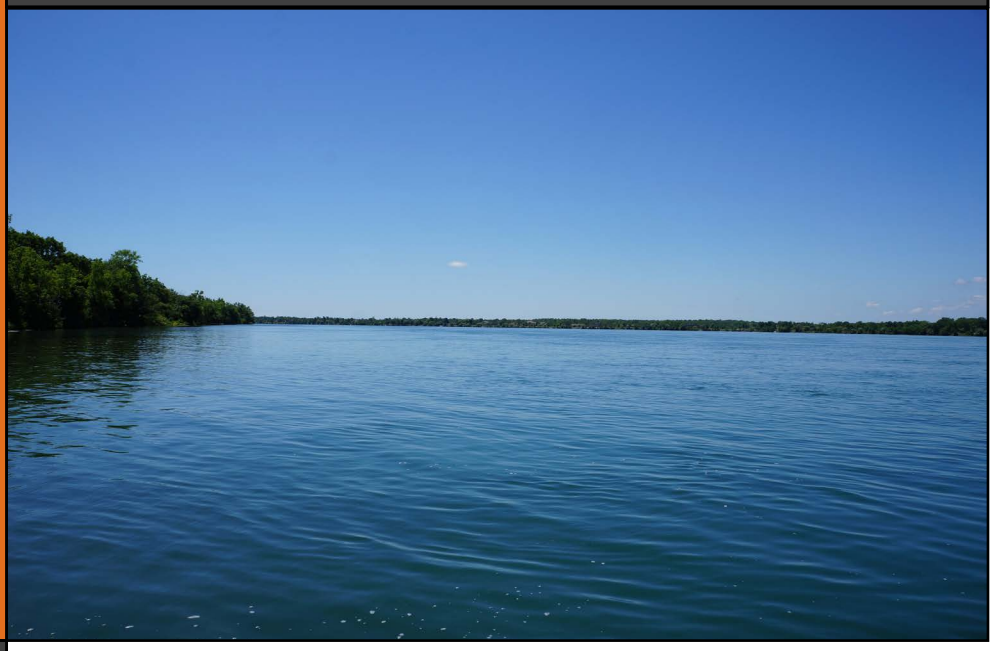
Great Lakes Center Newsletter

Fall 2014

RESEARCHING THE GREAT LAKES AND THEIR TRIBUTARIES SINCE 1966



The upper Niagara River, focus of one of our projects this summer.

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Productive season wraps up

by Kit Hastings, editor

Over the past few months, scientists and students at the Great Lakes Center have been busy. Twelve different projects took place between May and October, from season-long efforts to shorter-term intensive studies. All of this activity meant that careful coordination of our boats and our time had to be made to ensure that all of our samples could be collected. Sometimes there were three different groups out on the water at the same time!

A big portion of our time was spent on the Niagara River this year. The Emerald Shiner project consisted of weekly electrofishing, seining, and other collections to document the location of various life-stages of emerald shiners in the Upper Niagara River, as well as collecting the fish for various lab analyses. In conjunction with efforts from US Fish and Wildlife, we were also busy in the Lower Niagara River investigating the benthic invertebrate community and its ties to lake sturgeon habitat.

Three of our researchers spent the month of August aboard the US EPA's Lake Guardian collecting benthic samples from all of the Great Lakes in our second year participating in their Long-Term Benthic Monitoring study. Just before the researchers left for their tour of the Great Lakes, about half of our center was engaged in an intensive nearshore and offshore benthic study as part of the Year of Lake Erie, aboard the Lake Guardian or traveling to sites in Ohio or Canada.

We also started a study monitoring the harbors in Buffalo and Oswego, NY for new invasive species using a protocol from scientists in the Baltic Sea. The Baltic region is a source of new invaders to the Great Lakes and they are likely to keep coming into our ports, so early detection is key.

Early detection is also important for terrestrial invasive species. WNY PRISM staff were busy recording new instances of invasive species and educating stakeholders and the general public at local outreach events. They developed new educational materials and helped train others in detecting invasive species to enter into the iMapInvasives database.

