

TWINELINE

2015 SPRING/SUMMER EDITION VOL. 37/NO. 1

Fish *Genes*

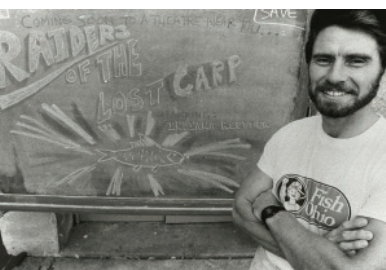
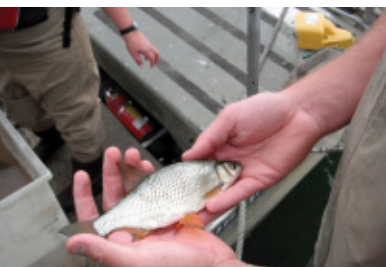
Genetic research in natural
fish populations helps
prevent viral outbreaks.



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TWINE LINE



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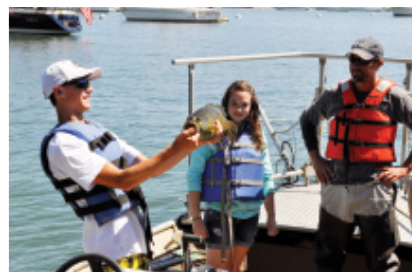
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STONE LAB

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For more information, visit stonelab.osu.edu/noncredit

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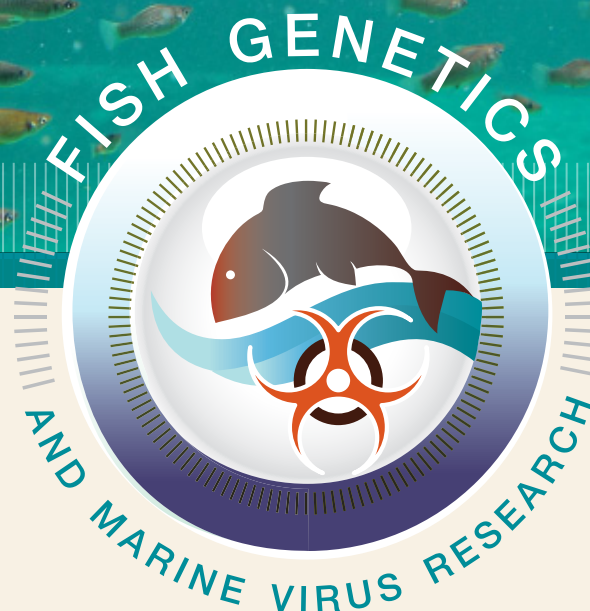
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Genetic Information Helps Keep Great Lakes Fishes Healthy

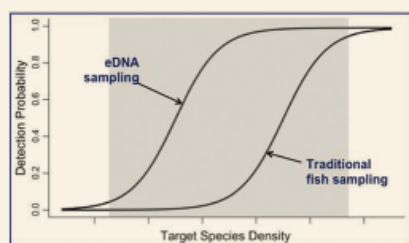
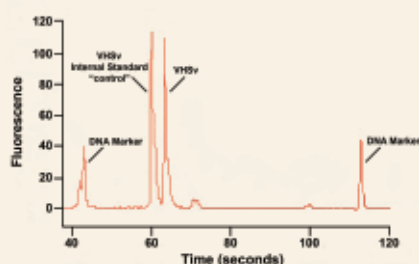
by Christina Dierkes, Ohio Sea Grant Communications

It's been almost a decade since the first outbreak of viral hemorrhagic septicemia virus (VHSV) was seen at the University of Toledo's Lake Erie Center in the summer of 2006. Dead fish washed up on shore, while others struggled in the shallow water, all showing bright red lesions on their bodies. VHSV is essentially the Ebola of the fish world: a highly contagious virus that causes erratic behavior, internal bleeding and death.



VHSV

Testing and Research



▲ *Environmental DNA left behind in waste products and mucus can help researchers detect aquatic organisms with higher sensitivity than some conventional sampling methods. (Graph adapted from Darling & Mahon 2011)*

Dr. Carol Stepien, Director of the Lake Erie Center and Professor of Ecology at the University of Toledo (UT), has worked on VHSV in Great Lakes fishes ever since that first outbreak at the beach across the road. Over time, viral testing, transport regulations and disease dynamics in natural fish populations have prevented extreme outbreaks like the one in 2006, but in recent years, some fish species have tested positive for VHSV without showing symptoms. This indicates that fish may have developed resistance to the virus, but these host fish might still spread the virus to other, more susceptible populations.

VHSV most likely started as a marine virus, infecting ocean fish in the North Atlantic, before mutating to adapt to freshwater systems. "The virus' genetic origin is in the Atlantic Ocean, but if fish die of a virus out at sea, nobody ever really sees them because they get eaten by a bigger fish, like a shark," Stepien says. "But if they die in fresh water or nearer to the shore, people will see them." For this reason, and because freshwater viruses are more likely to affect aquaculture operations like those in the Great Lakes, the freshwater viral variants are the focus of Stepien's research.

"We have a new National Science Foundation grant to trace the evolutionary trajectory of the virus over time, and we just met in West Virginia with the USDA's Agricultural Research Service (ARS), who has been funding the aquaculture side of this research," Stepien says. Because VHSV spreads easily when fish are in close contact, aquaculture operations are particularly susceptible to virus outbreaks.

To make potential infections easier to identify and prevent, Stepien and her research partner Dr. James Willey from the UT Health Sciences campus, her former PhD student Lindsey Pierce, and their technicians Erin Crawford and Vrushalee Palsule developed a new rapid test for VHSV that is not only much faster than the traditional cell culture method, but also has a much higher degree of accuracy than other molecular tests.

The test is based on a procedure called StaRT-PCR (standardized reverse transcriptase polymerase chain reaction, a DNA-based testing method) developed by Dr. Willey, which is very accurate, since it uses built-in internal controls. The research group has now adapted their test to use a qRT-PCR (quantitative real-time polymerase chain reaction, another DNA-based method) platform, as that equipment is already a part of most fish diagnostic labs.



► **Above:** Aquaculture operations are of special concern for Stepien's research, as viral infections can spread quickly when fish are kept in close quarters and VHSV infections in this setting can have a large economic impact on affected fish farms. ► **Inset:** Characteristic red lesions under the skin are an obvious sign of VHSV infection, but the virus has also been found in fish that did not appear sick.



Other assays that have been developed for VHSV include qRT-PCR tests that can have a false negative rate of 14-47%, since they lack built-in internal controls. And cell culture assays, which are the standard method of virus testing, can take a month or more to run, making results untimely at best, and can have false negative rates of as high as 76%, according to previous research. "It's a long procedure, and what we were told by agencies and other researchers was to develop an accurate, low-cost test," Stepien relates.

And that's what the team did, with funding from Ohio Sea Grant and the USDA. "We've developed a very rapid and accurate test that can tell every strain of VHSV from all over the world," explains Stepien. "We can diagnose VHSV 100% and our test is negative for any other type of fish virus or human virus, so it's very accurate."

