 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.
7. Pennuto, C. M., A. Y. Karatayev, A. Pérez-Fuentetaja, L. E. Burlakova, G. Matisoff, J. Kramer, and J. Conroy. The Nearshore and Offshore Lake Erie Nutrient Study (NOLENS). U.S. EPA Great Lakes National Program Office, Lake Erie Central and Eastern Basin Studies of Nearshore/Offshore Nutrient Fluxes and Interactions. **$150,000.** 2009.
8. Pérez-Fuentetaja, A., M. Clapsadl, D. Aga,_ Mehran Alaee. New York Great Lakes Protection Fund. Large Grants Program. Food web – mediated transport and bioaccumulation of flame retardants (PBDE) in sport fish from eastern Lake Erie. **$100,000.** 2009-2010.
9. Roehm, C. L. Wetland Remapping, EPA/ NYSDEC, **$100,000**. 2009-2011.
10. Roehm, C. L. (collaborative). Greenhouse Gas Emissions from Lakes in Northern Permafrost Areas: Quantitative Importance and Climate Impacts. Swedish Research Council. **$245,000.** 2009-2012.

Submitted Proposals (Total $4,170,183):

1. Boyer, G., A. Y. Karatayev, A. Perez-Fuentetaja, and L. E. Burlakova. Phosphorus, Dreissenids and Harmful Algal Blooms in Western Lake Erie. U.S. EPA Great Lakes National Program Office, Lake Erie Western Basin Algal Bloom Study. **$100,000**. 2009. (Not funded).
2. Burlakova L. E., A. Y. Karatayev, and M. D. Clapsadl. State Wildlife Grants. NYSDEC. Survey of freshwater molluscs and crayfishes in the Lake Erie Basin. **$294,937**. 2009. (Pending).
3. Burlakova L. E., A. Y. Karatayev. State-Wide Assessment of Unionid Diversity in Texas (One-Year Extension for 2010). State Wildlife Grants, U.S. Fish and Wildlife Service. Texas Parks and Wildlife Department. **$59,173**. 2009 (Pending).
4. Burlakova, L. E., A. Y. Karatayev, and W. Hoeh (Kent State University). Taxonomic Status of Texas Endemic and Rare Unionid Mussels. State Wildlife Grants, U.S. Fish and Wildlife Service. Texas Parks and Wildlife Department. **$136,593**. 2009-2010 (Pending).

5. Karatayev, A. Y., S. E. Mastitsky, L. E. Burlakova, and D. P. Molloy Parasites of invasive molluscs pose threat to wetlands. National Fish and Wildlife Foundation – Great Lakes Watershed Restoration Program. **$55,434.** 2008-2009 (Not funded).
6. Karatayev A. Y., L. E. Burlakova, S. E. Mastitsky, and D. Dittman. Impacts of Dreissenid colonization on structure and function of benthic community in Lake Ontario. Great Lakes Fishery Commission Project Pre-Proposal. **$95,380**. 2009. (Not funded).
7. Kumar, S. Phenolic metabolites of polybrominated diphenyl ethers as endocrine disruptors. National Institutes of Health. **$393,250**. (Not funded).
8. Mukherjee, J. J. and Kumar, S. Potentiation of PAH-induced carcinogenicity by alcohol (Revised). National Institutes of Health. **$147,000**. 2009-2011. (Pending).
9. Kumar, S. Kumar, S. and J. J. Mukherjee. Role of depurinating adducts in thia-PAH-induced mutagenesis/carcinogenesis. National Institutes of Health. **$822,250**. 2009-2012. (Not funded).
10. Kumar, S. and J. J. Mukherjee. Novel antimetastatic compounds for the potential treatment of prostate cancer. National Institutes of Health. **$404,250**. 2009-2011. (Pending).
11. Kumar, S. and J.J. Mukherjee. Novel MMP-9 inhibitors as anti-metastatic compounds for the potential treatment of prostate cancer bone metastasis. Prostate Cancer Foundation. **$105,175**. 2009-2010. (Not funded).
12. Kumar, S. and J.J. Mukherjee. Mechanism-based CYP2A6 inhibitors as smoking cessation agents. National Institutes of Health. **$220,500**. 2009-2012. (Pending).
13. Roehm, C. L. Promoting the integration of undergraduates into active and relevant research experiences within Watershed Pollution and Soil Science Management Courses. NSF CCLI-Phase 1: Exploratory. $**96,241**. 2010-2013. (Pending).
14. Oswald, D. and C. L. Roehm. Climate Change Adaptation - Water Monitoring Data Requirements and Indicators. CCME (Canadian Councils of Ministers of the Environment) (DE-Environment). **$100,000**. 2008-2009. (Not funded).
15. Soare, R. and C. L. Roehm. Comparative studies of pingos and pingo clusters in the Tuktoyaktuk Peninsula, NWT and Athabaska Valles, Canadian Space Agency. **$90,000**. 2009. (Pending).

Other funding sources

1. Karatayev A. Y. Request for additional funding for the Great Lakes Center submitted to New York Senate. **$1,050,000**. 2009. (Pending).