On top of all this new activity, two of our other monitoring programs continued. We completed our seventh season sampling for the Lake Erie Lower Trophic Level Assessment, collecting biweekly data from our two sites in Lake Erie. We also deployed our GLOS buoy again, continuously monitoring conditions on the lake outside of Dunkirk, NY.

Read on to find out more about all of our summer activities! •

The Year of Lake Erie

GLC researchers with EPA and USGS scientists and the crew of the *Lake Guardian*.

During the last 80 years, Lake Erie has experienced major environmental changes. In recent studies, GLC researchers compared 2009-2012 data on the density and diversity of bottom invertebrates with historical data reaching back to 1929. The historic datasets of benthic communities, assembled by the USGS Great Lakes Science Center, help explain ecosystem changes that have occurred as a result of dreissenid mussels and pollution-abatement programs. Although several interesting trends were discovered, the lack of recent large-scale surveys limited our comparison. Luckily, 2014 was the Year of Lake Erie, a perfect opportunity to fill that gap.

Following a 5-year rotation schedule, each of the Great Lakes is the focus of a multi-agency assessment made possible through the Cooperative Science and Monitoring Initiative (CSMI), a binational effort started by the U.S. EPA and Environment Canada in 2001. The goal of the studies is to facilitate research into questions facing Great Lakes managers. Lake Erie has previously been studied in 2004 and 2009. This year, researchers from the Great Lakes Center, the U.S. Geological Survey, and the EPA Great Lakes National Program Office cooperated in the Lake Erie Intensive Study.

During the spring and summer researchers collected more than 400 samples and 200 images of the bottom of Lake Erie aboard the EPA's R/V *Lake Guardian* and smaller GLC and USGS vessels. Samples were collected using either a PONAR grab or by diving in nearshore areas of bedrock. An exploratory habitat mapping approach was also employed along six transects in the central basin using an underwater camera mounted on a towed benthic sled. Video footage will be analyzed to map dreissenid abundance in relation to the hypoxic zone, confirmed with ponar grabs to assess mussel presence and absence.

Analysis of collected data will allow us to estimate lake-wide and habitat-specific benthic invertebrate abundance and biomass of Lake Erie this year and identify the long-term trends in dynamics of this extremely important community. Results will be presented in May 2015 in Burlington, Vermont, at IAGLR's 58th Annual International Conference on Great Lakes Research. •

*For more information see the following papers: Karatayev, A. Y., L. E. Burlakova, C. Pennuto, J. Ciborowski, V. A. Karatayev, P. Juette, and M. Clapsadl. 2014. Twenty five years of changes in Dreissena spp. populations in Lake Erie. *Journal of Great Lakes Research*. 40: 550-559.

Burlakova, L. E., A. Y. Karatayev, C. Pennuto, and C. Mayer. Changes in Lake Erie benthos over the last 50 years: historical perspectives, current status, and main drivers. *Journal of Great Lakes Research*. 40: 560-573.

Touring the Great Lakes: Benthic Edition

Researchers were out again this August collecting samples aboard the 180-foot EPA research vessel *Lake Guardian* across all of the Great Lakes for the Long-Term Biological Monitoring Project, an annual survey funded by the EPA. The GLC crew included Lyubov Burlakova, Susan Daniel, and Kit Hastings, who rotated on a 12-hour shift while onboard. Collaborating with researchers from Cornell University, they collected benthic organisms, zooplankton, and chlorophyll.

Lyuba using the elutriator to wash excess sediment from a benthic sample.

After a six-day delay due to engine troubles, the ship left Milwaukee, Wisconsin to start the summer survey. During the month long trip, scientists sampled in Lake Michigan followed by Lake Huron, Lake Erie, Lake Ontario, and finally Lake Superior.

GLC scientists collected 183 samples from 63 stations using a PONAR grab sampler. Back at the lab, students will extract organisms from the sediment to be identified by taxonomic experts. These data will be added to the EPA benthic database started in 1997. These samples will help shed light on current environmental status of the Great Lakes and provide a baseline for any future changes in water quality.

The multicore array with four sediment cores.