The test takes only a few hours, instead of a month or more with cell culture, and includes a built-in control that compares the study sample with a standardized virus sample. This ensures that a positive result is a true positive and not the false negative often seen without an internal control. The test also allows researchers to determine the quantity of virus present in the sample, which can be an indicator of whether an infection is latent – not causing any symptoms – or if it's an acute infection that will soon kill affected fish.

The assay is also being used in a related project that focuses on non-fish organisms

(zebra and quagga mussels, leeches and amphipods, a type of zooplankton) as reservoirs of VHSV. "Dr. Mohamed Faisal at Michigan State found the virus in lake leeches, which are parasites on fishes, so it's possible they may be an invertebrate vector that the virus can hang out in," Stepien says.

Although there hasn't been an active VHSV outbreak in the Great Lakes recently, researchers have found separate variants of the virus in May and June 2012, when staff members at the Ohio Department of Natural Resources offices in Sandusky noticed fish off the dock swimming erratically, which can be one of the first signs of VHSV infection.

"Neither fish had the lesions that are typical of VHSV infections, but they were swimming kind of weird, so we extracted RNA from their tissues, and we detected the virus," Stepien recalls. "In both samples, the virus was different from what we'd ever seen before, with both fish having different variants of VHSV, and both tested positive using our assay. One was a Freshwater Drum, and the other was a Largemouth Bass."

These results suggest that the virus has mutated quite a lot in different genes over time since it's been in the Great Lakes, so one current project in Stepien's lab is concerned with tracking these mutations to make sure researchers and natural resource managers can be alerted quickly if the virus once again becomes infectious for previously resistant fish populations.

"These viruses evolve very quickly, just like the flu virus, where given strains can vary a lot, and it's the same thing with this VHS fish virus," Stepien says. "So even though we think it may have died out, it could rear its ugly head again."

Stepien's lab has also developed a genetic assay that can detect all kinds of environmental DNA from water samples. Using next-generation sequencing, a rapid method involving the decoding of thousands of DNA strands simultaneously, this method not only provides results more quickly than traditional sample analysis under a microscope, but can also detect species that may not be found in the sample, but that had been in the area up to a week prior to sampling.

"It takes hours to pick through plankton samples, and then you can't identify a lot of the fish anyways, or you can only identify them to family or genus," Stepien says. "Here you can identify them to species, and you can use an algorithm to determine that species' relative abundance in a given area."

Environmental DNA is contained in anything that animals would shed into the water: mucus, skin cells and fecal matter are just some examples. Sampling for DNA

► **Below:** The first outbreak of VHSV in western Lake Erie left beaches littered with infected fish. Today, researchers have created a rapid and accurate diagnostic test for the virus that could help prevent similar outbreaks in the future.



The large dataset that is created by combining GenBank information on Great Lakes species with data from the lab becomes especially important when an unknown DNA sequence is detected in a sample.

instead of (or in addition to) sampling for the actual organism helps expand the range of species that can be found – a particular fish may not be caught during a sampling session, but it may have left behind environmental DNA that can still be detected.

The DNA results from the water samples are interpreted with the help of both GenBank, a National Institutes of Health repository of genetic information for a wide range of species, and with a database Stepien and her students have built for Great Lakes species and invasives over the years.

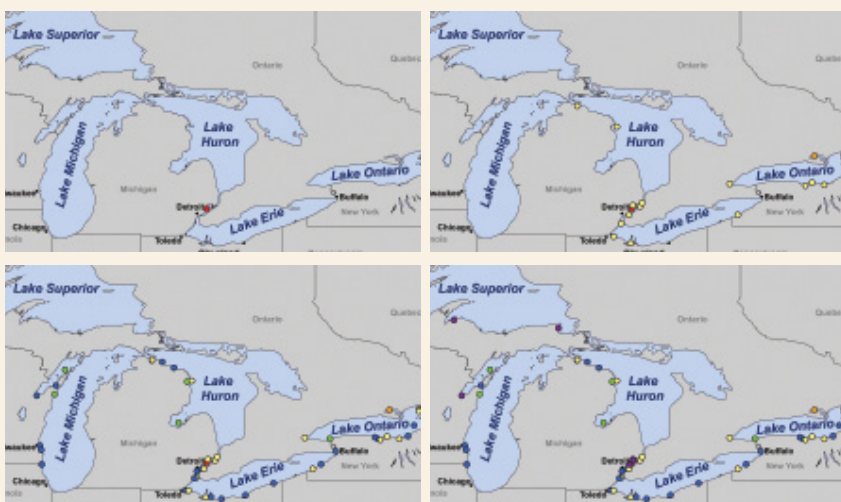
“What we do is align all the GenBank data on Great Lakes species, and then we fill in the gaps for missing species, like Black Sea Sprat,” Stepien explains. “Some of the species of invasives, we collected most of the data for it anyways in my lab, like the Gobies. And we’ve been working on some of the species, like Walleye, for 25 years, so we know the different genotypes of that species.”

The large dataset that is created by combining GenBank information on Great Lakes species with data from the lab becomes especially important when an unknown DNA sequence is detected in a sample. The researchers can then take the sequence, send it to GenBank, and have the system give them possible matches for that genetic information.

“With the database, all I have to do is send the sequence to the GenBank BLAST site, and it will tell you what the matches are across the world,” Stepien says. “It will also tell you if it was close to something – it could be an undescribed species, but then we know we have an unknown. And even if we don’t know what it is right now, some day we will.”

And in the end, that’s what science is really all about. **TL**

VHSV SPREAD in the Great Lakes



▲ From its first detection near Detroit in 2003 and the first Lake Erie outbreak in 2006, VHSV had been found in all the Great Lakes by 2009. While current outbreaks are rare, researchers are always cautious to prepare for a change in that status quo.

OHIO BOARD OF REGENTS FUNDING TACKLES HARMFUL ALGAL BLOOMS

in Coordinated Statewide Effort

by Christina Dierkes, Ohio Sea Grant Communications

“Because of the Toledo water crisis, Chancellor John Carey and the Ohio Board of Regents allocated \$2 million to universities in the state to work together to develop solutions for the harmful algal bloom problem. They asked Ohio State, led by Dr. Bruce McPherson, and the University of Toledo, led by Dr. Tom Bridgeman, to take leadership of this effort. Because of our 37-year history of supporting projects at Ohio universities, they asked Ohio Sea Grant if we could assist by identifying some of the scientists that should be involved.”

That's Dr. Jeff Reutter, former Ohio Sea Grant Director and one of the leads on that two-million-dollar initiative, talking about a new collaborative research group's formation. In addition to The Ohio State University and the University of Toledo, researchers from Bowling Green State University (BGSU), Heidelberg University and Kent State University (KSU) will lead a total of 18 projects in five different focus areas, along with scientists at Central State University, Defiance College and the University of Cincinnati.

In an effort to develop uniform and concise proposals that could be easily reviewed and evaluated, the group used Ohio Sea Grant's proposal development system and will use Sea Grant's project reporting system to report the results of all 18 two-year projects. Those reports will also be used to inform the public on new findings, along with a series of webinars in which researchers will discuss their projects.

“We also invited leading scientists from the Ohio EPA, Ohio DNR, the Ohio Department of Health, the Ohio Department of Agriculture and the Lake Erie Commission to serve on a state agency advisory committee,” Reutter adds. “Their participation will assure that our projects take advantage of, and are coordinated with, efforts underway within state agencies, and that our results address management needs.”