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

Fall 2008

- BIO 300/670 Biostatistics and Biological Data Analysis – *L. Burlakova*
- GEG 365/565 Soil Science and Management – *C. Roehm*
- BIO 430/630 Stream Ecology – *C. Pennuto*
- BIO 361 Biology Seminar – *C. Pennuto*

Spring 2009

- BIO 429/628 Fisheries Biology – *A. Pérez-Fuentetaja*
- BIO 104 Environmental Biology – *C. Pennuto*
- BIO 361 Biology Seminar – *C. Pennuto*
- GEG 619 Wetland Hydrology and Ecology– *C. Roehm*
- GEG 516 Watershed Pollution – *C. Roehm*
- BIO 590 Biostatistical Analysis, Individual Graduate Study – *L. Burlakova*

Lectures presented at the Field Station

- Clapsadl, M. Sept 30, 2008. Fisheries Biology of Great Lakes. Class Lecture Biology 213 Introduction to Ecology Environment and Behavior.
- Clapsadl, M. April 1, 2009. Great Lakes Environmental Disturbances. Class Lecture. University at Buffalo. Great Lakes Ecology laboratory.
- Clapsadl, M. April 14, 2009. Great Lakes Center Research Projects Class Lecture. Bio 429 Fisheries Biology.

Graduate Program

Multi-Disciplinary Masters Degree Program Administered by the GLC:

Student:	**Advisor:**
Vileno, Codie	Roehm, C. L.
Childs, Heidi	Potts, D
Reth, Kimly	Irvine, K.
Sowyrda, Alexander	Irvine, K.
Winkler, Katherine	Frothingham, K.
John, Karcz	Kumar, S.

Degree(s) Granted

Student: Krueger, Amy
Advisor: Frothingham, K.
Graduated: May 2009

Advising Undergraduate and Graduate Students

- Chris Pennuto was the advisor of three graduate students from the Biology Department (Bryan Young, Nini Dong, and Shannon Rupprecht), and one undergraduate (Mike Wydich);
- Charlotte Roehm supervised a senior thesis student (Jameieka Price) and URM student and McNair Scholar (Monique Wilson);
- Lyuba Burlakova was a co-adviser (with Sergey Mastitsky) of one graduate student (Eric Snyder) and one URM student (Marissa Hajduk). She also helped five other graduate and undergraduate students with statistical data analysis.
- Alicia Perez-Fuentetaja was the advisor of two graduate students (Jon Tarasiewicz, Jessica Wuertle), members of graduate committee for three students (Bryan Young, Shannon Rupprecht, and Nini Dong), advisor Undergraduate Summer Research (NSF) student (Jennifer Kishbaugh), and one undergraduate Honors student.

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 Operation, Activated Sludge, Grade 3 supervision, Grade 4 Management, and Basic Laboratory. Each of these courses was given during fall and spring semesters of 2008-2009. Total of 47 trainees attended these courses.

IV. Field Laboratory Activities

The bulk of the ecosystems/fisheries research is carried out at the GLC Field Laboratory. The Field Laboratory was designed as a state-of-the-art facility at the head of the Niagara River on Lake Erie that is capable of supporting high-level research in a variety of disciplines. The Field Laboratory 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. Unfortunately, due to a long period of underfunding, many field and laboratory sampling devices are partially or completely worn out and require substantial investment. Although the Field Laboratory can support numerous research projects, thorough analysis of all facilities revealed that many of them are in critical conditions and in the near future we need to fix and/or replace most of the old or broken equipment. Although we have made some significant progress towards the goal of updating, replacing and repairing equipment, we still have some significant challenges.

Improvements to the Infrastructure

Recently all of the computer systems in the GLC Field Station have been replaced with new machines. Most importantly, the increasingly unreliable computer that operated both the HVAC and the water treatment systems for the wet labs was replaced, the operating software transferred and is now functioning. We now have working computers in all the labs and in the lab/office used by guests at the station.

A significant effort went into cleaning and organizing and inventorying the field station. Truckloads of obsolete or useless materials such as old computers, non-functioning printers, outdated computer manuals, scrap metal, hula hoops etc. were either re-cycled or discarded. We examined materials stored in filing cabinets and were able to eliminate 9 cabinets. The elimination of these materials offered us the opportunity to move out of our old office into the underutilized “scientist office”, thus opening up badly needed space for a “microscopy and imaging lab”. This space will be used as a “dry” lab where moisture- and chemical-sensitive instruments can be used and stored.

Another upgrade at the station is the replacement of two of our large experimental tanks. Dr. Snyder received funding to conduct bio-energetic work with alewife and as part of that funding package he was able to purchase two new tanks to replace the two that did not properly “fit” along with the others. Additionally, Dr. Snyder re-plumbed these tanks and made numerous repairs to the associated water re-circulation system.

Research Vessels

Both the RV Pisces and RV Aquarius have been determined to not be worth the investment they would require to make operational. These vessels will be removed from our inventory. We have been fortunate in that the Research Foundation has made a significant investment with the purchase of a new 27 foot work boat, the John J. Friedhoff. This vessel is an excellent replacement for the Pisces and Aquarius.

The R/V Seneca has received mechanical and electronic repairs in preparation for the 2009 season. These repairs include replacing old hydraulic lines, replacing old wiring, repairing the generator, replacing main batteries, re-organizing the cabin area, cleaning fuel tanks and installing fuel gauges, repairing the tachometer, painting the main cabin, and other repairs.