In addition to routine benthic samples, stations were added to more closely monitor the native amphipod (scud) *Diporeia* spp. *Diporeia* has shown sharp decreases in abundance in all of the lakes except Lake Superior where a healthy population still exists. In response to this, researchers at Cornell University are searching for viral infections that may have led to the collapse. GLC researchers collected samples of *Diporeia* for Cornell and for the EPA benthic database.

Susan Daniel also collected her first set of samples for her master's thesis. The objective of her project is to evaluate the significance of current indices based on worm community composition that are used by the EPA, and to investigate changes in these indices in the eastern basin of Lake Erie. To address these inquiries, several sediment cores were taken to assess vertical distribution of organic matter, nutrients, and worm species. This data may shed light on the effect of *Dreissena* spp. on worm community structure and the index's response.

Overall, this sampling season for the Long-Term Biological Monitoring Project was a success! •

Shine on, you tiny Emeralds

by John Lang (Bio), Jacob Cochran (GLES), and Christopher Osborne (Bio)

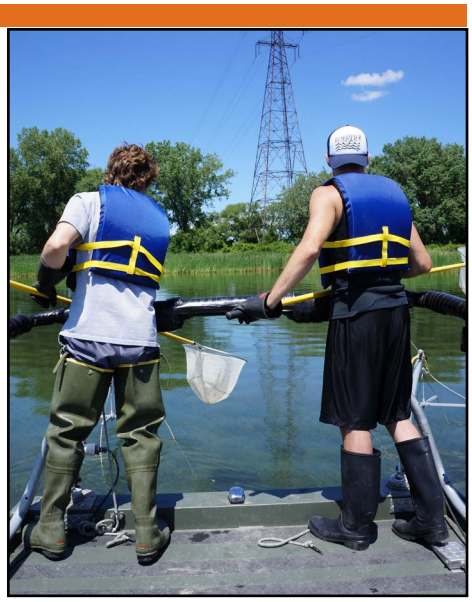
In June, we began field research for a project investigating the biology and ecological role of emerald shiners in the upper Niagara River. Since then, we have had the opportunity to experience this dynamic and ecologically important river on a weekly basis. Our team rotates biweekly between adult electroshocking and larval seining for emerald shiners, collecting as much data as we can before cold water temperatures shut down our sampling season.

Electroshocking weeks generally take three days in which we sample eleven sites located from Strawberry and Motor islands to the northern tip of Grand Island. We shock each site for a uniform time and collect as many emerald shiners as we can. The shiners are then taken back to the Field Station where they are weighed, measured, and preserved for future analysis. Along with shocking each site, we record water conditions. During these weeks, we also collect plankton, total phosphorous, and chlorophyll samples at three specific sites in the river.

Larval seining weeks are shorter and are conducted at six sites in the upper river. Two seine nets are utilized: one for juvenile fish and another that has a much smaller mesh, allowing for the collection of larval fish. With the field season coming to a close, we will turn our focus to analyzing what we have collected this summer and begin to prepare ourselves for next year's field season.

For us, getting out on the river and sampling the fish community has been a humbling way to spend the summer. Our sampling methods, for the most part, are not species-specific, so we are able to observe the river's fish community as a whole. From this, we have a better understanding of the river's ecosystem and this has led to a greater appreciation for the role emerald shiners play within it. Being a part of this team sometimes entails long days on the river or in the lab, but being surrounded with individuals that truly care about the state of this species' population makes it more than worth it. As a team, we've grown to understand the importance of this fish to the upper Niagara River and the role it plays as a key species in the river's food web.

Working out in the field has given us the opportunity to obtain a skill set that will benefit us in the professional world of scientific research. Spending a lot of time on a unique river like the Niagara has allowed us to experience how complex and diverse large riverine systems are. Unfortunately, such systems are often influenced by a number of anthropogenic



John and Chris netting fish on the electrofishing boat in the upper Niagara River.

Some of the electrofishing collections took place at night.

Emerald shiners in a net.

Jake and John processing emerald shiners in the lab.

Chris and Jake seining for larval fish at Strawberry Island.