A harmful algal bloom (HAB) is any large increased density of algae that is capable of producing toxins. In freshwater, such as Lake Erie, those algae tend to be cyanobacteria — more commonly known as blue-green algae — that are always present in the water to some extent, but which grow excessively in warm water with a high phosphorus concentration.

According to Reutter, another person who was instrumental to pulling together the funding as well as the teams of researchers was Marty Kress, Assistant Vice President in the Office of Research at The Ohio State University. Kress was able to link the strengths of the



state-wide group with a \$1 million Ohio State University water quality initiative called Field to Faucet that was also prompted by Toledo's water crisis in August 2014.

“Marty was instrumental in leading the creation of the five focus areas, and really providing the liaison with the Board of Regents,” Reutter says. “In many ways, he was our point person for the whole thing.”

“The key to the entire process was the early identification of the focus areas, because that drove the discussion from that point on,” Kress adds. “Rather than talk about what you already do, you have to talk about it in the context of the problem you're trying to solve.”

In a November meeting hosted by Heidelberg University, 65 investigators from a wide range of Ohio universities met to identify projects that should be included in the Board of Regents funding for each of the five focus areas: 1) Lake Erie water quality, 2) drinking water safety, 3) agricultural best management practices, 4) algal toxins' effects on humans and 5) economics and policy.

► **Above:** A statewide collaboration, prompted by the harmful algal bloom that shut down the city of Toledo's water supply in August 2014, brings together universities from across Ohio to develop solutions for the harmful algal bloom problem plaguing Lake Erie.



FOCUS AREAS

Focus area 1, led by the University of Toledo and BGSU, will develop detection, mapping and warning tools for the Maumee and Sandusky River bays, funded at \$250,000 each.

Researchers in focus area 2 will use another \$500,000 to examine options for the detection and treatment of cyanobacteria toxins in water treatment plants. The presence of one toxin, microcystin, was the major concern when water was shut off for most Toledo residents in 2014. Microcystin causes skin irritation, as well as liver, kidney and nervous system damage, and has to be removed with activated carbon treatments to ensure concentrations in drinking water don't rise above 1 part per billion (ppb).

Drawing on expertise from Ohio State University Extension and Heidelberg University, two projects in the third focus area intend to help reduce phosphorus runoff from agricultural fields into Lake Erie. Dr. Bruce McPherson, Dean of the College of Food, Agricultural & Environmental Sciences at Ohio State, will also contribute \$200,000 from Ohio State's Field to Faucet initiative to the \$400,000 allocated from the Board of Regents funding. That additional funding will go directly to expanding Heidelberg's phosphorus monitoring system in Lake Erie tributaries.

"Ohio State University, with its comprehensive capacity, is well positioned to lead the way in providing answers," McPherson said at the initiative's kick-off event in September 2014. "But we don't feel tackling this alone is sufficient, and it's clear there are other pockets of excellence. We're putting in [money] to get the effort off the ground, and we'll continue to look for partnerships to leverage that."

Focus area 4 turned out to be the biggest challenge to manage, according to Reutter. With seven good projects all focusing on important aspects of human health and toxin detection, the allocated \$400,000 simply did not stretch far enough for everyone. "Getting them down to that budget was difficult, and in the end, the University of Toledo added \$15,000 to three of the projects housed there," Reutter says.

The remaining \$200,000 went to focus area 5, where three researchers will investigate social influences, decision making and nutrient management policies in the heavily agricultural Maumee River basin, which contributes much of the problem phosphorus to Lake Erie.

"Our strong statewide effort will help protect water supplies from potential blooms this summer while we look for the most efficient ways to prevent future blooms," says co-chair Dr. Thomas Bridgeman of the University of Toledo, who is also leading one of the projects. **TL**

For more information, visit go.osu.edu/osgbor

► **Below:** In addition to toxins, harmful algal blooms produce unsightly algal mass that can foul beaches and negatively affect tourism.



Focus Area 1: Lake Erie Water Quality

HAB Detection, Mapping and Warning Network: Maumee Bay Area
Thomas Bridgeman, University of Toledo

HAB Detection, Mapping and Warning Network: Sandusky Bay
George Bullerjahn, Bowling Green State University

Focus Area 2: Producing Safe Drinking Water

Guidance for powdered activated carbon use to remove cyanotoxins
John Lenhart, The Ohio State University

Investigation of water treatment alternatives in the removal of microcystin-LR

Isabel Escobar, University of Toledo

Transport and Fate of Cyanotoxins in Drinking Water Distribution Systems

Isabel Escobar, University of Toledo

Investigation of ELISA and interferences for the detection of cyanotoxins
Isabel Escobar, University of Toledo

Focus Area 3: Land Use Practices, Sources of Enrichment, Water Quality and Engineered Systems

Farmer/Farm Advisor Water Quality Sampling Network
Greg LeBarge, The Ohio State University

Identifying the best strategy to reduce phosphorus loads to Lake Erie from agricultural watersheds
Laura Johnson, Heidelberg University

Focus Area 4: Human Health and Toxicity

Method Development for Detecting Toxins in Biological Samples
Kenneth Hensley, University of Toledo

Impact of pre-existing liver disease on microcystin hepatotoxicity
Thomas Sodeman, University of Toledo

Fish flesh and fresh produce as sources of microcystin exposure to humans
Stuart Ludsins, The Ohio State University

Identifying Bacterial Isolates for Bioremediation of Microcystin-contaminated Waters
Xiaozhen Mou, Kent State University

Development of Microcystin Detoxifying Water Biofilters
Jason Huntley, University of Toledo

Prevention of cyanobacterial bloom formation using cyanophages
Jiyoung Lee, The Ohio State University

Evaluation of Cyanobacteria and their Toxins in a Two-Stage Model of Hepatocarcinogenesis
Christopher Weghorst, The Ohio State University

Focus Area 5: Economics and Policy

Maumee Basin Lake Erie HABs Nutrient Management Options Comparative Analysis

Timothy Haab, The Ohio State University

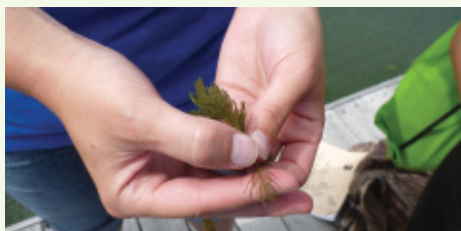
Social Network Analysis of Lake Erie HABs Stakeholder Groups
V. Kelly Turner, Kent State University

Maumee Basin Lake Erie HABs Stakeholder Informed Decision-Making Support System
Patrick Lawrence, University of Toledo

STONE LAB

By Lisa Aurand Rice, Ohio Sea Grant Communications

Stone Laboratory, Ohio State's island campus on Lake Erie, has added new educator courses and non-credit workshops to its already expansive course listings, as part of the organization's efforts to remain a top resource on education related to Lake Erie topics and issues.



Water and Wildlife Training for Educators Group Studies

50 CONTACT HOURS | JUNE 14-20

Taught by Ohio Sea Grant educators Lyndsey Manzo and Angie Greene, this one-week field-based experience will provide teachers, informal educators and education students with the chance to receive certifications in Project WILD curricula created and supported by the Council for Environmental Education — including Project WILD Aquatic — as well as programs created by the Project WET Foundation.