Instructional Support

- Dr. Standoro's class was given limnology equipment demonstration and lecture
- Help was provided on electro-fishing demonstrations for Math/Science Upward Bound high school students
- Elisa Bergslein class was taken on R/V Seneca to show sampling methods on Lake Erie
- Alicia Pérez-Fuentetaja class was given an electrofishing laboratory in the Black Rock canal
- Alicia Pérez-Fuentetaja class was given a lecture on Fisheries Biology of Great Lakes
- Facilities were provided for Lisa Anselmi's Anthropology class experiments

The Field Laboratory offered advice, facilities, and assistance for the following research activities:

- Provided research support and assistance with the PBDE project
- Provided research vessel and logistical assistance for the Nearshore Offshore Lake Erie Nutrient Study (NOLENS) project
- Built sampling equipment, provided research vessel and logistical assistance for the collaborative Lake Ontario Nearshore Nutrient Survey (LONNS)
- Provided research vessel and logistical assistance for the SENES project
- Provided facilities and support for Randi Snyder's Fatty Acid/alewife experiments
- Took over long-term sampling of the eastern basin of Lake Erie for USFW
- Assisted Alicia Pérez-Fuentetaja graduate students with Hemimysis experiments
- Assisted Jill Singer with logistics and instrument installation design for her Buffalo River current sonar modeling project
- Provided support and facilities for Kim Irving's CSO monitoring project
- Assisted Chris Pennuto in his study of crayfish predator avoidance using the AHAB Unit and the replicate tanks
- Worked with DEC constructing and emplacing protective structures to shield tern nesting sites from predators along the breakwalls of the Buffalo Harbor and Black Rock Canal
- Provided support to DEC with muskellunge spawning research
- Housed the Quartz Sleeve Bio-fouling experiments conducted by Robert E. Baier, University at Buffalo

V. New Initiatives

Strategic Plan for 2009-2014

Our strategic plan was reviewed and approved by the School of Natural and Social Sciences (January 2009), Dean's Council (January 8, 2009) and the Vice President's Council (March 16, 2009). The Strategic Plan is a product of numerous discussions with the members of the GLC, College faculty, faculty from other universities, federal and state agencies and other stakeholders. As a result of these discussions, we created a comprehensive plan, formulated strategic directions, initiatives and actions for research, education and public outreach, and determined resources required for GLC to fulfill these initiatives. The strategic plan is posted on the GLC website.

Great Lakes Center MS Program in Great Lakes Ecosystems

We made substantial progress toward development of a Master of Science program in the Great Lakes Ecosystem. This program 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 BSC'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.

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 2009, we published GLC 2007-2008 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 consider this as a beginning of a long-term tradition, and we will continue to publish and disseminate our annual reports.

Seminar

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 2008 – 2009 we invited 6 scientists to present talks on our seminar, including:

- Charlotte Roehm, Great Lakes Center, Buffalo State College. "Bioavailability of terrestrial organic carbon to lake bacteria: the case of a degrading sub-arctic permafrost mire complex". October 16, 2008.
- Charles Ramcharan, Laurentian University, Ontario, Canada. "The Abiotic-Biotic Model for Community Re-Assembly". October 30, 2008.
- Lars Rudstam, Cornell University. "Interactions at the edge of distributions - on the importance of understanding distributions in Great Lakes pelagia". November 13, 2008.

- Hugh MacIsaac, University of Windsor, Great Lakes Institute for Environmental Research, Ontario, Canada. “Ballast Water Management: will it work for the Great Lakes?” December 2, 2008.
- Sergey Mastitsky, Great Lakes Center, Buffalo State College. “New data on biology of the zebra mussel (Dreissena polymorpha): case studies from Belarus”, February 2009.
- Dianna Padilla, Professor, Ecology & Evolution, SUNY Stony Brook. “Invasion by an Ecosystem Engineer Dramatically Alters Benthic Communities In and Out of Marine Reserves”. April 9, 2009.

VI. Publications and Presentations

Last year the researchers of the GLC were very active in publishing papers and presenting their results on international and national meetings and conferences. Eleven manuscripts were published, another 10 were accepted for publication, and 10 were submitted to peer-reviewed journals. In addition, 3 manuscripts were published in non-refereed venues. A total of 37 presentations were made by the GLC researches, including: 23 presentations at national/international conferences, 7 invited talks, and 7 presentations were made in non-refereed venues.