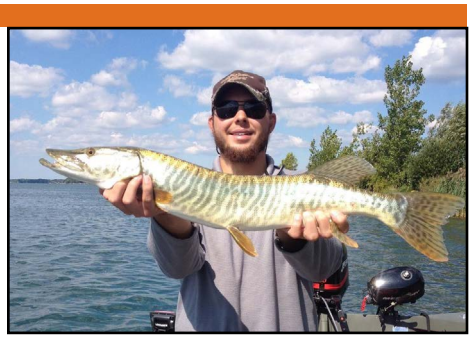
stressors. The impacts that humans generate on these systems are portrayed throughout the upper Niagara River through habitat degradation, shoreline development, pollution, flow modification and much more. Our project aims to quantify how some of these factors influence the emerald shiner population, along with understanding many other aspects of this understudied species. We are excited for the future of this project and expect that our accomplishments will benefit the Niagara River and potentially other aquatic ecosystems. •

Josh deploying the bongo nets, side-by-side plankton nets with different mesh sizes for collecting ichthyoplankton (larval fish).

Hulgrid Gourgue, Stephen Fleck, and John Lang (not pictured) worked on ichthyoplankton collections with the bongo nets.

Meet the Shiner Crew

Jacob Cochran



Jacob Cochran

My name is Jacob Cochran and I'm in my first year in the Great Lakes Ecosystem Science (GLES) M.A. program. I'm from Ohio where I obtained my bachelor's degree in environmental science at Heidelberg University. As a kid I spent many of my days exploring local aquatic systems and have been interested in them ever since. As an avid angler and fish enthusiast, I am drawn to fisheries biology and management, in which I hope to obtain a career within the Great Lakes region. I am a part of the emerald shiner project on the upper Niagara River and will conduct my thesis work on larval fish ecology.

John Lang

John Lang

My name is John Lang; I'm in the Biology M.A. program. I hail from the Crystal City - Corning, NY. I received my B.A. in Biology from Buffalo State, where I took advantage of a number of research opportunities. It was through these projects that I have developed a very broad interest in biology. Primarily, I am interested in the link between the molecular and ecological worlds and how such an understanding can be applied to conservation efforts. My master's thesis will focus on relating the population genetic structure of the emerald shiners to their morphology from two locations: the Niagara River and Lake Erie. I expect this program to prepare me for research in study at the Ph.D. level in the future.

Christopher Osborne

Christopher Osborne

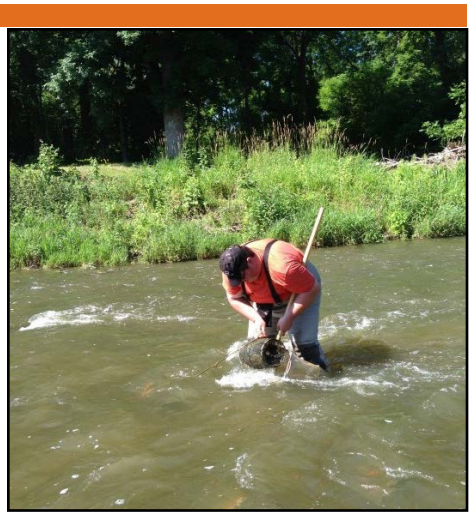
My name is Christopher Allen Osborne. I moved to Buffalo this past summer from Northwest Ohio where I obtained a B.S. in Environmental Biology from Heidelberg University. I am currently working on my M.A. in Biology at Buffalo State. I am a research assistant on a project studying the Emerald Shiners in the Niagara River. My thesis work is on the reproduction of emerald shiners, under the guidance of Dr. Randal J. Snyder. I aspire to obtain a Ph.D. after my work here and eventually become a professor of fish physiology. •

Round gobies linked to altered stream metabolism

How stream ecosystems process and use nutrients is a central theme in stream ecology. GLC biologist Dr. Chris Pennuto and his graduate students have been investigating how fish community structure might play a role in nutrient dynamics in streams of the Niagara Frontier.