"One of the things we wanted to be able to do was offer one week where teachers could earn multiple certifications at one time," Manzo says.

She and Greene will be putting their own Stone Lab spin on the class, too. "All of the activities that we'll do will have a Great Lakes or Lake Erie twist to them," she says.

The benefit of the class for instructors is that it gives them tools they can bring back to their classroom to both educate and engage students, Manzo says.

"I always call it your treasure box of activities and strategies," says Manzo, who teaches sciences at Westerville North High School. "I've been using them in my classroom since I started teaching and I've

been teaching for 15 years. They're inquiry-based, they're hands-on, and they're engaging for students. It's really nice to have that tucked away in your back pocket ready to use whenever you need."

Fisheries Fundamentals

Workshop **AUGUST 17-19**

Learn about fisheries management and research in this three-day workshop covering fundamental principles of sampling fish populations and using the data in management decisions from Dr. Chris Vandergoot, fisheries biologist at the ODNR Division of Wildlife.

The goal is for workshop participants to get field experience, Vandergoot says. Undergraduate students, for example, may not have experience operating a motor boat, taking and preserving fish samples and doing

an initial overview of the data collected.

"When (the ODNR hires) people every year in our Fairport and Sandusky offices, these are the things that we look for. We need to get an idea of how proficient people are in some of these things," Vandergoot says.

Fish Aging Workshop **AUGUST 20**

This workshop, which runs immediately after the Fisheries Fundamentals Workshop, is also aimed at undergraduate, graduate and professional students interested in fisheries science. The one-day Fish Aging Workshop focuses on this particular aspect of fisheries management, including aging techniques and data analysis.

"Fish aging is the crux of fisheries management," Vandergoot says. "If you don't know the demographics of the population you're trying to manage, you can't manage it."



NEW



Educator Courses and Non-Credit Workshops on the Summer Schedule



Aquatic Invasive Species Hazard Analysis and Critical Control Point

Workshop **AUGUST 17-19**

Participants will learn to develop and implement plans to identify and control potential invasive species introductions via natural resource management and research activities. The three-day workshop is taught by Ohio Sea Grant Extension educators Tory Gabriel and Sarah Orlando, and by Eugene Braig, aquatic ecosystems program director in Ohio State's School of Environment & Natural Resources.

Workshop participants will emerge from the program with both Hazard Analysis and Critical Control Point (HACCP) and Aquatic Invasive Species Hazard Analysis and Critical Control Point (AIS-HACCP) certification.

"HACCP started as a way for the food industry to control for cleanliness issues and it's traveled to a couple different industries since then," Orlando says. "The Great Lakes Sea Grant network has picked up on this strategy and adapted it for preventing the spread of aquatic invasive species."

Unlike other Stone Lab classes, workshop participants will spend much of their time in the classroom. The group will spend a lot of time discussing the particulars of their own jobs and how HACCP principles can be applied in their roles, Orlando says.

"The workshop is tailored toward the participants," she says. "We utilize examples based on what they're doing day-to-day and the class kind of evolves and adapts to their needs."

Instructors will work with participants to help them develop a plan they can use to help minimize the chances of introducing invasive species into new environments. **TL**

For more information, visit
stonelab.osu.edu/courses



OHIO SEA GRANT

joins
forces *with the*

LAKE ERIE NATURE & SCIENCE CENTER

by Sarah Orlando, Ohio Sea Grant Extension & Christina Dierkes, Ohio Sea Grant Communications

It's smooth sailing for Ohio Sea Grant and Lake Erie Nature & Science Center in Bay Village, Ohio as the organizations continue to collaborate. Ohio Sea Grant Extension educator Sarah Orlando can be found working at the Center on a regular basis, interacting with both staff and visitors and participating in programming and events.

"By being located at the Lake Erie Nature & Science Center a few days a week, I am able to frequently share new research and information about Lake Erie, such as the science behind harmful algal blooms and best practices to reduce pollution. I am also able to participate in exciting programs that reach new audiences for Ohio Sea Grant," says Orlando.

Ohio Sea Grant's focus on research, education and outreach for the Lake Erie region is a great fit for the Center, which offers high-quality nature, environmental and science experiences through school field trips, preschool, family, scouting and planetarium programs, nature hikes, and a variety of exhibits connected to its expansive wildlife rehabilitation program.

"The partnership between the Lake Erie Nature & Science Center and Ohio Sea Grant has been alive and well for nearly 30 years and continues to be an important relationship for a Center so close to Lake Erie," says Darci Sanders, the Center's Director of Education. "The expertise of Sea Grant staff is the perfect match to increase the effectiveness and efficacy of programming provided by our own talented staff."

Center staff and Ohio Sea Grant are working on hands-on informal science information sessions for 2015 that will feature experts on a variety of Lake Erie topics. Most recently, they hosted a workshop for faculty from Cleveland and Columbus that provided information, curriculum and supplies for teaching about aquatic invasive species in the classroom.

May 23 is Lake Erie Day, part of the Year of Clean Water Celebration, where visitors at the Center can celebrate all things Lake Erie. Ohio Sea Grant staff will be on hand to offer their expertise and interactive activities on aquatic invasive species, harmful algal blooms, boating and water recreation, beach safety, Lake Erie water snakes, and more.

"I'm really excited about the ability to work with Lake Erie Nature & Science Center staff on innovative ways to bring Lake Erie science to people from the region," says Orlando. "It truly is a wonderful partnership." **TL**

>> Learn more about the Lake Erie Nature & Science Center at lensc.org.



"There will be hands-on activities for kids, and our staff will be available for questions on a variety of Lake Erie information for the adults. We hope to create an informal, fun, and interactive event where visitors can engage one-on-one with researchers and agency staff," says Sarah Orlando, Ohio Sea Grant Extension educator.

Lake Erie Day is a partnership event between Ohio Sea Grant and the Lake Erie Nature & Science Center on Saturday, May 23 from 10:30 a.m. – 1:30 p.m. This event is part of the Year of Clean Water celebration for Sustainable Cleveland 2019, and event attendees will have a chance to enter to win a grand prize getaway at Cuyahoga Valley National Park through the Clean Water Tour & Sweepstakes! **>> Learn more at lensc.org.**
Admission: \$4 for ages 4 and up, and children, teens and adults are welcome.
Pre-registration is recommended. **TL**

researchers EXPLORE new avenues

► For more information about Ohio Sea Grant's Small Grants Program, visit ohioseagrant.osu.edu/research

with help from Ohio Sea Grant Small Grants



Often in academic research, it seems that all that matters is the big numbers: press releases report on hundreds of thousands of dollars in funding for multi-year projects with large research teams. But small grants can be equally as important to an area of study, first and foremost because most scientists don't start out by winning those highly competitive large grants.

Ohio Sea Grant's Small Grants Program allows researchers to submit funding proposals at any time, for up to \$10,000. While that generally does not cover a full project, it allows researchers to explore new aspects of their areas of interest, to potentially expand on in future investigations.