Refereed Journal Publications (Published)

1. Burlakova, L. E., A. Y. Karatayev, D. K. Padilla, L. D. Cartwright, and D. N. Hollas. 2009. Wetland restoration and invasive species: applesnail (*Pomacea insularum*) feeding on native and invasive aquatic plants. *Restoration Ecology* 17 (3):433-440.
2. Campbell, J. L., Rustad, L. E., Boyer, E. W., Christopher, S. F., Driscoll, C. T., Fernandez, I. J., Groffman, P. M., Houle, D., Kiekbusch, J., Magill, A. H., Mitchell, M. J., Ollinger, S. V. 2009. Consequences of climate change for biogeochemical cycling in forests of eastern North America. Canadian Journal of Forest Research 39: 264-284.
3. Christopher, S. F., Lal, R., Mishra, U. 2009. Long-term no-till effects on carbon sequestration in the Midwestern U.S. Soil Science Society of America Journal 73: 207-216.
4. Karatayev, A. Y., L. E. Burlakova, V. A. Karatayev, and D. K. Padilla. 2009. Introduction, distribution, spread, and impacts of exotic freshwater gastropods in Texas. *Hydrobiologia*. 619: 181-194.
5. Krakowiak, P. J. and C. M. Pennuto. 2008. Fish and macroinvertebrate communities in tributary streams of Eastern Lake Erie with and without round gobies (*Neogobius melanostomas*, Pallas 1814). *Journal of Great Lakes Research* 34:675-689.
6. Mukherjee J. J., Gupta, S. K., and S. Kumar. 2009. Inhibition of benzopyrene-diol-epoxide (BPDE)-induced bax and caspase-9 by cadmium: Role of mitogen activated protein kinase *Mutation Res.,* 661: 41-46.
7. Mukherjee, J. J., Gupta, S. K., and S. Kumar. 2008. Inhibition of benzopyrene diol epoxide-induced apoptosis by cadmium(II) is AP-1-independent: Role of extracellular signal related kinase. *Chem.-Biol. Interact*. 172: 72-80.
8. Piatek, K., Christopher, S.F., and J. Mitchell, M. J. 2009. Spatial and temporal dynamics of stream chemistry in a forested watershed impacted by atmospheric deposition. Hydrology and Earth System Sciences 13: 423-439.
9. Pennuto, C. M. 2009. Megaloptera (Alderflies, Dobsonflies). Pp 356-360, In: Likens, G.E. (editor), The Encyclopedia of Inland Waters, Vol. 2.
10. Pennuto, C. M. and D. A. Keppler. 2008. Short-term predator avoidance behavior by invasive and native amphipods in the Great Lakes. Aquatic Ecology 42:629-641.
11. Swartz, C. D., L. C. King, S. Nesnow, D. M. Umbach, S. Kumar, and D. M. DeMarini. 2009. Mutagenicity, stable DNA adducts, and abasic sites induced in Salmonella by phenanthro[3,4-b]- and phenanthro[4,3-b]thiophenes, sulfur analogs of benzo[c]phenanthrene. *Mutation Res*. 661:47-56.

Refereed Journal Publications (Accepted)

1. Burlakova, L. E., D. K. Padilla, A. Y. Karatayev, D. N. Hollas, L. D. Cartwright, and K. D. Nichol. Differences in population dynamics and potential impacts of a freshwater invader driven by temporal habitat stability. *Biological Invasions.*
2. Karatayev, A. Y., Burlakova L. E., Padilla, D. K., S. E. Mastitsky, and S. Olenin. 2009. Invaders are not a random selection of species. *Biological Invasions.*
3. Karatayev, A.Y., L. E. Burlakova, and D. K. Padilla. 2009. *Dreissena polymorpha* in Belarus: history of spread, population biology, and ecosystem impacts. In: The Zebra Mussels in Europe (G. van der Velde, S. Rajagopal and A. bij de Vaate, eds.).
4. Mastitsky S. E. 2009. On the role of alien mollusc *Dreissena polymorpha* (Bivalvia, Dreissenidae) in the spread of trematode infections among fishes in Belarus. *Voprosy Rybnogo Khozyaystva Belarusi*.
5. Molloy, D. P., L. Giamberini, L. E. Burlakova, A. Y. Karatayev, J. R. Cryan, S. L. Trajanovski, and S. P. Trajanovska. 2009. Investigation of the endosymbionts of *Dreissena stankovici* with morphological and molecular confirmation of host species. In: The Zebra Mussels in Europe (G. van der Velde, S. Rajagopal and A. bij de Vaate, eds.).
6. Prairie, Y. T., P. A. del Giorgio, C. L. Roehm, and A. Tremblay. 2009. Insights On Riverine Metabolism From Continuous Measurements Of CDOM Fluorescence In Eastmain-1 Reservoir, Quebec. *Verh. Internat. Verein. Limnol*
7. Roehm, C. L., Y. T. Prairie and P. A. del Giorgio. 2009. pCO_2 dynamics in lakes in the boreal region of northern Québec, Canada. *Global Biogeochemical Cycles* doi:10.1029/2008GB003297, 2009
8. Roehm, C. L., R. Giesler, and J. Karlsson. 2009. Bioavailability of terrestrial organic carbon to lake bacteria: the case of a degrading sub-arctic permafrost mire complex. *Journal of Geophysical Research – Biogeosciences*.
9. Semenchenko V. P., V. K. Rizevsky, S. E. Mastitsky, V. V. Vezhnovets, M. V. Pluta, V. I. Razlutsky, T. Laenko. 2009. Checklist of aquatic alien species established in large river basins of Belarus. *Aquatic Invasions*.
10. Vermette, S. and Christopher, S.F. 2009. Using the rate of accumulated freezing and thawing degree days as a surrogate for determining freezing depth in a temperate forest soil. Journal of the Middle States Geographer (In press).