Dr. Pennuto's most recent students, Allyse Fischer and Steve Tentinger, have focused on streams with and without round gobies as model systems having different fish community structure to investigate leaf decomposition dynamics. Both students showed leaves break down more rapidly when round gobies are absent for streams, and that this results from round goby predation on key leaf-consuming invertebrates. Tentinger has shown that crayfish (*Orconectes propinquus*) foraging is not disrupted by round gobies and Fischer showed round gobies do not alter microbial community composition, but both documented reductions in amphipod and other invertebrate shredder biomass and abundance when round gobies are present.

This work shows how food web structure, in this case the presence or absence of an invasive benthic fish, ultimately has impacts on stream ecosystem processes through indirect effects. It also suggests that loss of key invertebrate taxa following species invasion has ecosystem-wide impacts. Future studies are planned to assess these impacts across a wider array of stream types and fish communities. •



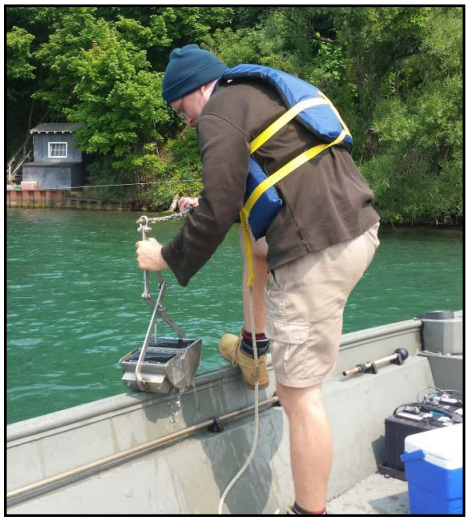
Graduate student Stephen Tentinger checking traps investigating round goby effects on crayfish leaf litter consumption in Ellicott Creek.

A trap array with different fish and crayfish treatments in Ellicott Creek.

Sampling in the lower Niagara River

Remote sensing plays an important role in our everyday life. It's used in GPS navigation, air traffic control, and observing large-scale algae blooms in the Great Lakes. But how can remote sensing be applied to understanding the benthic invertebrate community distribution in the Niagara River?

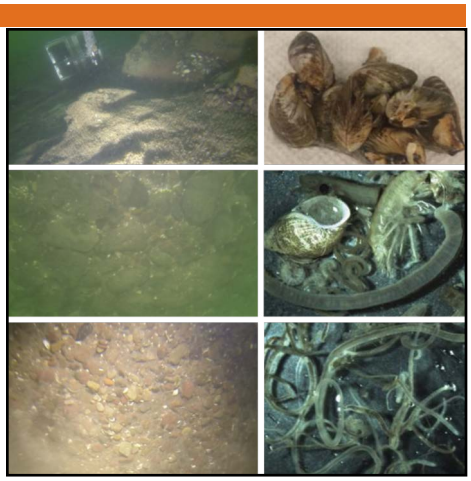
To answer this question, scientists from the Great Lakes Center received a three year grant from the Ecological Greenway Fund to study the benthic invertebrate community composition in the lower Niagara River. Using side scan sonar images obtained from the U.S. Fish & Wildlife Service together with video and sediment data, different types of bottom substrates were classified to create benthic habitat maps for the entire lower Niagara River. Then, benthic samples from each substrate were taken to assess the diversity and structure of the benthic invertebrate community. The results of this study will help to assess valuable habitats for conservation and identify critical habitats as feeding grounds for higher trophic levels. For instance, the occurrence of threatened lake



Knut Mehler collecting benthic samples from the lower Niagara River.

sturgeon (*Acipenser fulvescens*) in some parts of lower Niagara River might be related to more abundant food resources in these areas. In total, 257 sites were chosen along the lower Niagara River based on the habitat map and sampled throughout July and August with 124 benthic samples obtained. Additionally, 80 videos were taken and analyzed to describe the substrate in areas which could not be sampled due to strong currents or rocky substrates. 60 sediment samples were taken to determine the grain size distribution and the organic matter content of the substrate as both variables effect the invertebrate community.