In the past, the program has funded Dr. Amy Townsend-Small of the University of Cincinnati for research on Lake Erie methane emissions from natural and industrial sources, which turned into a successful Large Grant Program application, as well as the beginnings of the Ohio State Climate Change Outreach Team's *Great Lakes Climate Change Curriculum*, created and updated by Ohio Sea Grant Educators Dr. Rosanne Fortner and Lyndsey Manzo.

"There was a documented need for regionally-relevant, high-quality climate change lessons," explains Manzo, who teaches science at Westerville North High School in Columbus. "Our success at developing the *Great Lakes Climate Change Curriculum* set the stage for multiple larger projects, including a Climate Walk on Stone Lab's Gibraltar Island where students use the local environment to learn about climate change. Ohio Sea Grant's Education Team has also received an OSU CARES grant to partner with Energize Ohio and OSU's Office of Energy and Environment to develop a solar energy curriculum."

In a recent Small Grants project, Dr. Steven Vickner, currently an associate professor at Wilmington College, examined data from grocery stores across the country to determine the pattern of demand for seafood products like perch, which could come from aquaculture as well as wild capture. Vickner also planned on gathering supply-side information from fish farmers in Ohio to better understand the state's aquaculture industry.

As it turns out, supply information can be rather difficult to obtain. Vickner and his collaborator Dr. Laura Tiu attended the annual conference of the Ohio Aquaculture Association to ascertain what data were available, in addition to Vickner obtaining the most recent five-year census of aquaculture put together by the US Department of Agriculture (USDA) and the US Department of Commerce.

“When that came out in September 2014, I was really excited because anyone studying aquaculture cannot wait for the results in the new five-year census,” Vickner remembers. “Regrettably, most of the pages indicated the data were not reported.”

Many of the tables listing aquaculture data in different states for different fish and shellfish species either do not report data because it’s unavailable, or because publishing the data would jeopardize the anonymity of the businesses reporting it to the USDA due to the small overall number of fish and shellfish farmers in the state.

➤ **Facing Page Left to Right:** Educators from across the Great Lakes region complete lessons in Ohio Sea Grant’s Great Lakes Climate Change Curriculum to learn to apply them to their classroom or informal education setting. The lessons, covering everything from greenhouse gases to tree migration, are available as free downloads at go.osu.edu/climatelessons.

Vickner still analyzed relevant data from the document, creating thematic maps of aquaculture production and marketing by state, as well as comparisons of aquaculture production in Ohio and nationally. “One of the outcomes of doing this sort of exploratory research is to see what data is available,” Vickner says. “This is seed capital to help facilitate new exploration, but that is not without risks.”

Vickner was able to use previously obtained scanner data on grocery store purchases – collected by AC Nielsen, the same company that produces television ratings – to draw some preliminary conclusions about consumer buying patterns for frozen fish products, both from wild capture and from aquaculture. He will present his findings as an invited case study at the annual meeting of the Agricultural & Applied Economics Association in San Francisco in July 2015 and hopes to publish that case study in the January 2016 issue of the

American Journal of Agricultural Economics, which is considered the most prestigious journal in the field.

“For a small grant, that’s a pretty big payoff,” Vickner says.

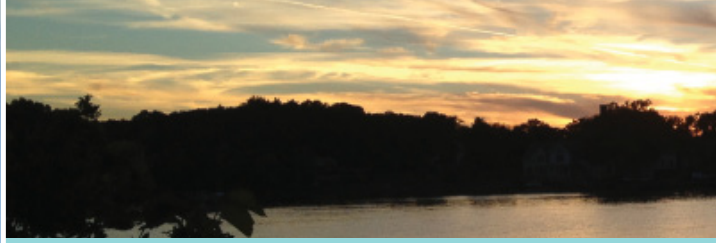
Information from the data analysis will also influence the work of Tiu, an aquaculture specialist for OSU Extension at The Ohio State University South Centers. Tiu focuses on aquaculture education and training to help develop and support Ohio’s aquaculture industry.

“Marketing product continues to be a challenge in the successful expansion of the aquaculture industry in Ohio,” Tiu says. “Having a better understanding of the availability and price of both the wild and aquaculture product in the marketplace can help fish farmers determine which markets they want to enter.” **TL**



Dr. Steven Vickner’s Small Grants project focused on seafood demand from both aquaculture and fisheries, and how that demand can be influenced by marketing and current events.

by Christina Dierkes,
Ohio Sea Grant Communications



01



02



STONE LAB

field trips

➤ NOT JUST FOR KIDS

While summers at Stone Lab, Ohio State's island campus on Lake Erie, are filled with college classes and research projects, spring and fall offer a whole new set of opportunities to students of all ages. Lake Erie Science Field Trips take participants out on the lake on a research cruise, where students trawl for fish and collect water samples, and back into the lab on Gibraltar Island, where a fish dissection gives participants a chance to learn how some of Lake Erie's inhabitants tick.

Middle school students make up the bulk of Stone Lab's field trip participants, but the program also offers some unique opportunities for high school and college classes who would benefit from an experience outside of a regular classroom.

"For some of the older college groups, we do offer their own classroom time," explains Dr. Kristin Stanford, Stone Lab's Education & Outreach Coordinator. "They can include some of our activities, but we also can provide them classroom space so they can come up with a plan to do their own thing."

Dr. James Bauer, a professor at The Ohio State University, takes advantage of Stone Lab's offerings with his Ecology of Inland Waters class each fall. "Before I moved to Ohio and came to Ohio State, I was completely unaware of the facility, and it's really a gem," Bauer says.

His students spend a long weekend on Gibraltar Island during the fall semester, usually towards the end of the Stone Lab season. Their days there cover a wide range of Lake Erie topics, from water quality testing to fish anatomy, and from sampling trips on a Stone Lab research vessel to identifying plankton samples under microscopes.

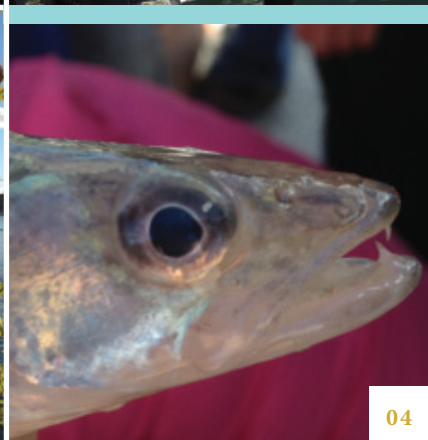
After a tour of the Algal & Water Quality Lab and a quick introduction to Stone Lab on Friday night, students start their Saturday on a Stone Lab boat out on the lake. "Basically we start showing them how to use everything from the very simplest early devices like Secchi disks and bottle samplers all the way up to state-of-the-art electronic sonde instruments that can measure temperature, pressure, conductivity, plant pigments and so forth," Bauer says. "We try to get the students as involved as possible, so we actually want the students each to have a turn trying the instrumentation, doing the



03



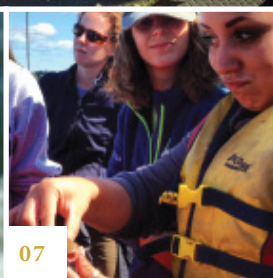
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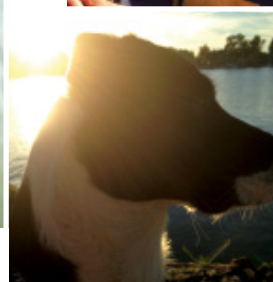
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08



09

readings and things like that as well, so there's a lot of hands-on work."