Refereed Journal Publications Submitted (in Review)

1. Boltovskoy, D., A. Y. Karatayev, L. E. Burlakova, D. Cataldo, V. Karatayev, F. Sylvester, and A. Mariñelarena. Colonization pattern, population density and ecosystem impact of the Asian invasive mussel *Limnoperna fortunei.* Submitted to *Freshwater Biology.*
2. Bridoux, M.; Sobiechowska, M.; Perez-Fuentetaja, A.; Alben, K. 2009. Algal pigments in Lake Erie dreissenids, pseudofeces and sediments, as tracers of diet, selective feeding and bioaccumulation. Submitted to *Journal of Great Lakes Research.*
3. Cheng H-W. A., F. Lucy, Graczyk, T. K., M. A. Broaders, S. E. Mastitsky, L. Tamang, and M. Connoly. Municipal wastewater treatment plants: as reservoirs, biological removal systems and environmental sources of human-virulent microsporidian spores. Submitted to *Applied Environmental Microbiology.*

4. Pérez-Fuentetaja, A. S. Lupton, M. Clapsadl, F. Samara, L. Gatto, and D. S. Aga. Differences in Bioaccumulative Response of Wild Common Carp (*Cyprinus carpio*) from Eastern Lake Erie to Ambient Levels of Polychlorinated Biphenyls and Polybrominated Diphenyl Ethers. Being modified for resubmission to the *Journal of Environmental Monitoring*.
5. Karatayev, A. Y., L. E. Burlakova, V. A. Karatayev, and D. Boltovskoy. The invasive freshwater mussels: could *Limnoperna fortunei* be worse than *Dreissena polymorpha?* Submitted to *Biological Invasions.*
6. Karatayev, A. Y., L. E. Burlakova, M. J. Vander Zanden, R. C. Lathrop, and D. K. Padilla. A century of change in a lake benthic community: evidence for alternative community stable states? Submitted to *Ecology*.
7. Karlsson, J., T. R. Christensen, T. Fribog, J. Förster, D. Hammerlund, M. Jackowicz-Koeczynski, U. Kokfelt, C.L. Roehm, and P. Rosen. Carbon emissions from a sub-arctic lake: quantitative importance and response to permafrost thawing. Submitted to *Ecosystems*.
8. Mastitsky S. E., A. Y. Karatayev, L. E.Burlakova, and D. P. Molloy. The underestimated threat posed by parasites of exotic species – a quantitative analysis. Submitted to E*cology*.
9. Pérez- Karlsson, J., T.R. Christensen, T. Fribog, J. Förster, D. Hammerlund, M. Jackowicz-Koeczynski, U. Kokfelt, C.L. Roehm, and P. Rosen. Carbon emissions from a sub-arctic lake: quantitative importance and response to permafrost thawing. Submitted to *Ecosystems*.
10. Sobiechowska, M.; Bridoux, M.; Ferreira Ferreira, A.H.; Perez-Fuentetaja, A.; Alben, K. 2009. Biomarkers of algal populations in phytoplankton, filamentous algae, and sediments from the eastern basin of Lake Erie 2003-2005. Submitted to *Journal of Great Lakes Research.*

Conference Proceedings and Other Non-refereed Publications (Published)

1. Roehm, C. L., R. Giesler, and J. Karlsson. 2009. Carbon Cycling in Alpine and Arctic watersheds affected by permafrost degradation: An insight from Sweden, *AGU Joint Assembly*, May 22-27, 2009. Toronto, Canada.

2. Roehm, C. L., R. J. Soare, G. R. Osinski, and F. Costard. 2008. Crater-Rim Gully Formation in Utopia Planitia: Hydrological Support of the Periglacial Origin Hypothesis. *40th Lunar and Planetary Science Conference,* March 23-28, The Woodlands, Texas.

3. Mastitsky S. E. 2009. The killer shrimp, *Dikerogammarus villosus*. In: CABI Electronic Invasive Species Compendium. Submitted to: CAB International (http://www.cabi.org/datapage.asp?iDocID=180).

International/National Conference Presentations

1. Burlakova, L. E., A. Y. Karatayev, and V. A. Karatayev. 2009. Effect of Invasive Bivalves *Dreissena polymorpha* and *Limnoperna fortunei* on Benthic Communities. 16th International Conference on Aquatic Nuisance Species. April 19-23, Montreal, Canada.
2. Burlakova, L. E., A. Y. Karatayev, D. Boltovskoy, V. A. Karatayev, D. Cataldo, and F. Sylvester. 2009. *Limnoperna fortunei:* The new potential invader to the Great Lakes. 52nd Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18 – 22, Toledo, OH.

3. Christopher, S. F., M. J. Mitchell, and S. Inamdar. 2008. The soil N source to stream runoff during springmelt is affected by soil freezing: A snow manipulation study in a forested watershed in the snow belt of western New York, USA American Geophysical Union Fall 2008 Meeting Abstract No. H11D-0791.

4. Christopher, S. F., S. Inamdar, and M. J. Mitchell. 2008. The soil N source to stream runoff during springmelt is affected by soil freezing: A snow manipulation study in a forested watershed in the snow belt of western New York, USA. Northeastern Ecosystem Research Cooperative Conference, New England Center, Durham, NH, November 12-13.