"It's a great study for two reasons," says Knut Mehler, Research Scientist at the Great Lakes Center. "First, it uses an interdisciplinary approach that draws from many different fields and second, it proves that remote sensing can be an important tool in benthic ecology." •



Common substrate and associated benthic fauna from lower Niagara River.

Lower Niagara sturgeon study gets going

by Eric Bruestle, GLES M.A. student

Your first encounter with the largest freshwater fish in North America is quite an experience. Adult lake sturgeon (*Acipenser fulvescens*) can reach up to 2 m in length and live up to 150 years. It is hard not to feel deep respect for a fish that has a longer lifespan than all of us. However, lake sturgeon populations sizes are just of a small fraction of what they were historically. An ongoing study by the Great Lakes Center and the U.S. Fish & Wildlife Service (USFWS) is examining the movement patterns and diet of the recovering lake sturgeon population in the lower Niagara River.

Grad student Eric Bruestle with a lake sturgeon about to be released after tagging.

This study, funded by the Niagara Greenway Ecological Fund, utilizes acoustic telemetry technology to identify critical habitats and diet analysis to determine the prey base vital to this recovery. Findings from this study will inform future conservation efforts to preserve these resources. This summer, researchers under Dimitry Gorsky from USFWS have tagged 30 adult lake sturgeon with acoustic transmitters. These tags emit ultrasonic pulses that are detected by 39 stationary passive receivers that have been strategically deployed throughout the lower river and at the mouth of Lake Ontario. The acoustic array tracks the movements of sturgeon up and down the river, identifies areas where they spend the majority of their time, and documents when sturgeon exit the river for Lake Ontario.

Acoustic tags were surgically implanted.

Another part of this study is to describe diet of lake sturgeon and identify important prey items using stomach content analysis and stable isotope analysis. These two techniques, when used in conjunction, can recreate the short and long term diet history of lake sturgeon. So far, 34 stomach samples and over 100 stable isotope samples have been collected.

Once thought to be on the road to extinction, the lake sturgeon is making a remarkable recovery. By furthering our understanding of this recovery we help ensure that future generations have their shot at meeting a lake sturgeon face to face. •

A summer of education, outreach, and invasive species management

This summer, WNY PRISM aimed to increase its profile through education and outreach initiatives that took place across the Western New York region. Equipped with large displays, informative handouts and specimens of invasive species, staff attended local fairs, farmer's markets and other community gatherings to raise awareness of the environmental, economic and human health impacts invasive species have on our region. Over the course of 3 months, WNY PRISM staff directly engaged more than 1,200 people at 22 different events. These events ranged from the highly attended Erie County Fair and Canal Fest of the Tonawandas, to smaller local gatherings like farmer's markets and Great Lakes Awareness Day.

Outreach display at Reinstein Woods Fall Festival on September 20th.

Discussions with those we spoke with varied based on geographic location, proximity to urban, suburban and rural settings and their various economic and environmental interests. This required talking points to be fluid and adaptable for different audiences. Listening to questions and concerns from the public helped drive changes in what outreach topics and materials WNY PRISM developed and focused on. It became clear that certain species like the emerald ash borer and zebra mussels had greater recognition due to media exposure and initiatives such as "Don't Move Firewood" and "Clean, Drain and Dry." This allowed for more in-depth conversations about similar species and important early detection species such Asian longhorned beetle and water chestnut. New outreach materials such as "Plant Wise" were added in order to promote the planting of native vegetation in yards and gardens while also raising awareness of common cultivars that are invasive. We also held invasive species identification and mapping workshops for those interested in becoming more involved.


iMapInvasives training at Roger Tory Peterson Institute, Jamestown, NY.

Invasive species management doesn't stop at education and outreach. The WNY PRISM Invasive Species Management Crew conducted invasive species mapping surveys at 19 different locations throughout Western New York. Surveys encompassed an array of different landscapes from established nature preserves such as Reinstein Woods, to navigating through the forested hills of Allegany State Park in search of the hemlock wooly adelgid (*Adelges tsugae*) and canoeing Tonawanda Creek in search of the aquatic invasive plant, water chestnut (*Trapa natans*). Over 2500 observations were made during the course of this summer, including 60 different invasive species. It is important to note that these surveys were intended to represent a general assessment of the invasive species found on the property and that each observation did not represent a single individual, but in most cases signified a population of a species. All collected data was uploaded to iMapInvasives and can be accessed for future educational and eradication efforts.