Saturday afternoon is generally spent with a mixture of lab work – such as dissecting some of the fish that were collected on the morning cruise – and presentations from Stone Lab staff on everything from invasive species to native amphibians and reptiles.

"About midway through the afternoon, the students have been sitting at their microscopes for a couple of hours and everybody's necks and eyes are sore," Bauer explains. "So we usually take about an hour for them to have a snack, wake up a little bit, and listen to Stone Lab personnel talk about some of the serious issues that are specific to Lake Erie.

Those presentations are well received by the students, because the staff does a lot of work with school-age kids, but they do a good job of making things more advanced for these college-level kids and the students in my class are very energized by hearing about that stuff."

Living on Gibraltar Island, even if it's just for a few days, also helps students and professors connect on a more personal level. A fire pit and lounge chairs by the water encourage everyone to stay up just a little bit longer after dinner and gives students, professors and teaching assistants a chance to socialize in a way they don't normally get to in class. "It's a really good bonding experience for everyone," Bauer says.

A spring visit tends to be the first choice for many school groups, because it allows teachers to make the field trip a culminating experience after a year of learning about the science related to Lake Erie and its inhabitants. But autumn trips like the one Bauer takes with his class are actually a great time to come up to Lake Erie and can help energize students for the rest of the semester.

"That end of September and early October period is really nice," Stanford says. "The water is still really warm, there are lots of insects, lots of birds, and it's just a really good time for our content and for good weather to do this stuff." **TL**

All images courtesy of Klaire Freeman. **01** Getting hands-on with native snakes is just one perk of Stone Lab's field trip program. **02** Lake Erie's tiniest inhabitants are on display at Gibraltar Island's Alligator Bar. **03** Students learn how to take water and sediment samples in the same way Lake Erie researchers do. **04** The fish trawl on a research cruise usually brings up some interesting species for further examination. **05** Stone Lab vessels are equipped for a wide range of research uses. **06** Spring field trip participants may well find larval fish during their time at Stone Lab. **07** Field trip participants range in age from grade 5 through adults, and trips can be customized for a group's specific needs. **08** The R/V *Gibraltar III* is most often used for larger field trip groups. **09** For many students, coming up to the Stone Lab docks for the first time is the start of a number of visits to Gibraltar Island over the years.

by Christina Dierkes,
Ohio Sea Grant Communications

ON A high note



And with accomplishments like the creation of a STEM youth program that reaches 8,000 people every year, more than \$1.3 million in endowments for scholarships and research equipment and partnerships ranging from local communities to international collaborations, Reutter leaves behind a legacy of successes that will benefit students and scientists, Lake Erie, Ohio Sea Grant, Stone Lab and Ohio State for years to come.

Reutter first joined Ohio Sea Grant in November of 1972 to take over management of a project related to the construction of Davis-Besse Nuclear Power Station. In 1977, he wrote the successful grant proposal that brought the NOAA Sea Grant College Program to The Ohio State University in 1978, and was instrumental in the university's designation as the country's 24th Sea Grant College in 1988. Since its inception, Ohio Sea Grant has supported over 300 principal investigators and more than 600 graduate students at over 20 universities and agencies, all working to help Lake Erie.

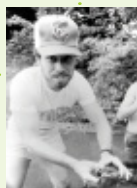
Reutter had previously attended graduate classes at Stone Lab in 1971 and immediately caught the bug. "I absolutely loved it. Took four courses, was in class six days a week for ten weeks, and couldn't wait to get off the island at the end of ten weeks. But I wasn't gone for more than about two weeks when I realized how much I missed it and how much of a total life-changing experience it was."

That life-changing experience started a 40-year career that, in the end, has always been focused on creating opportunities and educating people about the importance of Lake Erie to Ohio and to the Great Lakes region at large. From events for state and

If you live in the Great Lakes and pay attention to the news on a semi-regular basis, you've probably seen, heard or read about Dr. Jeff Reutter, Director of Ohio Sea Grant and Stone Laboratory at The Ohio State University. After 42 years at Ohio Sea Grant and Stone Lab, as a researcher, educator and administrator, Reutter stepped down from his position on March 31, 2015.



"I feel like I've had the best job at the university for about 40 years, but this is a good time to retire," Reutter says. "Our staff is incredibly talented, dedicated and prepared, everybody's jobs are set, we've successfully gone through multiple national reviews and are ranked as one of the top programs in the country, funding should be better but it's stable, I turned 65 – this is the time." — DR. JEFF REUTTER



► Reutter takes his first graduate class at Stone Lab in 1971.



For more than 30 years, Stone Lab has benefitted from 22 endowments created by the Friends of Stone Lab, a non-profit group of alumni first formed with Reutter's support.

► Ohio Sea Grant Legislature Days help lawmakers understand Lake Erie issues.



Stone Lab's Lake Erie Science Field Trip Program, co-created by Reutter in 1973, each year teaches 8,000 children and adults about the importance of Lake Erie to Ohio.



► Stone Lab staff have both given and received a number of awards during Reutter's tenure.



Reutter has served on more than 35 state, regional, national and binational organizations involved in water resources management, broadening Ohio Sea Grant's stature and reach throughout North America.

► Support from Ohio State leaders and state legislators has continued to have a big impact on Ohio Sea Grant and Stone Lab's work.



Under Reutter's tenure, Ohio Sea Grant was ranked one of the top Sea Grant programs in the country in four national NOAA reviews.



► Educating Lake Erie residents has always been a focus of Reutter's work.

Major renovations at Stone Lab, including an extensive solar energy set-up, would not have been possible without Reutter's dedication to finding partners and funding for these projects.

► Today, workshops for legislators, science writers and farmers bring Lake Erie science to these important audiences.



federal legislators and local elected officials to outdoor writers and the business community, Reutter's leadership made Ohio Sea Grant one of the premier sources for information about Lake Erie and the Great Lakes and their impact on the country.

"We have worked hard to create and to enhance understanding and awareness of how important Lake Erie is within the people who are making decisions about it," Reutter reflects. Hands-on educational programs like Ohio Sea Grant's State Legislature and Congressional Days, which started in 1982, and the Coastal County Commissioners, Mayors and Decision Makers Day are considered a Best Management Practice by NOAA's National Sea Grant College Program and have informed similar events across the country.

To expand Lake Erie education into other age groups, Reutter also initiated Stone Lab's field trip program by co-creating the first workshops at Stone Lab in 1973 along with Fred Snyder, Ohio Sea Grant's first Extension agent. Under the leadership of John Hageman, one of Reutter's former students and long-time Stone Lab Manager, those workshops blossomed into the current Lake Erie Science Field Trip Program, which teaches 8,000 people, from fifth graders to adults, about Ohio's most important natural resource each year.

When Stone Lab moved from Ohio State's College of Biological Sciences to reporting to the Provost's Office, Reutter was able to hire faculty to teach courses designed by Stone Lab instead of relying on what the college was able to offer. This gave him the chance to address a common request in previous years: adding introductory science courses to Stone Lab's curriculum that would be open to both college and high school students.