Great Lakes Center affiliates at the 52th Annual Conference on Great Lakes Research, May 2009. Alexander Karatayev, Lyubov Burlakova, Howard Riessen, Alicia Pérez-Fuentetaja, Shannon Rupprecht, Randal Snyder, Sergey Mastitsky, Nini Dong, and Christopher Pennuto.

5. Dong, N., and C. M. Pennuto. 2009. Effects of experience and age on predator avoidance behavior of crayfish in Lake Erie. IAGLR Annual conference, Toledo, OH.

6. Dong, N., and C. M. Pennuto. 2009. Effects of experience on predator avoidance behavior of crayfish. Great Lakes Research Consortium Student Faculty Conference. March 13-14, Syracuse, NY. Co-winner of best oral presentation.

7. Hajduk, M., L. E. Burlakova, S. E. Mastitsky, and A. Y. Karatayev. 2009. Unknown threats: an examination of endosymbions in non-native species. Great Lakes Research Consortium Student Faculty Conference. March 13-14, Syracuse, NY.

8. Karatayev, A. Y., D. Boltovskoy, L. E. Burlakova, D. Cataldo, V. A, Karatayev, F. Sylvester, and A. Marinelarena. 2009. Colonization pattern, population density and ecosystem impact of the Golden mussel *Limnoperna fortunei*. 16th International Conference on Aquatic Nuisance Species. April 19-23, Montreal, Canada.

Great Lakes Research Consortium, 19th Annual Student Faculty Conference 2009. Syracuse, March 2009. Alexander Karatayev, Vadim Karatayev, Shannon Rupprecht, Jessica Wuerstle, Sergey Mastitsky, Nini Dong, Monique Wilson, Beryl Ankrah, Christopher Pennuto, Alicia Pérez-Fuentetaja, Marissa Hajduk, and Lyubov Burlakova.

9. Karatayev, A. Y., V. A. Karatayev, L. E. Burlakova, and D. Boltovskoy. 2009. Could *Limnoperna fortunei* be worse than *Dreissena polymorpha*? Population density and potential impacts. 16th International Conference on Aquatic Nuisance Species. April 19-23, Montreal, Canada.

10. Karatayev, A. Y., L. E. Burlakova, V. A. Karatayev, and D. K. Padilla. 2009. Vectors of introduction spread and potential impacts of exotic freshwater gastropods in Southern US. 16th International Conference on Aquatic Nuisance Species. April 19-23, Montreal, Canada.

11. Karatayev, A. Y., L. E. Burlakova, S. E., Mastitsky, D. K. Padilla, and E. L. Mills. 2009. Invasion paradox: why *Dreissena rostriformis bugensis*, being less invasive, outcompetes *D. polymorpha*? 52 Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18-22, Toledo, OH.
12. Karatayev, V. A., A. Y. Karatayev, L. E. Burlakova, and D. Boltovskoy. 2009. The density, distribution, and characteristics of *Limnoperna fortunei* in a waterbody. Great Lakes Research Consortium Student Faculty Conference, March 13-14, Syracuse, NY.
13. Mastitsky S. E., A. Y. Karatayev, L. E. Burlakova, and D. P. Molloy. 2009. Aquatic invaders as a vector of spread of parasites and their potential effect on invaded ecosystems. 16th International Conference on Aquatic Invasive Species. April 19-23, Montreal, Canada.
14. Mastitsky S. E., A. Y, Karatayev, and L. E Burlakova. 2009. Alien fishes of Belarus: diversity, vectors of introduction, and risk assessment. 16th International Conference on Aquatic Invasive Species. April 19-23, Montreal, Canada.
15. Mastitsky S. E., A. Y. Karatayev, L. E Burlakova, and D. P. Molloy. 2009. Freshwater invertebrate invaders as vectors of the spread of parasites. 52nd Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18-22, Toledo, OH.
16. Pennuto, C. M., P. J. Krakowiak, and C. E. Janik. 2009. Seasonal abundance and summer energy consumption by round gobies (*Apollonia melanostoma*) in Lake Erie tributary streams. 52 Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18-22, Toledo, OH.
17. Pérez-Fuentetaja, A., M. Clapsadl, J. Markham, and K. Kayle. 2009. Shiners and Smelt are the Main Forage Base for Steelhead Trout (*Oncorhynchus mykiss*) Populations in Lake Erie. 52nd Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18-22, Toledo, OH.
18. Roehm, C. L., R. Giesler, and J. Karlsson. 2009. Carbon Cycling in Alpine and Arctic watersheds affected by permafrost degradation: An insight from Sweden, AGU Joint Assembly, May 22-27, Toronto, Canada
19. Roehm, C. L**.,** R. J. Soare, G. R. Osinski, and F. Costard. 2009. Crater-Rim Gully Formation in Utopia Planitia: Hydrological Support of the Periglacial Origin Hypothesis. 40th Lunar and Planetary Science Conference, March 23-28, The Woodlands, Texas
20. Rupprecht, S. and C. M. Pennuto. 2009. Assessing the swimming performance of the round goby (*Neogobius melanostomas*) and its implications for upstream migration in tributary streams and rivers. Great Lakes Research Consortium Student Faculty Conference. March 13-14, Syracuse, NY. Co-winner of best oral presentation.
21. Rupprecht, S. and C. M. Pennuto. 2009. Assessing the swimming performance of the round goby (*Neogobius melanostomas*) and its implications for upstream migration in tributary streams and rivers. 52 Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18-22, Toledo, OH.
22. Wuerstle, J., J. Tarasiewicz, and A. Pérez-Fuentetaja. 2009. Food Web-Mediated Transport and Bioaccumulation of Flame Retardants (PBDE) in Lake Erie. Great Lakes Research Consortium Student Faculty Conference. March 13-14, Syracuse, NY.