Invasive species management crew identifying and mapping invasive species at Bergen Swamp.

Invasive plant eradication projects were also implemented at various nature preserves throughout Western New York, including Japanese knotweed (*Polygonum cuspidatum*) and pale swallow-wort (*Cynachum rossicum*) removal at Tifft Nature Preserve, invasive brush removal at WNY Land Conservancy's Niagara Escarpment

Preserve and water chestnut removal at Jamestown Audubon.

2014 WNY PRISM Invasive Species Management Crew: Patrick Gormley, Jerry Krajna, Andrew Stadler, and Angela Driscoll.

To support all of these activities, WNY PRISM coordinator Andrea Locke hired on four seasonal employees this summer. Patrick Gormley, as Education and Outreach Assistant, worked mainly on planning and coordinating with partners on outreach events and educational opportunies, as well as developing education and outreach materials. There were three Stewardship Assistants, Angela Driscoll, Jerome Krajna (a Buffalo State graduate), and Andrew Stadler. The stewardship assistants often worked in the field doing invasive species mapping with iMapInvasives and assisting partners with invasive species removal projects, although they also attended community outreach events, meetings, and trainings. Their positions overlapped quite a bit with Patrick's as strengths and interests became more apparent– for instance, Angela helped out with the education and outreach materials development. They finished up their work in early September, so we thank them for all of their hard work and wish them luck in their future endeavors. •

Monitoring ports for new invaders

Starting in March, the GLC, U.S. Fish and Wildlife Service (USFWS), and Baltic Marine Environment Protection Commission (HELCOM) discussed a collaborative plan to advance invasive species detection in the commercial shipping ports of the Great Lakes. The project had been originally proposed as part of the US EPA Great Lakes Long-term Monitoring program. The purpose of this project was to develop a protocol comparable to studies done by HELCOM in the Baltic Sea that is applicable to the Great Lakes, since the Baltic region is a likely source of alien species into the Great Lakes system.

Wendy Paterson doing preliminary sampling in Oswego Harbor last spring. They sampled and set up settlement plates in the spring and did another sample and collected traps in September.

Using HELCOM's 2013 survey protocol for identifying alien species as a guide, we sampled in Buffalo and Oswego harbors starting in May through September. We tested several different sampling types focusing on spring and late summer zooplankton populations, epifauna (mobile and fouling), benthic organisms, and environmental parameters. To target fouling organisms we deployed settlement plates for nearly four months and collected wall scrapings. To survey benthic organisms we collected ponar samples and benthic sled tows. We also looked for mobile epifauna by setting minnow traps and light traps in the late summer. The samples were processed live and then preserved for later identification. Once we have completed identification, we will share our findings using HELCOM's Risk Assessment Tool database. We also plan to share our findings with the USFWS in hopes they will adopt some of the same methods as HELCOM into their federal monitoring program. By sharing our findings we hope to develop a more effective way to prevent the spread of alien species into and out of the Great Lakes and to grow a more robust international information network that will help us address issues efficiently.

The project has already been a massive joint effort spanning many universities and organizations and only plans to get bigger by expanding our research to other harbors throughout the Great Lakes. Many people helped in the field as well as in the lab. On top of the fantastic team we have here, students and faculty/staff from SUNY Oswego (Diann Jackson, Andrew McElwain, Kamal Mohamed, Rachel Corin, Carrie Preston, and Brian Springal) helped us with field and lab work and also provided access to their beautifully rebuilt field station. Curtis Karboski and Matt Paufve from the U.S. Geological Service field office in Oswego were also

essential during the sampling season. Our work is part of a collaborative grant working with Cornell University and members of their field station (Lyndsie Collis, Joseph Cononoly, James Watkins, and Ellen George) who provided assistance and equipment. Aside from all of those who helped in the field, USFWS, HELCOM, and Buffalo Crushed Stone provided equipment, advice, and access to sampling location needed for the project. •

In other news…

Invasive Species Awareness Week

The week of July 6-12 was the first Invasive Species Awareness Week. WNY PRISM coordinated several education and outreach events throughout Western New York to build awareness of invasive species and their detection. Andrea Locke, coordinator of WNY PRISM, was interviewed by the local news.