"We received numerous requests every year from high school students, so in 1990, I offered the first one-week course, an introductory aquatic biology course," Reutter remembers. "We had to offer it twice that year and we still turned away a bunch of students. It was a huge success, and Stone Lab enrollment grew from about 60 students per year to 169 in one year and currently attracts 200-250 students per year."

Today, about 60 outstanding high school students from across the Great Lakes region attend Stone Lab courses each year, with many receiving partial scholarships totaling

close to \$20,000 to help offset the cost of spending a week learning hands-on science on a Lake Erie island.

Some of those scholarships are supported by endowments specifically created by the Friends of Stone Lab (FOSL), a nonprofit group of Stone Lab faculty, alumni and friends that has supported the lab through donations, volunteer hours and informal advertising for more than 30 years.

"The creation of the Friends of Stone Lab was a big help," Reutter says. "People laughed at me when I worked on creating some of those endowments because at the beginning we had one endowment that had \$3,000 in it, and you're not going to generate a lot of revenue with that. But the growth has been good, and the commitment of the Friends to the lab is really contagious."

Today, 22 endowments worth more than \$1.3 million have supported over 2,200 students, and another \$4.3 million in planned gifts will continue to benefit future students through scholarships, employment opportunities and facility upgrades.

The National Sea Grant Office completed a Site Visit of Ohio Sea Grant in November of 2014, reviewing the program for its accomplishments and its productivity. The review team confirmed Ohio Sea Grant's long-standing ranking as one of the top programs in the country, focusing specifically on the high-quality partnerships, numerous accomplishments and extensive facility renovations that took place during Reutter's tenure.

"Of course, those accomplishments and facility renovations would not have been possible without an amazing staff, generous donors and volunteers, and the great support we get from Vice President for Research Caroline Whitacre, Vice President for Agriculture Bruce McPherson, the Ohio State Legislature and many, many other people," Reutter is quick to add.

But with a new generation of staff in place, ready to take on new responsibilities, Reutter is looking forward to slowing down just a little. "I'm giving serious thought to buying a boat," Reutter laughs. "And I'll enjoy being a grandfather to my twin grandsons."

Ohio Sea Grant Associate Director Dr. Christopher Winslow has been named interim director while the university completes the search for a new permanent director. **TL**



Ohio Sea Grant Knauss Fellow

Champions Ocean Education from the EAST COAST TO THE ROCKIES

by Christina Dierkes, Ohio Sea Grant Communications

The first comment Erin Sams Cooper usually has to address when she talks about her employer, the education non-profit Teens4Oceans, is “but... you’re based in Colorado.” And while the Rocky Mountains around Boulder were covered by an ocean a few million years ago, it’s not the first place most people would think of when asked where to start an ocean education program.

However, for Cooper, a former Ohio Sea Grant Knauss Fellow and now a program director for Teens4Oceans, the nonprofit is the perfect place to combine her love of biology with a dedication to all types of environmental education.

“There are so many people who live in this state that appreciate all kinds of nature,” Cooper says. “They love the mountains, they ski in the winter, but they often go diving in the summer. So any conversation about the ocean seems to come full circle more often than you would think.”

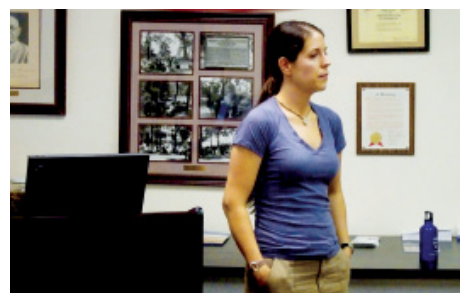
Cooper started working for Teens4Oceans after she completed a Knauss Fellowship at NOAA’s Office of Education. The fellowship provides a unique experience to graduate

students who have an interest in ocean, coastal and Great Lakes resources and in the national policy decisions affecting those resources. The fellowship matches students with government host offices in and around Washington, D.C. for a one-year paid position.

During her year at the Office of Education, Cooper had the chance to work with representatives from all across NOAA’s education community, organizing monthly meetings and conferences and sitting in on grant reviews for environmental literacy programs. “I wasn’t allowed to really aid

Left: Erin Sams Cooper (*left*) attended an international conference in Australia during her Knauss Fellowship.

Below: Cooper shares her Knauss experience with Stone Lab students and guests during the summer 2014 Stone Lab guest lecture series.



in the decision process, but I got to read all these different applications from these incredible organizations from all over the country and I was there for all the conversations, which was pretty cool,” Cooper remembers.

She also helped train educators to use NOAA’s Science on a Sphere system (sos.noaa.gov), which uses computers and video projectors to display data on what is essentially a giant animated globe. Science on a Sphere has been installed in over 100 museums and science centers all over the world and is generally used to help large groups of young students connect what they’re seeing on the screen with the information they are learning at the museum or in the classroom.

“The data sets show things like visualizations of climate data, of sea surface temperatures, of migration patterns of different species,” Cooper explains. “All these different things can visually stimulate somebody to think in a more creative way about how earth’s systems function and interact with each other.”

In addition to the professional experience she gained during her fellowship, Cooper also treasures the connections she made with other Knauss Fellows during her year in Washington. “D.C. is a very fast-paced place, and it’s important to both work hard and also find ways to enjoy your time off,” she says. “And that’s easy to do when you have a large group of other people that are in the same boat, which is a pretty unique aspect of the fellowship.” **TL**



For more information about the John A. Knauss Marine Policy Fellowship Program, visit seagrant.noaa.gov/FundingFellowships/KnaussFellowship.aspx. Applications for the Class of 2017 are expected to be available in December 2015.

FROM OCEANS TO LAKES

and back again

by Lisa Aurand Rice
Ohio Sea Grant Communications

Frances Bozak's love of aquatic wildlife started, of all places, indoors.

As a fifth grader, Frances was intrigued by television shows on life underwater. Encouraging her, Frances' mother got her videos of sea turtles. They lived in Avon, Ohio, so trips to Lake Erie with her family and fishing trips with her uncle were frequent.

But it was her experience outdoors during a one-week introductory course at Stone Laboratory that has cemented her determination to pursue a career in marine science.

Last year, her senior year at Avon High School, Frances was accepted to Coastal Carolina University, which has the largest undergraduate marine science program on the East

Coast. Online research about opportunities to study marine science in Ohio led Frances' mother to Stone Laboratory.

After she visited Gibraltar for a tour of the lab, Frances decided to take a summer class before she left for her freshman year at the school in Conway, S.C., just outside Myrtle Beach.

What she learned in Stone Lab's Introduction to Biological Studies – Aquatic Biology has already given her a leg-up during her freshman year at CCU.

"I took marine science and biology this year," Frances says. "We learned about phylum, class, order and families at Stone Lab, and I got to use that information in my marine science class. I felt like I had more experience."

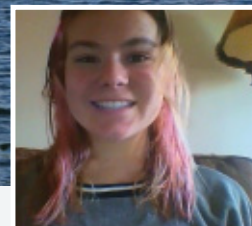
The week-long course, taught by Stone Lab and Ohio Sea Grant Research Coordinator Justin Chaffin, introduces students to the components of freshwater ecosystems, including invertebrates, plants and fish and the structural components of aquatic systems. Students spend time aboard the lab's research vessels and take day-long field trips to nearby watersheds.