23. Young, B.T. and C.M. Pennuto. 2009. The role of environmental context and mutual predation in amphipod in invasion success in the Great Lakes. 52 Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18-22, Toledo, OH.

Conference Presentations (Non-Refereed)

1. Burlakova, L. E., Karatayev, A.Y., Karatayev, V. A., May, M. E., Miller, T., and Basiliko, C. Status of rare and endemic freshwater molluscs in Texas. 9th Annual Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 30, 2008.
2. Christopher, S.F., Inamdar, S., Mitchell, M.J. 2008. The soil N source to stream runoff during springmelt is affected by soil freezing: A snow manipulation study in a forested watershed in the snow belt of western New York, USA. 9th Annual Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 30, 2008.
3. Hajduk, M., Burlakova, L.E., Mastitsky, S.E., and A. Y. Karatayev. Hidden invaders: endosymbionts and parasites of non-native species. Great Lakes Day in Albany. Poster Competition, GLRC Poster Session, Albany, April 28, 2009.
4. Kumar, S. A highly facile synthesis of the ultimate carcinogen of dibenzo[def,p]chrysene, a potent environmental carcinogen. 9th Annual Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 30, 2008.
5. Mastitsky, S. E., A. Y. Karatayev, and L. E. Burlakova. Parasites of invasive molluscs pose threat to the Great Lakes. 9th Annual Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 30, 2008.
6. Mukherjee, J. J. Inhibition of benzopyrene-diol-epoxide (BPDE)-induced bax and caspase-9 by cadmium: Role of mitogen activated protein kinase. 9th Annual Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 30, 2008.
7. Roehm, C.L., 2008, Aquatic Metabolism Response to allochthonous C sources from a degrading permafrost mire complex, sub-arctic Sweden. 9th Annual Faculty and Staff Research and Creativity Fall Forum, Buffalo State College, October 30, 2008.

Invited Talks

1. Burlakova, L. E., Karatayev, A. Y. SWG-funded survey of freshwater mussels Unionidae in Texas: long-term trends in diversity and status of rare and endemic species. Texas Parks and Wildlife Department, Austin, Texas. May 4, 2009.
2. Karatayev, A. Y., Burlakova, L. E., Padilla, D. K., Boltovskoy, D., Minchin, D. Mastitsky, S. E., and Karatayev, V. A. 2009. Change in global economies and trade: the potential spread of exotic freshwater bivalves. EEB seminar at the University of Buffalo. February 27.
3. Mastitsky, S. E. New data on biology of the zebra mussel (Dreissena polymorpha): case studies from Belarus. Great Lakes Center and Biology Department Seminar, Buffalo State.
4. Pérez-Fuentetaja, A., S. Lupton, M. Clapsadl, L. Gatto, D. Aga. 2009. Environmental sentinels: PCB, PBDE and vitellogenin levels in wild carp from Lake Erie. Environmental Chemistry Unit, Chemistry Dept., University at Buffalo, Buffalo, NY. January 29.

5. Pérez-Fuentetaja, A., S. Lupton, M. Clapsadl, L. Gatto, D. Aga. 2009. Persistent Organic Pollutants in Male Common Carp and Steelhead Trout from Lake Erie. Wadsworth Institute & SUNY-Albany, Albany, NY, February 17.
6. Roehm, C. L. 2008. Insight into the potential impact of permafrost degradation on aquatic metabolism in sub-arctic watersheds, Sweden. SUNY Oneonta. November 14.
7. Roehm, C. L. 2008. Bioavailability of terrestrial organic carbon to lake bacteria: the case of a degrading sub-arctic permafrost mire complex, Great Lakes Center and Biology Department Seminar, Buffalo State.

VII. Service Activities

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

Caleb Basiliko:

- CERT member
- Represented BSC at the annual Great Lakes Assn of Science Ships meeting
- President- Grant Amherst Business Assn
- Board Member- Black Rock Canal Park Steering Committee
- Organized and ran Scajaquada Creek Clean up
- Worked with Sea Scout Ship 0029

Lyubov E. Burlakova:

- Coordinator of the Great Lakes Center and Biology Department Seminar Series.
- Aquatic Invasive Species Session, Co-chair, 52nd Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18 – 22, 2009, Toledo, OH.
- Member of the Great Lakes Research Consortium.
- Reviewed doctoral dissertation by Anastasija Zaiko "Habitat Engineering Role of the Invasive Bivalve Dreissena Polymorpha (Pallas, 1771) in the Boreal Lagoon Ecosystem", April 2009.
- Reviewed manuscripts for the Journal of Applied Ecology (1 manuscript), and the Journal of Biological Invasions (3 manuscripts).
- Judge, 52 Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18 – 22, 2009, Toledo, OH.
- Judge at Student Conference: 2009 Great Lakes Research Consortium Student Faculty Conference, March 13-14, 2009.
- Hooder at Honor's Graduation Ceremony in May 2009.