GLC Seminar series announced

The Great Lakes Center Seminar Series promotes collaboration among Buffalo State scientists, scientists from other universities, and scientists who work with agencies responsible for researching and implementing science-based environmental management practices. See a list of our planned speakers on our website.

Senator Mark Grisanti, President Conway-Turner announce funding for Great Lakes Center Field Station

Buffalo State was awarded $150,000 to rebuild our boat launch and dock. When the boat ramp has been deepened, it will allow us to launch even when water levels are extremely low (see "View from the Water's Edge" in Issue 1). We also plan to replace the current dock with a floating dock, which would enable us to leave boats in the water without having to worry about huge fluctuations in the water level.

GLC 600 seminar series announced

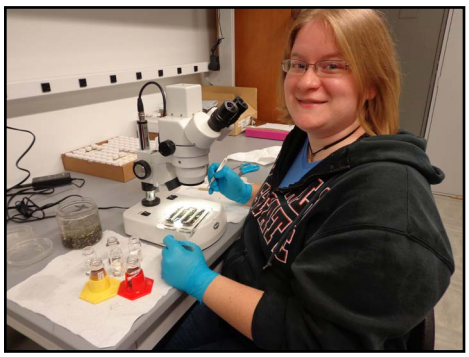
One of the GLES courses is GLC 600, Great Lakes Seminar. Each week throughout the semester scientists from the Great Lakes Center and other local agencies like the NYS Department of Conservation present topics related to their careers and how they interact with the Great Lakes. Look online for a list of upcoming speakers.

New technician hired

Brianne Tulumello, who previously worked for the benthic ecology lab as a student, was hired as a Senior Research Support Specialist this fall. Congratulations! •

Sasha and Lyuba with speaker Rick Barbiero.

President Katherine Conway-Turner, State Senator Mark Grisanti, and Dean Mark Severson at the press conference at the Field Station.



Brianne Tulumello

Invasive species spotlight: Pale swallow-wort (*Cynanchum rossicum*)

Pale swallow-wort (*Cynanchum rossicum*), is a perennial, herbaceous vine-like species that is causing a lot of damage in our natural areas. Growing in dense patches and in a wide range of habitats, this invader from Eurasia has the ability to overtake native plant communities. Pale swallow-wort also impacts our native fauna. It is commonly mistaken as milkweed by monarch butterflies whose larvae need the glycoside toxins found in native milkweed plants to survive.

Pale swallow-wort overgrowth.

Pale swallow-wort has the ability to spread very quickly. Seeds may be polyembryonic (capable of producing multiple seedlings), are wind dispersed, and can remain viable in the soil for 3 to 5 years. It can also spread vegetatively through rhizomes and studies have shown that toxins released through their roots may alter soil chemistry, to the detriment of native plants.

Pale swallow-wort flowers.

Once established, pale swallow-wort can be very difficult to control. For individual plants or small populations, it may be possible to remove them by digging up the plant, however care must be taken to remove the entire root mass. As infestations become larger, more intensive management may be necessary. At this point, our best options for management are prevention, through cleaning off vehicles and mowers that may have come in contact with the plant to reduce transport and spread, and early detection, so we can remove individual plants before they become well-established infestations.

Pale swallow-wort leaves are opposite and oval shaped with pointed tips. The five-petaled flowers are small and pink to brown in color. We often rely on flowers for our identification, but these guys are not that easy to spot. The most conspicuous characteristic for identification of pale swallow-wort is its seedpod, which looks like long narrow milkweed pods and are lime-green in color. Seedpods start forming in July and open in late summer. Black Swallow-wort (*C. louiseae*), a similar species, can be differentiated by their flowers which are dark purple and downy. •

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