"I thought it was so cool because we got to do a lot of hands-on experience collecting our own fish, trawling and catching baby walleye and white bass," Frances says. "We got to learn how to identify the fish and know what kinds are which and learn how to identify insect larvae."

One of Frances' favorite activities from the week was a trip to the Vermillion River, collecting samples of the water and fish and taking them back to the lab for analysis.

"The things we were testing were things that we went out and caught on our own. I liked that," Frances says.

She roomed with three other teens about her same age and said that even the dormitory experience was a positive one.



"It helped show what people actually do with marine science, it wasn't just sitting in a classroom all the time."

FRANCES BOZAK

"If we were studying and wanted it quiet, everyone would respect everyone else's wishes," she says.

After spending time at Stone Lab, Frances can more clearly see her future in marine science, a field which includes aspects of biology, chemistry, geology, physical oceanography and atmospheric science.

"It helped show what people actually do with marine science," Frances says. "It wasn't just sitting in a classroom all the time."

The course earned her two college credits toward her bachelor's degree from CCU, and Frances says she's considering taking another Stone Lab course next summer.

"It was so much fun and helped me get a jump start on my education," she says. **TL**



Friends Of Stone Laboratory

Dear friends,

As I write this letter I'm sitting in my little home office looking out the window at a snow-covered landscape. The temperature is about 20 degrees and forecast to drop to near zero tonight. Right now the sun is shining but most days recently have been a dull and dreary gray. My boat, which we keep at a marina on East Harbor, is shrink-wrapped and sitting in a parking lot along with several hundred others. It is midwinter in Ohio.

At times like this the memories of warm sunny days on the lake seem so very far away! But there is a light at the end of the tunnel... FOSL's Spring Work Weekend was held April 17-19. Now for many of you this may not seem earth-shattering news, but for me that weekend heralds the beginning of the Lake Erie boating season - the beginning of summer!! My boat will still be in the parking lot, and will remain there until early May, but the work weekend is always my first trip to the lake after a long winter in Columbus and I look forward to it like a child anticipates Christmas!

Indeed, the April work weekend was my introduction to Stone Lab. Probably a decade or more ago I came across information about the work weekend. I only knew of Stone Lab as a mysterious, secret little island with "No Trespassing" signs, stuck in the middle of Put-In-Bay harbor. But I found out I could volunteer for this work weekend and I would actually be welcomed to the island, even fed and housed for two nights, and all I had to do was work 6-8 hours on Saturday. What a no brainer!

But this is only one of several work opportunities available during the year for FOSL members. I urge you to check out the Stone Lab/Sea Grant website for more information. If you're not already a member please consider joining us, then you too can chase away the winter blues while helping prepare the islands for summer courses and workshops. I look forward to seeing you at some of our future events!

*Sincerely,
Ken Scott, FOSL President*



The Friends of Stone Laboratory (FOSL) began in 1981 as a support group to “bring Stone Laboratory into the 21st century with the best possible facilities, equipment and professors, and make this an unequalled learning experience available to all outstanding students.” Members of the Friends provide a way for former students to support the facility by raising awareness and funds for scholarships, research, and equipment.



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Winter Program Raises Funds for Stone Lab Scholarships

The 17th annual Friends of Stone Lab Winter Program and Silent Auction, held at the Ohio State Columbus campus on February 5, raised \$2,033 for Stone Lab summer student scholarships and essential lab needs. The event has become a tradition for many FOSL members, with some traveling all the way from Cleveland to attend.

Students from last year's Stone Lab Research Experience for Undergraduates (REU) Scholarship Program introduced guests to their research projects, which are in part supported by FOSL donations. Victoria Simons, a microbiology major, worked with Stone Lab Research Coordinator Dr. Justin Chaffin in one of the limnology REUs offered each year. Blair Perry, a zoology major, assisted Stone Lab Education & Outreach Coordinator Dr. Kristin Stanford with tracking Lake Erie Watersnakes. Both are students at The Ohio State University.

The evening's featured guest, Jim McCormac of the Ohio Department of Natural Resources Division of Wildlife, spoke about "Birding Ohio's North Coast"

and introduced attendees to a number of rare bird species that can be found along the Lake Erie shoreline. McCormac's book *The Ohio Lake Erie Birding Trail Guidebook* was published by Ohio Sea Grant last year, with a reprint planned later this year. Copies of the first print run are still available for purchase.

Other guest speakers included Dr. Caroline Whitacre, Vice President for Research at Ohio State, Dr. Bruce McPherson, Vice President of Agricultural Administration and Dean of the College of Food, Agricultural and Environmental Sciences, and Ken Scott, President of the Friends of Stone Lab. All commented on the importance of Ohio Sea Grant and Stone Lab to both the university and the state of Ohio, and on the lab's role in protecting Lake Erie from environmental stresses.

You can still make a donation to Stone Lab scholarships, even if you weren't able to make the event. Visit stonelab.osu.edu/fosl/give for more information. FOSL

Silent Auction Donors

Armstrong Air and Space Museum
 Bird Watcher's Digest
 The Blackwell Bistro 2110
 The Boardwalk Restaurant
 Joan Bradley
 Lauren Bradley
 Eugene Braig
 Center of Science and Industry
 Columbus Guitar Society
 Columbus Museum of Art
 Columbus Outdoor Pursuits
 Laura Finch
 Dr. Donald Gartman
 Graeter's Ice Cream
 Great Lakes Science Center
 Kings Island
 Miller Ferries to PIB & Middle Bass Island
 Mohican Resort and Conference Center
 Moretti's on Sawmill
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 The Refectory Restaurant
 Stratford Ecological Center
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2015 Stone Lab Guest Lecture Series >

Hear about current Lake Erie research topics and get status updates from representatives of our State agencies. You can either attend in person on Gibraltar Island or watch the lectures from the comfort of your own home via live stream from Stone Lab.

Join us Thursday evenings for the Stone Lab Guest Lecture Series.

June 18	Scott Zody Chief, Ohio Department of Natural Resources Division of Wildlife
June 25	Jim McCormac Ohio Department of Natural Resources Division of Wildlife
July 2	Sandra Doyle-Ahern President, EMH&T Consulting
July 9	Tinka Hyde Water Division Director, US Environmental Protection Agency Region 5 Susan Humphrey Associate Regional Director General - Ontario Region, Environment Canada Sandra George Environment Canada Jeff Reutter Special Advisor Ohio Sea Grant and Stone Lab, The Ohio State University <i>"Great Lakes Water Quality Agreement: Annex 4 Recommendations to Address HAB, Hypoxia, and Cladophora Problems on Lake Erie"</i>
July 16	Dr. Caroline Whitacre Vice President for Research, The Ohio State University
July 23	Stone Lab Research Experience for Undergraduates Presentations
July 30	Dr. Bruce McPherson Vice President for Agriculture and Dean of CFAES, The Ohio State University
August 6	Craig Butler Director, Ohio Environmental Protection Agency
September 12	Stone Lab Open House



FOR MORE INFORMATION ABOUT THE LECTURE SERIES, CONTACT THE STONE LABORATORY OFFICE
AT 614.247.6500 OR 419-285-1800 OR VISIT GO.OSU.EDU/STONELABLECTURES