Mark Clapsadl:

- Member on the Hiring Search Committee for the Great Lakes Center Research Technician.
- Assisted NYSDEC with annual Trawl Surveys.
- Channel 2 News interview discussion effects of climate change on Lake Erie and surrounding communities.
- Buffalo News Interview discussing activities at Great Lakes Center and story behind new research vessel.

Kit Hastings:

- Joined Safe Zone Committee in Spring 2009

Alexander Karatayev:

- Presented Great Lakes Center Strategic plan for 2009 – 2014 at the Vice President's Council: March 16, 2009.
- Organized Great Lakes Center Open House (March 2009).
- Published Great Lakes Center 2008 – 2009 report (March 2009).
- Aquatic Invasive Species Session, Co-chair, 52nd Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18 – 22, 2009, Toledo, OH.
- Buffalo News Interview discussing activities at Great Lakes Center and story behind new research vessel.

- TV Tokyo America, INC. Interview discussing Dreissena spread and their economical and ecological impacts.
- Campus representative for the Great Lakes Research Consortium.
- Member on the Hiring Search Committee for the GLC Research Technician.
- Member of the Biology Department Personnel Committee.
- New Science Building Renovation Committee member.
- Member of the RV John J. Freidhoff christening committee.
- Member of the International Association for Great Lakes Research.

Alexander Karatayev gives interview for TV Tokyo America on zebra mussels, June 2009.

- Reviewed doctoral dissertation by Anastasija Zaiko "Habitat engineering role of the invasive bivalve *Dreissena polymorpha* (Pallas, 1771) in the boreal lagoon ecosystem".
- Reviewed Book Chapter (1), manuscripts for the Journal of Biological Invasions (3), and Journal of Ecological Applications (1).

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.
- Represented Buffalo State College at Niagara River Remedial Action Plan Remedial Advisory Committee Meeting.
- Member of American Chemical Society, American Association for Cancer Research, American Association for the Advancement of Sciences, Sigma Xi, Phi Lambda Upsilon, Environmental Mutagen Society.
- Member of Great Lakes Research Consortium.
- Reviewed manuscripts for Journal of Medicinal Chemistry, Chemical Research in Toxicology, ARKIVOC (Also Serves in Editorial Board), Letters in Drug Design, Current Medicinal Chemistry, Journal of Combinatorial Chemistry, Bioorganic and Medicinal Chemistry Letters, Bioorganic and Medicinal Chemistry, and Journal of Heterocyclic Chemistry.

Sergey Mastitsky:

- Maintenance of the Great Lakes Center website.
- Assisted in preparation of the Great Lakes Center Annual Report for publication.
- Assisted in preparation of booklets about the Great Lakes Center for publications.
- TV Tokyo America, INC. Assisted in collection of Dreissena for report production.
- Reviewer for Aquatic Invasions.

Jagat J. Mukherjee:

- Reviewed manuscript for the Journal of National Cancer Institute.
- Assisted undergraduate student (Ronald Gocinski) to obtain hand on experience in biological techniques related to ongoing research endeavor.

- Participated in meetings related to Science building renovation.
- Member of the American Association of Cancer Research.

Cathy Nasca:

- Assisted in preparation of the Great Lakes Center Annual Report and booklets about GLC for publication.
- Organized Great Lakes Center Open House.
- Assisted in preparation for the RV John J. Freidhoff christening.

Christopher Pennuto:

- Faculty advisor, NASO (Native American Student Organization).
- Faculty co-advisor, Biology Club.
- Chair, Biology Department Graduate Committee.
- Chair, Great Lakes Center Graduate Program Committee.
- Graduate Advisory Council member.
- Chair, Hiring Search Committee for the Great Lakes Center Research Technician.
- Member of the Great Lakes Research Consortium.
- Aquatic Invasive Species Session, Co-chair, 52nd Annual Conference on Great Lakes Research. The International Association for Great Lakes Research, May 18 – 22, 2009, Toledo, OH.
- Hooder at Master's graduation ceremony in May 2009.

Alicia Pérez-Fuentetaja:

- Member of the Biology Department Graduate Committee.
- Member of the Biology Department Communications Committee.
- Judge at Student Conference: Great Lakes Research Consortium Conference. March 13-14. SUNY-ESF, Syracuse, NY.

Charlotte Roehm:

- Departmental Review Program Committee member.
- Chair of Committee for the Great Lakes Center Research Symposium IAGLR 2013.
- Member of the Great Lakes Center Graduate Program Committee.
- PI for the Great Lakes Center Project to study the impacts of Climate Change on the hydrodynamics and biology of Lake Erie.
- Member on the Hiring Search Committee for the Great Lakes Center Research Technician.
- Member of the Great Lakes Research Consortium.
- Completed the Buffalo State Community Emergency Response Team (CERT) course.
- Reviewer for Canadian Journal for Fisheries and Aquatic Sciences.